ISSUES AFFECTING THE UPTAKE OF RENEWABLE ENERGY SOURCES FOR RURAL ELECTRIFICATION AND DEVELOPMENT PROJECTS IN NIGERIA

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ABSTRACT

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How has being a fossil fuel-rich country affected the large scale adoption of renewable energy and its associate technologies for rural electrification and rural development projects in Nigeria? How is renewable energy and its associate technologies viewed by the bureaucrats tasked with the responsibility of providing electricity for rural communities in Nigeria? What are the dynamics involved in accepting an alternate form of energy for rural electrification projects in a fossil fuel rich country like Nigeria? These are some of the questions that are of significant interest to energy experts and observers in Nigeria, and it is believed that knowledge of the factors at play could help soothe the troubling energy dichotomy in the country – of having an abundance of energy sources but is one of the least electrified countries in the world.

The aim of this qualitative phenomenological study was to explore the perceptions of government officials and experts responsible for rural electrification in Nigeria, the seemingly lack of interest in the utilization of the abundant renewable energy sources for rural electrification projects in Nigeria, and the influence, if any, that fossil fuel has had on the use of renewable energy sources for rural electrification. Following a qualitative research methodology, data on specific issues affecting the uptake of renewable energy technologies in rural electrification in Nigeria was collected through document analysis and semi-structured interviews across a spectrum of 17 senior federal government executives within various agencies tasked with managing the nation's electric energy sector.

Analysis provided findings which showed that the concept of renewable energy powered rural electrification was a welcome idea that will only work as a viable option for power generation in a fossil fuel rich country like Nigeria, if built on already proven strengths of the concept, it can overcome certain generic and country specific barriers and misconceptions. It was found that renewable energy needed a high level of legitimacy to succeed in Nigeria. Legitimacy as found by the study would require conscious government participation, increased awareness, serious advocacy, improved bureaucratic involvement, and efforts to overcome liabilities of newness of the concept of renewable energy powered rural electrification.

It was also found that certain perceptual factors will have to be addressed for renewable energy to gain a stronghold in the country. These perceptual factors were found to either be inhibitors or facilitators of the concept of renewable energy powered rural electrification. Internal and external physiognomies of renewable energy, as well as country specific characteristics associated with it, could also greatly influence the adoption of renewable energy in a fossil fuel rich nation like Nigeria.

In the final analysis, it was found that renewable energy was actually recognized as an important option in achieving rural electrification in Nigeria, and that the factors identified by this study were already playing different roles in the nation's energy sector, albeit minute. The issue, it seems, was the absence of a coordinating factor in the form of a champion for the renewable energy course; one who could rally the available resources and current policies to adequate action. It is suggested that having a champion from among the bureaucrats would propel advocacy for renewable energy powered rural electrification projects more easily and also help in tying together the rural electrification goals of the Government with the technical requirements needed to promote the use of renewable energy technologies for rural electrification in Nigeria.

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ABBREVIATIONS AND SYMBOLS

Abbreviations	**Equivalence**
ECN	Energy Commission of Nigeria
MOP	Ministry of Power
NERC	Nigerian Electricity Regulatory Commission
REA	Rural Electrification Agency
REF	Rural Electrification Fund

Symbols

MW	Megawatt

CHAPTER 1

INTRODUCTION

If the mere existence of natural energy sources in a country meant its appropriate use and application for electric power generation, then today the whole of Nigeria – especially all of the rural communities – would be completely served with electricity. Topographically, Nigeria is a nation "endowed with abundant energy resources, both conventional and renewable, which provide her with immense capacity to develop an effective national energy plan" (Akinbami, 2001, p. 155). However, owing to prevalent flaws in the electricity sector and poor exploration of available renewable energy sources (GEF, 2013; Ohiare, 2015) the overall level of electrification and "household access to electricity services in Nigeria is low" (Oyedepo, 2014, p. 261).

Despite the abundance of renewable energy sources in Nigeria, "renewable energies have not played a major role in its developmental efforts so far" (Efurumibe, Asiegbu, and Onuu, 2014, p. 74). Compared to other Sub-Saharan African countries with similar topography, for example Kenya, with one of the most active renewable energy sectors in Africa (ABB Group Media Relations, 2015), the level of uptake of renewable energy sources for electrification especially in the rural areas is more or less at its barest. This has not been helped with the nation's strategy for rural electrification; of extending the national grid instead of a more decentralized generation strategy that could have made use of the available renewable energy sources.

While some researchers (e.g. Akinbami, 2001; Efurumibe, Asiegbu, & Onuu, 2014; Karekezi & Kithyoma, 2003) may argue that the issues with the development or large scale adoption of renewable energy sources for electrification in Nigeria are as a result of the country being a very large fossil fuel economy and hence pays little or no attention to renewable energy sources; others (for instance Mohammed, Mustafa, Bashir, & Mokhtar, 2013; Oyedepo, 2012b) have argued that the generic barriers to

renewable energy have essentially contributed to the challenges faced by Nigeria in its renewable energy deployment for electricity provision in general, and rural electrification in particular.

1.1 Context of the Study

In spite of the perceived low renewable energy development in Nigeria, interestingly, it is evident that quite a large amount of resources have been expended in rural electrification and renewable energy development programmes in the country. Various establishments and agencies have been instituted in line with seeing to the harnessing of the vast array of natural energy sources prevalent in the country. Taking these efforts of the Federal Government of Nigeria in regards to harnessing renewable energy for electricity generation into consideration, and considering the plans as documented in the Renewable Energy Master Plan (REMP) as well as the National Energy Policy (see Energy Commission of Nigeria, 2005a, 2012), "the inability to scale up access to electricity may not entirely be a result of lack of funding by the government" (Eleri, Ugwu, & Onuvae, 2012, p. 11). It could be said that the issues facing the use of renewable energy sources especially in powering rural electrification projects in Nigeria is more of a reflection of the difficulty of translating priorities established at the policy level into practice down the bureaucracy.

This study seeks to explore the phenomenon of a seemingly lack of actual interest in renewable energy sources for rural electrification projects in Nigeria despite the abundance of these resources. Though some past studies (e.g. Adeoti, Oyewole, & Adegboyega, 2001; Akpan, Essien, & Isihak, 2013) have been completed on renewable energy powered rural electrification in Nigeria with a focus on the engineering, development and techno-economic aspects using quantitative methodology, little attention has been paid to the energy option decisions or how existing energy options, like the abundance of fossil fuel, has influenced the choice of the use of the plentiful renewable energy sources for rural electrification in the country.

Against this backdrop, therefore, further research is needed to ascertain the reasons behind such occurrences, especially from the perspective of the energy

bureaucrats tasked with the responsibility of seeing to the exploration of energy options for electricity generation and specifically the actualization of rural electrification in the country. In this light, therefore, this research explores the perception of these bureaucrats with the aim of figuring out some of the issues affecting the uptake of renewable energy sources for rural electric power generation and the effect, if any, the existence of fossil fuel has had on the adoption of renewable energy for electric power generation for rural electrification and development in Nigeria.

To illustrate the phenomenon under investigation, this research employed a qualitative methodology and analysis, based on data obtained from both a thorough document review and in-depth interviews of 17 key respondents drawn from various agencies associated with the Ministry of Power in Nigeria, tasked specifically with the responsibility of providing electricity in the country via the exploration of the abundant natural energy sources. The study stems from the understanding that a more naturalistic interaction with these bureaucrats could provide a platform to learn more about the factors that could influence adversely or positively the notion of a renewable energy powered rural electrification programme in Nigeria.

1.2 Background of the Problem

With an estimated population of about 177 million people (Central Intelligence Agency, 2014), Nigeria is the most populous nation in Africa and one of the least served with electricity. Only about 55.6% of the population has access to grid electricity (World Bank, 2015a) and at the rural level where about 53% of the population live (World Bank, 2015b), World Energy Outlook data show that the overall rate of electrification stands at just 35% (International Energy Agency, 2014).

Nigeria, as a nation, boasts of many natural energy sources such as large hydro from the rivers Niger and Benue (and their various tributaries), coal, wind, natural gas and crude oil. “It has the seventh largest natural gas reserve in the world and the largest in Africa” (Aliyu, Ramli, & Saleh, 2013, p. 354) on which it ought to rely for its electricity needs, but this seems to not be the case. Table (based on 2005 data) shows the nation’s potential energy sources and its estimated reserves. Ideally with

figures like these, an energy crisis should not be one of the nation's problems. The reality is that most "of these resources are yet to be exploited" (Ohunakin, Ojolo, & Ajayi, 2011, p. 2007) and the maximum utilization of the few that have been tapped has been inadequate.

Table 1.1 Nigerian Energy Reserve and Capacity

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	3,500 MW
Fuel wood	13,071,464 ha
Crop residues	83 million tonnes/year
Animal wastes	61 million tonnes/year
Solar radiation	3.5–7.5 kW h/m2/day
Wind	2–4 m/s @ 10 m height

Source: Oseni, 2012, p. 3968.

Presently, electricity supply in Nigeria comes mainly from a combination of "hydro, thermal and fossils sources" (Akinlo, 2009, p. 683). With an estimated installed power generating capacity of about 9,955 MW and available capacity of roughly 5,516 MW supplied by seven independent power producing stations, three hydropower stations, seven thermal stations, and three national integrated power producing stations (Natinal Control Centre, 2012) as shown in Table , meeting the nation's electricity needs has proven to be an uphill task. As indicated by Ikeme and Ebohon (2005, p. 1214), "much of this capacity are non-operational or operates at sub-optimal levels"; bringing actual power generation to typically between 1,500 and 2,500 MW. The implication of this, therefore, is that the Nigerian electricity sector

lacks the capacity to meet the demands of its teeming consumers. This has subsequently led to episodes of incessant blackout and shortages in power supply in the urban areas, and little or no power in the rural areas (Akinlo, 2009; Bada, 2011).

Table 1.2 Electricity in Nigeria: Source and Generating Capacity

	Power Station	Installed Capacity (MW)	Average Availability (MW)	Availability Factor
IPP	Rivers	180.00	35.12	0.20
	Omoku GT	150.00	38.53	0.26
	Trans-Amadi GT	100.00	30.65	0.31
	Okpai Gas	480.00	440.86	0.92
	Ibom	155.00	32.08	0.21
	Afam VI (gas)	650.00	603.70	0.93
	AES (gas)	302.00	203.99	0.68
Sub total		2,017.00	1,384.93	0.69
Hydro	Kainji	760.00	295.38	0.39
	Jebba	578.40	414.42	0.72
	Shiroro	600.00	497.46	0.83
Sub total		1,938.40	1,207.26	0.62
Thermal	Egbin Steam	1,320.00	1,022.56	0.77
	Afam (I-V) (gas)	351.00	95.32	0.27
	Delta (gas)	900.00	246.23	0.27
	Sapele ST	720.00	98.52	0.14
	Geregu (Gas)	414.00	274.96	0.66
	Olorunsogo I	335.00	214.39	0.64
	Omotosho	335.00	113.02	0.34
Sub total		4,375.00	2,065.00	0.47
NIPP	Olorunsogo II	750.00	496.20	0.66
	Omotosho NIPP	500.00	144.73	0.29
	Sapele NIPP	375.00	218.26	0.58
Sub total		1,625.00	859.19	0.53
Total		9,955.40	5,516.38	2.31

Source: NCC, 2012.

Apart from the constraints in supply, the country similarly faces a serious electric energy crisis (Aliyu, Ramli, & Saleh, 2013) resulting from "declining electricity generation from domestic power plants which are basically dilapidated, obsolete and unreliable, and in an appalling state of disrepair" (Ikeme & Ebohon, 2005, p. 1215) – a reflection of the poor maintenance culture in the country and the general inefficiency of the electric power generating sector (Oyedepo, 2012a; Ubi, Effiom, Okon, & Oduneka, 2012).

A common feature of the Nigerian electric power arrangement has been the recurring "blackouts or brownouts, and total breakdown that can last weeks or even months" (Dada, 2014, p. 1004) as well as "general load shedding [which] generally impinge upon the level of economic activities in the country" (Nwosu, & Nnamdi, 2013, p. 86). "Rationing and unplanned power outages [which the people have become used to], both on the transmission and distribution network, have thus become a common feature of the Nigerian power landscape" (Ikeme & Ebohon, 2005, p. 1215). This has led to people and businesses practically providing power for themselves by way of very expensive personal diesel and gasoline powered electric generators (Okafor & Joe-Uzuegbu, 2010; Reuters, 2013). Though these household generators have been serving the immediate purpose, little or no consideration has been given to the associated social, health and financial costs which are already taking their toll on the citizens in particular and the nation in general.

That the plethora of natural renewable energy sources have not really played any significant role in power generation for urban use in Nigeria, and that in the rural areas where renewable energy sources are in very large supply, the fact that there has been minimal adoption remains unfathomable. Despite the potentials of renewable energy as observed by Shaaban and Petinrin (2014, p. 79), "regrettably, renewable energy resources are presently disregarded from the energy supply mix in Nigeria." This strengthens the allusion by Okoro. (1999) of Nigeria being a country solely dependent on non-renewable fossil sources of power for electricity as the country's inclination is fossil fuel oriented.

Of the reported grid electricity capacity of about 5,900MW[1], about two-thirds of that is generated from fossil fuels by thermal means, and the remainder by large hydro (Central Intelligence Agency, 2014; PHCN, 2011). This mentality has exposed

[1] Reported grid electricity capacity over the years have fluctuated around the 5,500 – 5,900 MW range.

the country to the perils of over dependence on fossil fuels which, over three decades ago, was warned against by the then President of the Federal Republic of Nigeria, Alhaji Shehu Shagari, at the 'United Nations Nairobi Conference on New and Renewable Sources of Energy,' where he stressed that the diversification away from petroleum was a development welcomed by Nigeria and one that provided the opportunity "to take action before stumbling into a fossil fuel trap" (United Nations, 1981, p. 113) – a trap the nation has fully become entangled in today.

1.2.1 Electrification in Nigeria

Based on the International Energy Agency (IEA) 2008 estimates, about 22% of the world's population live without access to electricity and those living in the rural areas make up 85% of this number (International Energy Agency, 2009, p. 128). Nigeria is a representation on this statistic, being a country with relatively low electricity coverage with a national electrification rate of 45% (International Energy Agency, 2014).

Figure .1 puts in perspective for comparison purposes the share of the population with electricity access in rural and urban areas in 2008 for Nigeria, Sub-Saharan Africa (SSA), Least Developed Countries (LDCs) and Developed Countries (DCs).

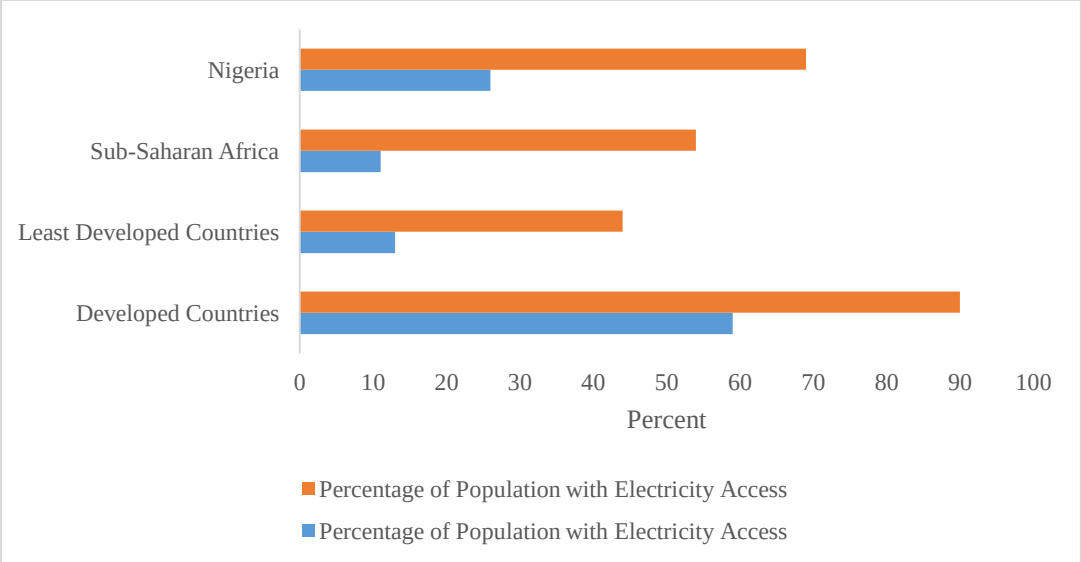

Figure 1.1 Share of Population with Electricity Access

Source: UNDP/WHO, 2009.

The share of Nigeria's population without electricity access as of 2008 according to agglomerated data from the United Nations Development Programme (UNDP) and World Health Organization (WHO) combined report of 2009, stood at 53% (UNDP/WHO, 2009, p. 12), with an overall rate of rural electrification of 26% and urban electrification of 69% of the rural and urban population respectively (International Energy Agency, 2009)[2].

The statistics and existing data (see Energy Commission of Nigeria, 2011; Ikeme and Ebohon, 2005; NCC, 2012) show that at current power generation capacity, it is obvious that the nation does not have enough power to distribute to the urban and peri-urban areas, let alone the rural ones. A precarious electricity situation reminiscent of Wessenauer (1963, p. 55) declaration that:

> In many countries a paramount need is for more generating capacity and for lines and substations to deliver electricity to villages and farms. Meeting this need is a challenging problem, particularly for nations whose major cities and major industries have far too little power.

Meeting the electricity needs of the Nigerian people has really posed a challenge which experience have shown, that merely increasing the generating capacity and feeding more power into the grid would not solve. As highlighted by Ajao, Ajimotokan, Popoola, and Akande (2009), the issue is more of overcoming the major factors contributing to unreliability and inefficiency in the power sector like frequent breakdown of generating plants and equipment as well as obsolete transmission and distribution equipment due to inadequate repairs and maintenance. This is as a result of the national electricity grid being too large, too old and too complex, as well as being fraught with large infrastructural decay.

1.2.2 Rural Electrification and Development in Nigeria

The link between rural electrification and development was made by Painuly (2001, p. 73) when he stated that if we are to make a difference in the lives of rural dwellers, "we have to provide them with a connection to the electricity grid or provide

[2] For the purpose of this research, the most accurate available data was used.

them with power sources suitable for off-grid applications – i.e. renewable electric technologies." Due to the prevailing electric power situation in Nigeria (as already presented in the preceding sections), the option of grid connection by extending the national electricity grid is out of the question as the current available power is inadequate for urban supply, let alone rural consideration on one hand; on the other hand, the grid is currently not in a state to handle the distribution of electricity to the whole nation (Ikeme and Ebohon, 2005; IseOlorunkanmi, 2014).

Therefore in a bid to tackle the issue of Nigeria's fossil fuel backed centralized power supply crises and "coupled with the increasing need to get the rural dwellers served with electricity, it has therefore become necessary to extend the list of technological alternatives for energy investment decision-making to include decentralized sources of supply" (Adeoti, Oyewole, & Adegboyega, 2001, p. 156), paramount of which are the vast renewable energy sources in the country.

1.3 Problem Statement

That Nigeria is an energy rich nation with both fossil and renewable fuels has never been in question. "Its renewable energy potential base, which includes biomass (animal, agricultural and wood residues, and fuel wood), solar, hydro, wind and geothermal [is there to be harnessed for electric power generation]" (Akinbami, 2001, p. 156). Although prior studies and reports (e.g. Energy Commission of Nigeria, 2013a; Ikuponisi, 2004; Ohunakin, Ojolo, & Ajayi, 2011; Sambo, 2005) have found that renewable energy technologies for electric power generation are feasible in Nigeria due to the abundance and immediate availability of renewable energy sources in the country, especially in the rural areas, the reality is that, as a predominantly fossil fuel dependent nation, Nigeria's use of renewable energy for electricity generation has been negligible (Central Intelligence Agency, 2014).

This apparent lack of interest in renewable energy for electricity generation and the inadequate supply of electricity in Nigeria is quite puzzling, considering the fact that the use of renewable energy sources for electricity development is not a novelty to Nigeria, as electricity was first produced from a renewable energy source using renewable energy technology (60 kW micro hydro system) back in 1896 –

barely “fifteen years after the introduction of electricity in England” (Niger Power Review, 1985 as cited in Okoro & Chikuni, 2007, p. 52).

In spite of this very early introduction of electric power and renewable energy technology into the country, it’s safe to say that electricity development never took off in Nigeria, as more than a century later, the nation is still battling with an inadequate power supply in the urban areas and little or no power in the rural areas. Rural electrification has suffered the most, and achieving electrification has proven close to impossible considering that Government efforts to provide electricity to rural communities in Nigeria has been ill construed by being designed to revolve around the idea of extending existing distribution lines of a moribund national grid. According to Akpan, Isihak, and Udoakah (2013, p. 2), this is not advisable as a result of “low capacity utilization due to low demand” and the conviction that extending the distribution network to rural communities may not be cost-effective (Goldemberg, 2000; Gollwitzer, 2014).

This approach as can be seen, has not in actuality translated to availability of electricity in the rural areas, “especially given the larger problem of low electricity generation capacity and high transmission and distribution losses faced by the Nigerian electricity sub-sector” (Akpan, Essien, & Isihak, 2013, p. 505) on one hand; and on the other hand, the fact as indicated by Borhanazad, Mekhilef, Saidur, and Boroumandjazi (2013, p. 210 based on Sreeraj, Chatterjee, & Bandyopadhyay, 2010) that rural dwellers actually live in thinly populated areas spread over wide expanse of land, “difficult terrains and thick jungles”, therefore making the extension of the grid to these areas economically unfeasible due to the high cost of distribution and associated transmission losses.

With an abundance of wind power, biomass, solar insolation and natural water sources which are well suited for power generation, especially in the rural areas of Nigeria (Sambo, 2005), there is no reason why these renewable energy sources are not being harnessed on a much larger scale for electricity provision purposes in the rural areas. So drawing from the above assertions and considering the abundance of energy at the disposal of a country like Nigeria, one therefore wonders why it has been practically impossible to harness these natural energy sources for electric power supply, and consequently ponder what those factors that have been prevailing against

the large scale adoption of renewable energy sources, especially for rural electrification in an energy rich nation like Nigeria, could be.

1.4 Purpose of the Study

The purpose of this qualitative phenomenological study is to explore the perceptions of government officials and experts responsible for electric power development and rural electrification in Nigeria, on why it seems that there has been very little interest in the adoption of renewable energy sources for rural electrification projects in Nigeria, and the influence, if any, fossil fuel has had on the use of renewable energy sources for rural electrification.

1.5 Research Questions Guiding the Study

The actual phenomenon forming the focus of this study is the seemingly dearth of renewable energy sources and technology in the provision of rural electrification in a renewable and non-renewable energy rich economy like Nigeria. To understand this phenomenon, a good starting point, as seen by many qualitative researchers, is a well-constructed research question that emerges from a reflective and interrogative process "required for developing research questions (that) can give shape and direction to a study in ways that are often underestimated" (Agee, 2009, p. 431).

Following the suggestion that in the qualitative research method of phenomenology, "the researcher must allow the data to emerge" (Bentz & Shapiro, 1998; Kensit, 2000 as cited in Groenewald & Schurink, 2003, p. 95), it is believed that an understanding of a phenomenon like the one this study seeks to explore will, therefore, be better enhanced by seeking responses to a set of research questions that can explicate findings that are more emergent in nature than being answers to a direct inquiry.

In this light, the qualitative research questions, which as indicated by Agee (2009, p. 432) as a "need to articulate what a researcher wants to know about the intentions and perspectives of those involved in social interactions", were framed as follows:

1.5.1 Factors Influencing the Choice and Diffusion of Renewable Energy Technologies for Rural Electrification in Nigeria

1) How has being a fossil fuel-rich country affected the large scale adoption of renewable energy technology for rural electrification and rural development projects?

1.5.2 Perceptions of the Bureaucrats for Increased Support for the Adoption of Renewable Energy Powered Rural Electrification

2) How can policy makers be encouraged to support the use of renewable energy technologies in promoting rural development in Nigeria?

3) How do the bureaucrats tasked with the responsibility of providing electricity for rural communities in Nigeria view renewable energy technologies in Nigeria?

1.5.3 Features of Renewable Energy that Could Make or Mar its Acceptance as an Option for Rural Electrification Projects in a Fossil Fuel Rich Country Like Nigeria.

4) What are the dynamics involved in accepting an alternate form of energy for rural electrification projects in a fossil fuel rich country like Nigeria?

1.5.4 Sustainability of a Renewable Energy Powered Rural Electrification Program in a Fossil Fuel Rich Economy Like Nigeria.

5) How has the interaction between having an abundance of fossil fuel and renewable energy sources in Nigeria affected the choice of including modern renewable energy sources and technologies in the electrification mix?

To help meet the objectives of the research, and in line with seeking emergent data from "rich descriptions of phenomena and their settings" (Bentz, & Shapiro, 1998; Kensit, 2000 as cited in Groenewald and Schurink, 2003, p. 95), the actual interview questions posed to the participants during the interview sessions for data gathering purposes were phrased to grasp the participants' "viewpoints for understanding interaction, process, and social change" (Strauss, 1987, p. 6). The interview questions, as shown in the interview guide (see Appendix A: Framework for Data Collection) were guided by the overarching research questions above.

1.6 Rationale and Significance of the Study

The rationale behind this study originates from the researcher's desire to encourage a greater interest in the use of the abundant renewable energy resources in the country and the renewable energy technologies available in the provision of rural electricity in rural development projects in Nigeria. A better understanding of the dynamics at play when it comes to making the necessary decisions it is believed, may not only improve the chances of selecting renewable sources of energy for rural electrification projects, but also increase the chances of institutionalizing such renewable energy sources as a viable source of power in a fossil fuel dominated economy like Nigeria.

1.6.1 Contribution to Knowledge

This study, explored through data obtained from key officials of several agencies, linked with the Federal Ministry of Power in Nigerian those factors that are critical to the large scale application of renewable energy technologies in providing electric power for rural development in a predominantly fossil fuel rich economy. A study such as this, located within the field of Development Management in Public Administration provides a platform for the appreciation and understanding of the important elements of a given policy area – renewable energy and electric power supply – and how it relates to a given development management area – rural development – from the perception of the individuals tasked with the responsibility of implementing it.

1.6.2 Relevance to Public Policy

Considering that "the relationship between research, policy and practice is complex, multi-factoral, non-linear, and highly context specific" (Young & Mendizabal, 2009, p. 2), the findings from this study has the potential to guide energy policy makers in ascertaining salient issues inhibiting the large scale adoption of alternative sources of energy for electric power generation in a predominantly fossil fuel rich society. It is also hoped that knowledge gleaned from this study will reinforce the importance of actively diversifying the energy sources of a given country, especially those endowed with a variety of energy resources.

1.6.3 Usefulness to Practitioners

Identifying some of the issues that could affect the large scale adoption of renewable energy sources and technology in rural electrification projects in a fossil fuel rich country like Nigeria will have implications for bureaucrats and implementers tasked with the job of steering rural electrification and development policy matters. Apart from bringing these issues to the limelight, identifying them will not only make them known, but also serve as a starting point for providing much needed interventions and practical solutions.

1.7 Research Approach

To gain better insight into the phenomenon being studied, this research explored the experience and perceptions of 17 senior government executives in several federal agencies in the Nigerian energy and electrification sector using a qualitative research approach. The process of the research represented a phenomenological study using qualitative research methods in line with Creswell (2008, p. 4), suggestion of using "emerging questions and procedures, data typically collected in the participant's setting, data analysis inductively building from particulars to general themes, and the researcher making interpretations of the meaning of the data."

The primary method of data collection was in-depth interviews which were voice recorded and later transcribed verbatim. The data obtained were analyzed and subsequently formed the basis for the overall findings of the study. Using the frame conceptualized as a guide of the study as gathered from Bloomberg and Volpe (2012, pp. 139-142), coding categories were developed and refined on an ongoing basis until satisfactory themes suited for this study emerged. Bearing in mind the understanding that the concept of applying renewable energy technology for rural electrification and rural electrification in itself has to be treated within the context of rural development at large, and that the phenomenon being investigated cuts across several disciplines, the study embraced an integrated multi-disciplinary approach in order to expedite comprehension from different perspectives.

1.8 Role of the Researcher

The researcher is not an expert in policy, rural development or renewable energy. Nonetheless, this is not an issue, as it is believed, based on the provisions by Thomas (1996, p. 107), that to carry out a study such as this, "the need is for an appreciation of the important elements of a particular economy or policy area without specializing in economics, social policy, or any other single discipline." In line with the above understanding, this study was successfully carried out by integrating the knowledge and academic experience gathered during the course of the researcher's academic programme with information from existing literature which informed the key interview questions, as well as guided the adopted research method.

It is further acknowledged that the same experiences on which the credibility to carry out this research is based, could also be a liability in terms of the research design and interpretation of the findings, which "are deemed to be influenced by the disciplinary and theoretical perspectives of the researcher" (Thorne, Paterson, Acorn, Canam, Joachim, & Jillings, 2002 as cited in Boeije, 2009, p. 155). Considering, therefore, that the disciplinary orientation and prejudice of authors, which are "reflected in the framing of the research questions, the data collection and analysis methods, the interpretation of the findings and the presentation of the reports" (Boeije, 2009, p. 155), cannot be avoided in qualitative research like this, it was imperative that the researcher's stance in this research be stated clearly. Therefore, as dictated by qualitative research ethics, in order to address the subjectivity and strengthen the credibility of this research, assumptions and theoretical inclinations were made explicit and backed by various procedural safeguards such as triangulation of data sources and ensuring of a vigorous audit trail of the methods.

1.8.1 Researcher's Perspective

This study was initiated from a practice and an entrepreneurial stand point. Although the phenomenon under consideration can be approached from various view points, the research, however, has been carried out from the perspective of a renewable energy practitioner seeking to pinpoint the problems associated with implementing renewable energy powered rural electrification projects in a fossil fuel dominated society like Nigeria.

As already stated, the researcher has never claimed to be an expert in any of the relevant disciplines, but has used extant literature and findings across several fields made possible by earlier studies and research to gain sufficient in-depth knowledge for the scope of this work. In carrying out this study, which is mostly a combination of theoretical, academic and practical experience, occasional personal views and preferences cannot be avoided. However in these situations, these views should be considered solely as complementary commentary to the information gathered.

1.8.2 Researcher's Assumptions

Based on the researcher's experience and background, three key assumptions were made regarding the phenomenon under investigation. First, the provision of electricity services should not be an issue in Nigeria considering the abundance of a diverse array of energy sources in the country. This assumption is based on the premise that the nation has the wherewithal to combat the problem of electricity generation and supply. So in a country with so many energy sources and reserves, there should not be the issue of a lack of electricity, as this goes against the tenets of the local Nigerian aphorism popularized by Achebe (1996, p. 117) that one "cannot live by the bank of a river and wash his hands with spittle."

Second, it has taken too long for the Nigerian electricity industry to not have gotten it right. The difference in time between when renewable energy powered electricity was first introduced in the United Kingdom and in Nigeria is just 15 years, but the difference in electric power development between both countries today is astronomical. Nigeria has been left behind in all aspect of power generation, distribution, quality, reliability and supply. Finally, because of the moribund nature of the national grid, decentralized electricity generation and distribution powered by renewable energy should not even be a second thought. This is because the present policy of pushing for the extension of the national grid makes no sense since the associated cost of doing this will continue to frustrate the effort.

1.9 Definition of Key Terminologies

For the purpose of this study, the following terms are defined:

Renewable Energy: Energy derived from natural processes that are replenished constantly. In its various forms, it derives directly or indirectly from the sun, or from heat generated deep within the earth (International Energy Agency, 2012, p. 11).

Renewable Energy Technologies: Technologies used to produce power, heat or mechanical energy by converting renewable energy resources either to electricity or to motive power (Armstrong & Hamrin, 2000).

Rural Electrification: The provision of electricity to rural and remote areas of low demand and highly dispersed potential consumers which can be made possible through small-scale auto generation, local independent grids, or a central regional or national grid (Cecelski & Glatt, 1982, p. 1).

Decentralized Energy: This is the production of electricity at or near the point of use, irrespective of size, fuel or technology (Ajao, Ajimotokan, Popoola, & Akande, 2009, p. 89).

Electric Power Grid: A system of high tension cables by which electrical power is distributed throughout a region (WordNet 3.0, 2008).

Electricity Grid Extension: Increasing the reach of the electric power distribution grid to cover more parts of a region. Highly discouraged based on economical, technological and developmental reasons as an appropriate solution for rural electrification (Energypedia, 2015).

1.10 Limitations of the Research

Research and studies with this chosen methodology are usually plagued with several inherent limitations that may weaken the research. Some of these limitations emanate from the shortcomings of qualitative research methodology in general, while some are inherent in the study's research design. Quality in this case, is heavily dependent on the skills of the researcher and this might have easily been influenced

by the researcher's personal biases and idiosyncrasies. This is because “qualitative studies in general are limited by researcher subjectivity” (Bloomberg & Volpe, 2012, p. 126) and as analysis ultimately rests with the thinking and choices of the researcher, this becomes an issue.

Data relied on participants’ long-term recall of their understanding of the phenomenon which posed a problem of reliability. The researcher, during the interviews, may have had some difficulties recalling or articulating certain thoughts and might have provided opinions that might not have been relevant to the subject matter of the interview, or guided some participants to respond in line with expectations or expected answers. To mitigate these limitations, the researcher acknowledged the research agenda and stated the assumptions up front.

As gleaned from the example used by Bloomberg and Volpe (2012), coding schemes, documents and transcripts used in the analysis were scrutinized by the researcher's advisor and through peer review from the researcher’s colleagues who provided constructive critique and advised on how to better present the interview questions. This study emphasized the experiences of selected senior executives in specific agencies linked with the Ministry of Power in Nigeria; there was no attempt to generalize the findings to other countries. At the end of the day, this study can only serve as a guide for researchers who desire to extend the subject matter in Nigeria more qualitatively or as a starting point for a quantitative study.

1.11 Organization of the Dissertation

Following this introductory chapter, the specific components of this dissertation are presented in Chapters 2 through 5. Chapter 2 provides a review of the literature. Chapter 3 contains the methodology and procedures utilized in the study. A presentation of the textual data and analysis are presented in Chapter 4, while the interpretation of the findings, conclusion and recommendations for future research makes up Chapter 5.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview and Organization of the Review

A phenomenological study like this – aimed at exploring the perceptions of participants on what has been the issues militating against the utilization of the abundant renewable energy sources in a fossil fuel rich nation for electrification projects in rural development efforts – will tend to cut across various disciplines. So it was necessary to complete a critical review of extant literature to help explore and contextualize the various interdisciplinary aspects of this research. In line with this understanding, and in order not to end up re-inventing the wheel, the review of relevant literature conducted was also used as the foundation to provide a general framework of background information relevant to addressing the multidisciplinary topic covering renewable energy, rural electrification and development.

As expected of a qualitative research, the review was ongoing throughout the research design, data collection, data analysis and synthesis stages of the study. So rather than having all of the reviewed literature presented in this chapter, part of the reviewed literature from various sources appear in the other chapters as they touch on the subject being discussed.

As already indicated, a review of relevant literature was conducted to help build a general context of background information necessary for understanding the concept of renewable energy, rural electricity provision and rural development in a developing fossil fuel rich nation like Nigeria. This review is structured into three key sections. The first section looks at an overview of relevant theoretical perspectives that would help to further illuminate the study. Though theory, per se – in the sense it is used in quantitative research – plays little or no consequential role in qualitative research, highlighting individual theories associated with the various disciplines involved in this study was deemed quite necessary for better understanding and grasping of the context in which each concept was utilized.

The second and final sections, respectively, present literature on renewable energy powered rural electrification and development, and views from related research on renewable energy, rural electrification and rural development in general. The chapter concludes with a framework on which the study was carried out. It is presented as an output of the synthesis and discussion of themes associated with the various aspects of the research.

2.2 Theoretical Perspectives

Creswell (1994, p. 94) posits that in qualitative studies, unlike in quantitative research, "one does not begin with a theory to test or verify." Theory in qualitative research, "is supposed to [emerge as] an outcome of an investigation rather than something that precedes it" (Bryman, 2012, p. 384). This premise, however, does not dismiss the role of theory in the conceptualization of a phenomenological study such as this, as the sources of data for the concepts in the framework of the study are arguments generated from theories from the various disciplines "addressing the social, cultural, political, or environmental phenomenon in question and the multidisciplinary literature on the subject" (Jabareen, 2009, p. 57).

Theory can generally enter the research process in different ways. They might be drawn from "existing theories of culture" (Creswell, 1994, p. 94); the "scientific research may be guided by a conceptual framework, model, or theory that suggests possible questions to ask or answers to the question posed," or theoretical understanding can factor indirectly into the research process on the strength of Kuhn's (1962) argument of all scientific observations being 'theory ladened' (National Research Council, 2002, pp. 61-62).

The challenge of a lack of a single guiding theory, other than that directly linked to the methods of this study, has also been made more difficult due to the multiple disciplines from which the phenomenon is examined. However, this lack of a clear or specific theory is compensated for, based on two perspectives: one, the understanding that "the choice of what to observe and how to observe it is driven by (a form of theory or) an organizing conception – explicit or tacit – of the problem or topic (which) drives the research question, the use of methods, and the interpretation

of results" (National Research Council, 2002, p. 62); and two, that synthesizing concepts informed by theories from different disciplines can be said to collectively constitute the theoretical framework of the study, as they represent distinctive aspects of the theoretical foundations of such a study (Jabareen, 2009).

The subsequent part of this section will be used to highlight some theoretical concepts relevant to, and essential in, providing support for the arguments used in this research.

2.2.1 Public Policy Perspective

The literature on the public policy making process – analysis, implementation and evaluation – is rich in discourse, and they all point to one focal understanding that "no matter how one approaches the task of explaining why and how public policy is developed and changed, the policy process, in actuality, is disorganized and chaotic" (Neiman & Stambough, 1998, p. 449). Wide-ranging definitions of what public policy is or should be, abound in the treatise on public policy. Dye (1992, p. 2) saw public policy as "whatever governments choose to do or not to do," while Anderson (1994, p. 5) defined it as a "purposive course of action or inaction undertaken by an actor or a set of actors in dealing with a problem or matter of concern". According to Wilson (2006, p. 154) public policy is seen as "the actions, projections, or pronouncements of governments on particular matters, the steps they take (or fail to take) to implement them, and the explanations they give for what happens (or does not happen)."

Irrespective of the different definitions of public policy, Birkland (2006 as cited in Smith & Larimer, 2009, p. 4) indicated that there is a general agreement that public policies are responses to specific problems, which involves the process of making choices and the outcomes or actions of particular decisions backed by the coercive powers of the State. Due to the various actors in play within the policy process, the concept of choice, as well as interactions and action, are therefore key parts of what is required of the institutions involved in the policy process.

"In democracies, the processes associated with how governing institutions address various policy issues and alter public policies always have been primarily an amalgam of various forces" (Neiman & Stambough, 1998, p. 449). These forces, as was further elaborated, cut across public opinion, organized pressures, constituency

interests, personal views of legislators, and the views of those tasked with the implementation of the policy as well as the role of formal rules and institutional contexts in which these processes take place.

It therefore suggests that proper consideration of the above factors inevitably leads to choice and who makes that choice. The choice of what to consider and what not to consider, and astute decision making in the policy process, which invariably highlights the importance of the roles of the 'choice-makers', actors and/or players, and the influence they could exert on the process. This accordingly implies the existence of advocacies who could lobby for or against a given policy position or aspect of the policy.

To help simplify the complexity posed by the existence of the numerous actors and above factors with regards to how they affect the policy process and how they relate to each other, this study draws from the Advocacy Coalition Framework proposed by Sabatier and Jenkins-Smith (1988) in looking at the roles the various actors and stakeholders play. This framework, along with elements of arguments from institutional theory, is used to synthesize a platform for understanding the mechanisms in play in legitimizing a new energy source in the presence of an already dominant one in the provision of electric power in a given society.

2.2.2 Advocacy Coalition Framework

The description of policy processes as processes which involve "many actors (individuals and organizations) and is defined by local (and sometimes external) political, social (cultural and belief systems), and institutional realities (bureaucratic structures and capacities) within which it operates" (Aberman, Schiffer, Johnson, & Oboh, 2011, p. 4) epitomizes what a framework like the advocacy coalition framework is set up for. This resonates with Sabatier (1998 as cited in Bergek, Jacobsson, & Sandén, 2013, p. 57) who indicated that "policy making takes place in a context where advocacy coalitions, made up of a range of actors sharing a set of norms or beliefs, compete in influencing policy in line with those beliefs."

Highlighting the importance of advocacy coalitions in an energy policy domain, Negro, Alkemade, and Hekkert (2008, p. 4) based on Sabatier (1998) and Sabatier and Jenkins-Smith, 1988), observed that:

> In order for a new technology to develop well it must become part of an incumbent regime, or even overthrow it. Parties with vested interests will often oppose this force of 'creative destruction'. In such an event, advocacy coalitions can function as a catalyst; they put a new technology on the agenda (function guidance of the search), lobby for resources (function resource mobilization), favorable tax regimes (function market formation) and by doing so create legitimacy for a new 'technological trajectory'.

On the strength of the above, it is therefore, vital for renewable energy sources and their associated technologies to be repackaged in order to make them more attractive to existing coalitions or actors in the energy arena in Nigeria. In like manner, for there to be any meaningful headway in adopting the use of the abundant sources of renewable energy and its associated technologies for rural electrification in Nigeria, the policy makers will have to work with members of different energy related advocacy coalitions and interest groups.

In so doing, it is believed they will see renewable energy technologies in a different light – as viable and practical options that could supplement the use of large hydro and fossil fuel in power generation in Nigeria, especially in the rural sector. As recommended by Jacobsson and Bergek (2004, p. 842), the Government or "policy makers may therefore find it useful to strengthen existing advocacy coalitions … to support the work of various interest groups associated with the new technology." This, as emphasized by Scheer (2004, p. 146), is because:

> How fast and how widely the potential of renewable energy is realized depends on the motivation of many millions of people, on the level of energy awareness in the public consciousness, and above all, on the extent to which political action widens the scope for exploiting renewable sources.

This implies, as indicated by Jacobsson and Lauber (2006, p. 271), that actors, coalitions and policy (Government action) cannot be discounted from the energy policy debate. The effect of actors – researchers, farmers, technicians, entrepreneurs,

customers and others – in the renewable energy technologies policy process is very significant, as no matter how limited and ambivalent their support, they form a fertile ground for the active development of new technologies.

The Advocacy Coalition Framework emphasizes the role of Science in policy, policy change, learning, and coalition behavior, and has "been considered most applicable to subsystems[3] marked by elevated political conflicts and scientific and technical uncertainty, as found in environmental and energy policy" (Sabatier & Jenkins-Smith, 1988, p. 6). As a framework developed to study complex, enduring public policy processes involving multiple actors (Stich & Miller, 2008), the Advocacy Coalition Framework provides a platform on which the interconnectedness of the roles of the different players can be explored.

Although not specifically based on Advocacy Coalition, this study uses, as a conceptual guide, aspects of the Advocacy Coalition Framework as developed by Sabatier and Jenkins-Smith (1988) in a similar way as Jegen and Audet (2011) in Advocacy Coalitions and Wind Power Development: Insights from Quebec. in which the notion of an advocacy coalition helps reinforce the understanding and explanation of how the actions of those tasked with implementing a renewable energy powered rural electrification programme in Nigeria could be seen as a determinant of the adoption of renewable energy for such projects. Arguments from the framework were employed to further explore and understand the influence advocacy coalitions could have on the process of legitimating renewable energy technologies for rural electrification within the energy policy domain of a fossil fuel rich economy like Nigeria.

2.2.2.1 Rationale for the Advocacy Coalition Framework

The shaping of policy does not come about based on the actions of one player; it occurs through the actions of many drivers, or policy participants who exist either as groups or individuals in organizations (Putt & Springer, 1989). Based on an agglomeration of participants and what they bring to the table, such as expertise and influence, Engel (2007, p. 5) argued that "the Advocacy Coalition Framework maintains an open ontology to the question of which actors are important in a policy

[3] Policy subsystems are interactive networks of legislatures, interest groups, beneficiaries and agencies (Stein and Bickers, 1997 as cited in Sabatier and Jenkins-Smith, 1988, p. 6).

area and how these position themselves in relation to the policy" or affect the policy eventually. As it can be seen, these actions are the decisions necessary to formulate and implement public policies.

Not only are there multiple drivers within organizations that formulate and carry out public policy, as found by various studies, there are numerous external interest groups and individuals influencing public policy (Berry, 2010; Burstein, & Linton, 2002). These individuals and groups often have different conceptions of the need for and the purposes of public policy. They carry different priorities for what constitutes appropriate public policy, different moral and ethical commitments, and different conceptions of what cause social problems and how to resolve them (Putt & Springer, 1989).

Since it was formulated, the Advocacy Coalition Framework has undergone various improvements and modifications based on the expansion of the hypotheses, its criticisms and extension of its use to other policy fields and wider geographical context other than the United States (Sabatier & Weible, 2007). It has become a robust tool, well suited for interpreting the roles different actors could play within the context of positioning a novel ideology as in the case of increased interest in renewable energy for rural electrification in Nigeria.

2.2.2.2 Advocacy Coalition Framework as a Bridge

Although no one singular framework, theory, or model has the potential to fully capture the range of factors that shape or underlie the policy process, having a framework, theory or model has been suggested as a very reliable strategy for approaching complex phenomena as it can help organize or explain the complexities of the process (Buechner Institute for Governance, 2013). So considering the copious number of stakeholders in the policy process, which in the case of this study include the various agencies involved in rural development, natural resources, energy and electrification, a framework that can incorporate their respective values, beliefs and perspectives with respect to the policy process would be of the greatest importance and advantage.

In this study, aspects of the 2005 Advocacy Coalition Framework (See Appendix B: Advocacy Coalition Framework) have been adopted, as suggested by Ostrom (2007), to guide the analysis, as well as help facilitate an easier generation of the explanations to the questions needed to be addressed. The use of this framework

has helped illuminate, with a simple conceptual model, a connection between the roles of the various actors from renewable energy, rural electrification and development. It has also helped connect policy elements of this study with aspects of institutional theory and provided a clearer picture of the relationship between renewable energy and fossil fuel – be it positive or negative – in providing rural electrification and development in a fossil fuel dominant economy, and the effective way an active participation of the various stakeholders leads to proper implementation of the energy policy.

2.2.3 Institutional Theory Perspective

Exploring the importance of the concept of a renewable energy powered rural electrification programme in a fossil fuel rich country like Nigeria within the context of this type of study also requires the synthesis of several features of the institutional theory like legitimacy and institutionalization. These features, which were synthesized from the theory and adopted in the framework of the study, were used mainly for explanatory purposes. The aim was to use these features of the institutional theory literature to explain how mechanisms that lead to an increase in legitimacy of renewable energy technologies could further enhance their acceptance within the policy arena, and hence culminate in instituting their application in the Nigerian energy and rural electrification policy system.

This premise is based on Scott's (2005, p. 460) view that institutional theory is all about the "processes by which structures, including schemas, rules, norms, and routines, become established as authoritative guidelines for social behavior." It can be argued, therefore, that institutional theory possesses the necessary elements that can be used to provide the required explanation needed to substantiate the efficacy of renewable energy technologies as an option for rural electrification in the policy process, and also serve as part of the building blocks of the proposed explanatory model.

2.2.3.1 Legitimacy

The concept of organizational legitimacy, as presented by Turcan, Marinova and Rana (2012, p. 426), "as the outcome of a purposeful pursuit of external and/or internal validity and recognition, as well as a means or resource for an

organization to strengthen … institutional, and, more widely, social support" can be extended to renewable energy in this study. Legitimacy, in this case, further denotes a means or resource for strengthening and maintaining relationships and gaining social support. It has been shown to be a great resource for enhancing acceptance and reducing barriers to the access of scarce resources, and also maintaining the support of valued stakeholders (Ashforth & Gibbs, 1990; Bergek, Jacobsson, Carlsson, Lindmark, & Rickne, 2008; Suchman, 1995).

To make a case for the legitimacy of renewable energy technologies within the Nigerian context, it can be argued that renewable energy technologies will have to be presented in a manner "considered appropriate and desirable in relation to applicable institutions as judged by relevant actors in order for resources to be mobilized, for demand to form and for actors … to acquire political strength" (Bergek, Hekkert, & Jacobsson, 2008, p. 9). Legitimacy, as further indicated by Bergek, Jacobsson, Carlsson, Lindmark and Rickne (2008, p. 416), "is a matter of social acceptance and compliance with relevant institutions"; it is not given, "but is formed through conscious actions by various organizations and individuals in a dynamic process of legitimation that help to overcome the 'liability of newness'" (Zimmerman & Zeitz, 2002 as cited in Bergek, Jacobsson, Carlsson, Lindmark, & Rickne, 2008, p. 417) "associated with new actors and technologies and [which] eventually lead to institutional change" (Bergek, Jacobsson, Carlsson, Lindmark, & Rickne, 2008, p. 419).

Legitimation is described as "the socio-political process of legitimacy formation through actions by various organizations and individuals" (Bergek, Jacobsson, & Sandén, 2008, p. 578). Its centrality, in regards to renewable energy and other new technologies, and how difficult it could be to obtain, is further highlighted by Bergek, Jacobsson, and Sandén (2008, p. 581) drawing from Aldrich and Fiol (1994); Deeds, Mang and Frandsen (2004); Rao (2004); de Ven (1993) when it was observed that:

> Perhaps acquiring legitimacy is particularly problematic in the energy and transport sectors, where incumbent technologies, actors and institutions have had decades (in some cases more than a century) to secure their positions as familiar and socially accepted.

Legitimation, therefore, is of the essence if renewable energy technology is to gain any grounds against incumbent technologies, especially where such incumbent technologies, actors and institutions are well-established and are now more socially accepted as in the case of fossil fuel and large hydro in Nigeria. The above observation, therefore, calls for an awakening to the recommendation of Jacobsson and Bergek (2004, p. 841) "that policy makers will have to find a strategy whereby they can challenge and overcome opposition from incumbent actors in order to align the institutional framework to the new technologies." It is, therefore, apparent that one of the major resources that renewable energy technology requires within the Nigerian energy and electrification policy arena is legitimacy, and, to a large extent, it is not whether the technology is applicable or feasible in accommodating the task of rural electrification.

This is because it has been demonstrated that the requirement of feasibility and viability of renewable energy powered rural electrification has been met as the feasibility of renewable energy technologies have already been established in most parts of the world (Flavin & Aeck, 2005; Geller, 2002) and also in Nigeria (Energy Commission of Nigeria, 2013a). However, without legitimacy, other objective quantification of its importance will serve little or no purpose as renewable energy technologies will continue to occupy the backburner in policy matters as is currently being experienced.

"Legitimacy is a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs and definitions" (Suchman, 1995, p. 574). In congruence with this position by Suchman (1995), legitimacy is being sought basically for renewable energy and its associate technologies as a boost to the credibility of renewable energy for rural electrification that could spark active support from the Government which will help renewable energy technology gain approval or avoid sanctions and achieve a stronger footing in the Nigerian energy policy system.

2.2.3.2 Institutionalization

Institutionalization connotes "a reciprocal typification of habitualized actions by types of actors" (Berger & Luckmann, 1966, p. 72). It is the process by which actions are repeated and given similar meaning by the actors (Scott, 1992). This study maintains that if factors that lead to legitimization of renewable energy and

its associate technologies could be identified, understanding how they could affect the adoption of renewable energy will enhance the institutionalization of the use of renewable energy and its associate technologies within the energy policy system of a country like Nigeria.

This is based on the reasoning that if the barrier of legitimacy of renewable energy technology can be overcome, renewable energy technology will definitely become attractive to the Government, policy makers and all those involved in the energy and electrification fields. Being more attractive would lead to making it the preferred choice for application in rural electrification programmes in Nigeria, leading to its subsequent institutionalization within the energy and electricity domain.

Sabatier (2007, p. 3) highlighted the importance of governmental institutions in the public policy-making process. They "formulate alternatives and select policy solutions which get implemented, evaluated, and revised" as the case may be. This implies that if renewable energy technologies became more attractive to those in the relevant government institutions, renewable energy and its associate technologies would have a better chance of taking root in Nigeria.

Based on institutional theory assumptions, this study particularizes "legitimation" and "institutionalization" – two aspects of institutional theory – and discusses how they influence the acceptance and adoption of renewable energy as well as its associated technologies in a given policy domain. If renewable energy fulfills the requirements of being an adequate and viable source of energy for rural electrification, then based on the concepts of legitimacy and institutionalization, the argument is that it could gain credibility to the extent of actually becoming the default option in the rural electrification arena in a fossil fuel rich economy like Nigeria where the effect of fossil fuel in electricity generation for the rural sector has made little or no impact.

2.3 Rural Development

Just like the term development, there is no commonly accepted paradigm on regional or rural development as there abound several theories depending "on the characterization of the principal actors and the mechanisms of the argument"

(Galdeano-Gómez, Aznar-Sánchez, & Pérez-Mesa, 2011, p. 54). Rural development, according to Van Der Ploeg et al. (2000, p. 404), has been termed "a disputed notion – both in practice, policy and theory," and in this field, "no comprehensive definition of rural development" exists (Clark, Jones, Potter & Lobley, 1997; Nooij, 1997 as cited in Van Der Ploeg et al., 2000, p. 391).

Although rural development cannot be adequately defined per se, for the purpose of this study, the 'rural' is described in line with Van Der Ploeg et al. (2008, p. 2) "as the place where the ongoing encounter, interaction and mutual transformation (in short: the co-production) of man and living nature is located." Its development, should, therefore, essentially be about its revitalization and strengthening. Rural development could be said to be aimed at repositioning "the rural within the wider society, by making the rural more attractive, more accessible, more valuable and more useful for society as a whole" (Van Der Ploeg et al., 2008, p. 3).

It has been established that rural development has been conceptualized in a variety of ways and it is impossible to find a single unifying definition. However, for the purpose of this study, the idea of rural development as essentially what the concept literally indicates – "the development of the rural" (Van Der Ploeg et al., 2008, p. 3) – will be accepted. This is because efforts aimed at improving and/or enhancing the lots of rural dwellers and bringing about significant improvement in their quality of life resonates well with this study's notion of rural development. One that "simply connotes a sustained improvement in the quality of life of the rural people" (Nwachukwu & Ezeh, 2007, p. 4).

It should go without saying that neglecting rural development is detrimental to a nation's overall success. "Rural residents are often the caretakers of a nation's natural resources and lack of development can lead to the destruction of those resources" (Green & Zinda, 2013, p. 3). So, if we are to go by the actual tenets of rural development - that is, the development of the rural areas - it can be maintained that Nigeria as a country stands to gain a lot from developing its rural areas since all that needs to be done is revitalize and further develop existing natural resources which are in abundance here.

Developing the rural areas should not be debatable because as already established, its development is connected to the general development of the entire

country. So arguably, for there to be any meaningful development in a country like Nigeria, the custodians of its natural resources have to be taken care of. This hypothesis draws on the understanding that as the bulk of the country's population and resources (particularly land, natural and mineral resources) are in the rural areas, "the true success of any comprehensive, economic and social development programme in Nigeria is primarily dependent upon the extent to which it contributes to the wellbeing of those living in those areas" (Nwachukwu & Ezeh, 2007, p. 3).

2.4 Rural Electrification

Rural electrification has been defined "as the supply of electricity to the countryside" (Obeng & Evers, 2009, p. 3). However, at the risk of underscoring Ranganathan (1993, p. 148) supposition that "some studies are prejudiced against rural electrification ab initio, mostly with a view to advocating decentralized energy options," this definition is too basic and might limit rural electrification activities to just a process of taking electric power to the rural areas, therefore simply implying grid extension.

The above definition of rural electrification really does not accommodate in situ generation or decentralized power provision which largely takes into consideration renewable energy sources. Putting the definition 'right' is therefore noteworthy, as it will help "clarify the scope of regulation, financing of certain rural electrification obligations and further amendment of Rural Electrification Acts through legislative instruments" (Rural Electrification Act, 1936-1993 as cited in Obeng & Evers, 2009, p. 3) as experienced in the United States of America back in the 1930s.

A more encompassing description of rural electrification, as indicated by Lahimer, Alghoul, Yousif, Razykov, Amin and Sopian (2013, p. 315) based on (Mainali & Silveira, 2012; Yadoo, Gormally, & Cruickshank, 2011; Zhang & Kumar, 2011), presents rural electrification as:

> The provision of long term, reliable, and satisfactory electricity service to households in remote, rural communities via grid or decentralized/centralized, renewable/nonrenewable energy resources supply.

The description of rural electrification by Cecelski and Glatt (1982, p. 1), "as the provision of electricity … made possible through small-scale auto-generation, local independent grids, or a central regional or national grid," also frames the concept of rural electrification within the context envisioned by this study. An extension of this definition is the description by Alfaro and Miller (2014, p. 904), who indicated that "grid expansion or extension and decentralized generation are two methods that can be used to achieve rural electrification goals" and as such not rural electrification in and of itself.

As further elaborated by Alfaro and Miller (2014, p. 904):

> Grid extension extends the centralized generation capacity by creating transmission and distribution networks to rural populations, while decentralized generation uses smaller generation units located close to the rural load centers, avoiding large distribution networks.

Decentralized generation, as a form of rural electrification, is almost often powered in situ by renewable energy, and "may involve the use of micro-grids joining a few communities or load centers and may eventually be connected to a larger grid" (Alfaro & Miller, 2014, p. 904).

The provision of electricity to the poorest populations in most countries, especially those living in the rural areas, is plagued with significant challenges - "One of which is deciding how to create or modify existing institutions and policies to support rural electrification initiatives" (Barnes, 2011, p. 260). It is, therefore, believed that if rural electrification is clearly distinguished from grid extension, individual problems associated with each approach could be tackled specifically and electricity provision to rural areas could become less cumbersome in delivery.

The importance of rural electrification is not lost on policy makers and governments all over the world. As asserted by Cecelski and Glatt (1982, p. 1):

> The provision of electricity in rural areas is widely believed to be a stimulus to increased agricultural productivity and output through irrigation and mechanization, to the growth of rural industries, and to raising the living standards of rural people. In most developing countries, rural electrification is considered important enough to subsidize extensively.

The ambiguity of the term rural development notwithstanding, "rural electrification in less developed countries is widely viewed by development policy-makers, planners and administrators as essential to rural development" (Alderfer, Hekhuis, Paine, Street, & Turner, 1963, p. 74). Its relationship with rural electrification is further explained by Ranganathan (1993, p. 149) who contended that rural electrification "should be part of rural development planning and not rural energy planning, because electricity is not one of a number of competing alternatives for meeting a given energy demand."

In this section, existing misconceptions in regards to rural electrification, and the problems they cause, have been highlighted. It has been seen that the approaches to providing electric power to rural areas, which have been generally termed rural electrification, has led to a misunderstanding at the policy-making level in most developing nations, including Nigeria. Grid extension, for instance, has been misconstrued in most cases to be rural electrification in and of itself, leading to the sector overlooking the exploration of other energy options which has caused lots of problems and hindrances to the execution of wide spread rural electrification of a country like Nigeria.

In the broad spectrum of rural development, rural electrification, according to Wolfram (2013), remains a critical development challenge in low-income countries – one that promises great social benefits. However, due to the method of delivery in Nigeria, the process has been besieged with many obstacles and high delivery costs. Considering these challenges, the objective of most developing nations now is to determine how best to harness the benefits of rural electrification while minimizing costs. In this vein, as observed by Cecelski and Glatt (1982, p. 62), rural electrification now commands "large sums of investment capital and subsidies in developing countries on the assumption that the benefits, in terms of raising living standards and economic development, are commensurate."

Barnes and Foley (2004, p. 7) highlighted that “well-planned, carefully targeted, and effectively implemented rural electrification programmes provide enormous benefits to rural people.” It, therefore, means that “the expansion of the use of electricity as an objective all developing countries have in common” (Schurr, 1963, p. 17) should be a strong enough motivation for developing rural electrification programmes. So if adequate rural electrification is to be achieved, a more cost effective technique, like the use of renewable energy in decentralized schemes, should be adopted to deliver the benefits of electricity to rural dwellers.

2.5 Renewable Energy

Due to the vagueness of the term “renewable” in the field of renewable energy, various definitions of what is renewable energy exist. For the purpose of this study, renewable energy is defined using the definition set down by the Renewable Energy Working Party of the International Energy Agency as:

> Energy derived from natural processes that are replenished constantly. In its various forms, it derives directly or indirectly from the sun, or from heat generated deep within the earth. Included in the definition is energy generated from solar, wind, biofuels, geothermal, hydropower and ocean resources, and biofuels and hydrogen derived from renewable resources. (International Energy Agency, 2012, p. 11)

The use of renewable energy sources involve the harnessing of natural occurring energy like sunlight, wind, waves, falling water, ocean currents, and tides, or the tapping of natural stocks of energy like ocean thermal gradients, biomass, and hydro power reservoirs whose rates of replenishment are comparable to or greater than their rate of depletion (Holdren, Morris, & Mintzer, 1980).Though various sources of renewable energy abound in Nigeria, with regards to electric power generation “renewable energy resources other than hydro (particularly large-scale) and traditional biomass are currently not given any consideration in the national energy supply mix and can even only account for a tiny contribution in the decades to come” (Akinbami, 2001, p. 174).

As further indicated by Akinbami (2001), renewable energy resources should offer good strategies for effective energy decentralization and security to both rural and urban dwellers, and through its exploration, some ecological problems, such as deforestation, desertification, greenhouse gases emissions, as well as soil erosion, could be curtailed. While globally, "the contribution of renewable energy resources to total world energy supply is getting more significant" (Akinbami, 2001, p. 156), the situation in Nigeria seems to go against this trend. Several reasons have been proffered as to why this is the case including the following: technological incapability, high cost of energy infrastructure, financial constraints, low level of awareness (Akinbami, 2001, pp. 175-177); political, environmental, technical, economic and social issues (Bada, 2011, pp. 2647-2648); and subsidies for competing fuels (Beck & Martinot, 2004, p. 266).

Although this study is positioned as advocating for the use of renewable energy and its associate technologies, the use of fossil fuel wherever it is more competitive or efficient cannot be overlooked. It is the understanding that where it is more convenient or economically more competitive, the fossil-fueled national grid can be extended to fully provide electricity for the rural dwellers. In line with this understanding, it is the candid view in this study that it is time renewable energy started playing a more significant role in the provision of electric power in Nigeria, especially in the rural areas.

2.6 Renewable Energy Technologies

Renewable energy sources are in abundance around the globe and "could provide all of the energy consumed in the world" (Geller, 2002, p. 18). From available statistics, renewable energy resources abound in excess supply in Nigeria (Elusakin Julius, Olufemi, & Chuks, 2014, p. 52; Ibitoye & Adenikinju, 2007, p. 493; Shaaban & Petinrin, 2014, pp. 75-79). "Modern renewable energy technologies are used to turn these widely available but intermittent resources into usable forms of thermal, chemical, mechanical, and electrical energy" (Flavin & Aeck, 2005, p. 7).

In spite of the abundance of fossil fuels, its existence and exploration has not translated to availability of electric power in Nigeria (Oyedepo, 2014) and it has been

"found that the access to modern form of energy in the country is very low despite the country's abundant energy endowment" (Oseni, 2012, p. 3967). Unreliable and inadequate supply of electricity and petroleum products has been a persistent symptom of energy insecurity in the country. If the provision of adequate electric power is to be achieved in Nigeria, especially for the rural sector, an alternative option, like the use of decentralized off grid systems "with renewable energy-based electricity generation technologies playing a predominant role" (Okafor & Joe-Uzuegbu, 2010, p. 211), has to be considered. As such "decentralized, small scale options based on local renewable sources offer the greatest near-term and possibly long-term potentials in rural areas" (Okoye & Achakpa, 2007, p. 10).

The dissemination of decentralized renewable electric energy technologies, it has been thought, would go a long way to help raise the supply reliability of electricity, and thereby reduce energy insecurity as highlighted by Flavin and Aeck (2005, p. 26) who argued that although "more difficult to quantify, renewable energy technologies also create value through their contribution to energy security, environmental sustainability, and human health". The use of these technologies, could also help compensate for the short falls of the fossil-fuelled electricity grid and reduce environmental impacts associated with fossil fuel and large hydro powered electricity generation in the country (Aliyu, Ramli, & Saleh, 2013, pp. 358-359).

Interest in this study is limited only to those renewable energy technologies meant for the purposes of electricity generation, and relevant to the conditions of an economy like Nigeria. Of interest, therefore, are renewable energy technologies like biogas/biomass for decentralized electricity, small hydro power, small wind power, and solar photovoltaics for water pumping and local electricity. Though this study is not meant explore the technography of renewable energy technologies, it is fitting, in order to put things in perspective, to talk about the above technologies in some detail. Therefore, in line with this, a brief description of each technology should suffice.

2.6.1 Biogas/Biomass for Decentralized Electricity

Biomass is any non-fossil organic matter of animal or plant origin which can be used to produce heat (for industrial thermal demand) to generate electricity and/or to be transformed into other forms of energy, including solid (charcoal, briquettes),

liquid (ethanol, biodiesel), and gas (biogas from organic waste) (Ministry of Mines and Energy. Brazil, 2013). It has been established, as in the case of Brazil, that decentralized electric power generation and cogeneration (combined heat and mechanical energy) make biomass a technically and economically competitive electricity energy option. Its use promotes local energy generation and decentralized jobs, and reduces the problem of rural exodus and dependence on imported energy for electricity generation.

Biomass resources in Nigeria can be found in wood, animal waste obtained from agriculture, forestry, municipal and industrial activities, and also from aquatic biomass, forage grasses and shrubs (Bada, 2011, p. 2645). Biomass in form of fuel wood happens to be a traditional source of energy in Nigeria, constituting about "37% of the aggregate national energy demand, and 95% of rural energy use" (Energy Commission of Nigeria, 2005b, pp. 31-32). A profile of some of these biomass resources, which are all by-products of agricultural activities available in abundance in varied forms in different parts of Nigeria, are shown in Figure 2.1

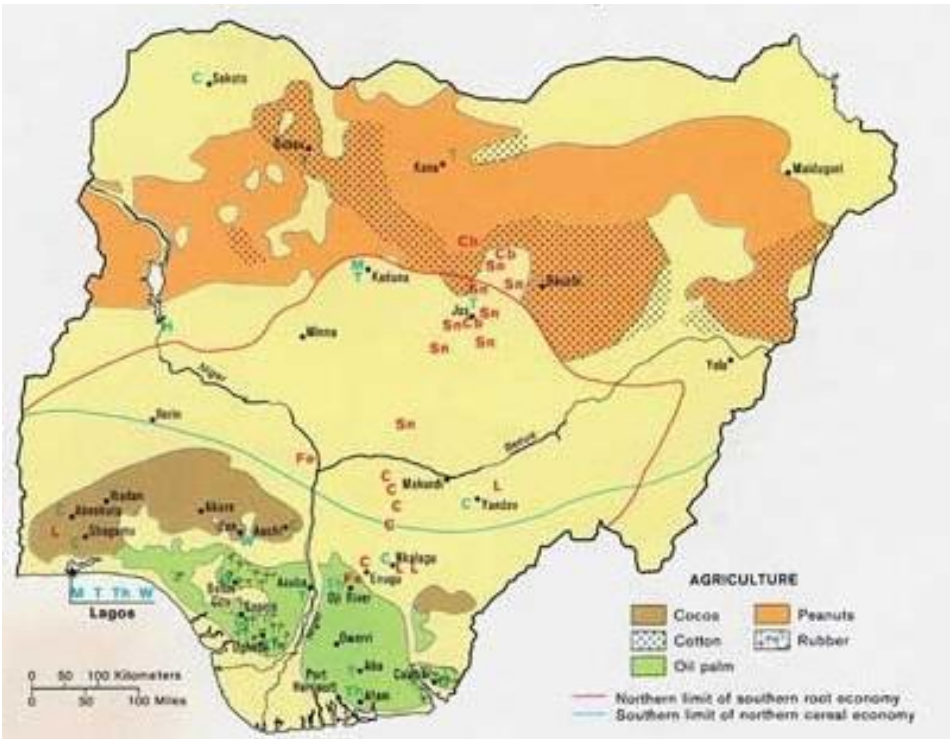

Figure 2.1 Profile of Nigeria's Agricultural and Economic Activities

Source: Aregheore, 2015.

An important derivative of biomass is the biogas. “Biogases are derived principally from the anaerobic fermentation of biofuels and solid waste and is combusted to produce heat and/or power” (International Energy Agency, 2012, p. 6). It finds applications in cooking and lighting, as well as agricultural and industrial use. In most Southeast Asian countries, the use of biogas for household electric power generation is gradually gaining ground (Asia Development Bank, 2010; Economic and Social Commission for Asia and the Pacific, 2008). Sambo (2009, p. 17) highlighted that in Nigeria, although:

> Opportunities exist in electric power generation from biomass resources in the following: fuelwood lot, biogas generation/biofertilizer production, electricity generation from industrial effluents such as bagasse and ethanol production. There is no existing biomass fired power plant in Nigeria and so no local experience.

“There exists a huge potential for the successful deployment of biomass energy in Nigeria, particularly in the rural agricultural areas” (Sesan, 2008, p. 10). With “considerable experience in biogas generation and utilization of fine particle biomass [and opportunities that also] exist for briquetting of saw dust and other fine particle biomass” (Sambo, 2009, p. 17), it is expected that if better attention is paid to this sector, the potentials of biomass renewable energy technologies could be realized in Nigeria.

2.6.2 Small Hydro Power for Local Electricity

Hydropower systems rely on the potential energy difference between the levels of water in rivers, reservoirs, dams or lakes and their discharge tail water levels downstream to generate electricity via the use of water turbines which convert the potential energy of water to mechanical energy used in shaft rotation of the generator coupled to it (Sambo, 2005). “It is the use of gravitational force of falling or flowing water to generate electricity” (Muhammad, 2012, p. 3).

Power is obtained from water when useful work can be performed by it by the turning of water wheels or suitable water devices to generate electricity at a rate such

that the development of power can be accomplished in a most efficient and economical way (Adejumobi & Adebisi, 2011). “Generating approximately 20% of the world's electrical energy, hydroelectricity is by far the most established form of renewable energy. It accounts for more than 80% of all renewable energy installed capacity” (Ferry & Monoian, 2012, p. 33).

The classification of hydropower systems varies as they “can range from tens of Watts to hundreds of Megawatts … and definitions also vary from country to country as “there is no internationally recognized standard definition for hydropower sizes” (United Nations Industrial Development Organization, 2007, p. 21). Hydropower systems generally fall into one of the categories shown in Table .

Table 2.1 Classification of Hydropower by Size

Hydro System	Size	Note
Large hydro	More than 100 MW	Usually feeds into a large electricity grid
Medium hydro	10 or 20 MW to 100 MW	Usually feeds into an electricity grid
Small hydro	1 MW to 10 MW or 20 MW	Usually feeds into an electricity grid. (Definitions vary) Europe tends to use 10 MW as a maximum, China uses 20 MW and Brazil 30 MW
Mini hydro	100 kW to 1 MW	Either standalone of more often feeding into an electricity grid
Micro hydro	5 kW to 100 kW	Usually provides power for a small community or rural industry in remote areas away from the grid
Pico hydro	50 W to 5 kW	Usually for remote rural communities and individual households. Applications include battery charging and/or food processing

Source: United Nations Industrial Development Organization, 2007, p. 21.

Small hydro power “can be the most affordable and accessible option to provide off-grid electricity services” (Muhammadu & Usman, 2014: 41) and hence rural development. The harnessing of hydro-resources, as indicated by Sambo (2009, p. 17), “leads to decentralized use and local implementation and management, thereby

making sustainable rural development possible through self-reliance and the use of local natural resources." For rural areas with suitable hydro power sources that are too far for the national grid to extend to, small hydro technology is deemed to be the best option. It "is considered more environmentally friendly; since it avoids the significant environmental impacts associated with large-scale hydro, including loss of habitat, change in water quality and siltation" (Inversin, 1986 as cited in Karekezi & Kithyoma, 2003, p. 17).

"The hydropower potential of Nigeria is very high and hydropower currently accounts for about 29% of the total electrical power supply" (Sambo, 2005, p. 15). The implication of this, with respect to providing hydro powered electricity in rural areas, is that based on the country's topography, the availability of rivers and natural falls, and as confirmed by some recent studies, "potential sites exist in virtually all parts of Nigeria with an estimated capacity of 3,500 MW" (Muhammad, 2012, p. 3) suitable for the provision of a considerable amount of electricity for most of the rural areas in the country.

2.6.3 Small Wind Power for Local Electricity

Wind is a natural phenomenon related to the movement of air masses caused primarily by the differential solar heating of the earth's surface (Sambo, 2005, p. 16). Wind energy is the energy stored in wind. It can be harnessed for electric power generation with the use of wind energy conversion systems like wind turbines – devices which convert the kinetic energy of the moving air to rotary motion of a shaft (mechanical energy) – coupled to generators. As highlighted by United Nations Industrial Development Organization (2007, p. 7), "wind energy systems are classified in three categories: grid connected electricity generating, standalone electricity generating and mechanical systems." The standalone electricity generating wind systems are often subdivided into battery-based or autonomous diesel, the later having automatic startup when the wind speed falls, although diesel generators may also be used within stand-alone battery systems.

Wind technology is not a novelty in Nigeria per se. Windmills were successfully deployed and used in the 1960s in the northern part of the country for water pumping purposes (Bada, 2011). Though the potential for wind power in

Nigeria, especially "in northern Nigeria" (Akinbami, 2001, p. 157) based on Ojosu and Salawu (1990) exists, it is not widespread as Nigeria is situated within a low-to-moderate wind zone as shown in Figure 2.2. However, with recent advances in wind energy technologies, the available wind resources in Nigeria is deemed to be able to cater for a reasonable amount of electric energy for suitably located rural dwellers in the country.

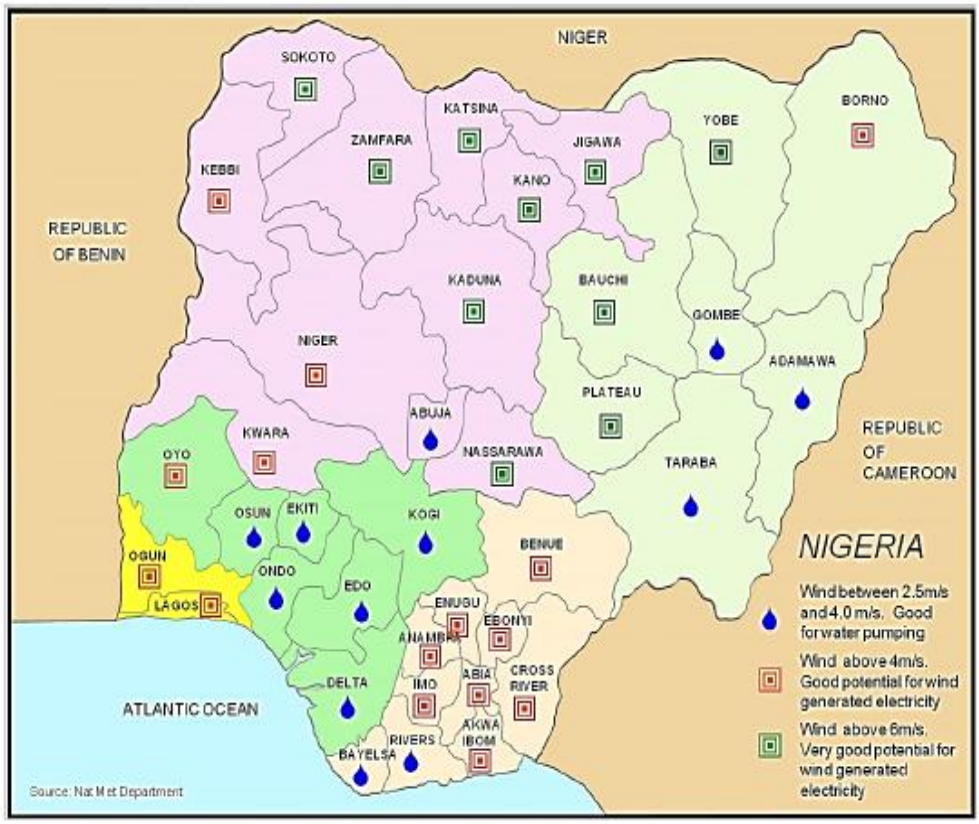

Figure 2.2 Wind Energy Profile of Nigeria

Source: Vincent and Yusuf, 2014, p. 227.

2.6.4 Solar Photovoltaics for Local Electricity

In solar photovoltaic applications, the energy from the sun – solar radiation – "is exploited for electricity generation by photovoltaic cells" (International Energy Agency, 2012, p. 5) or semiconductors. Photovoltaic systems transform sunlight into electricity, storing it in batteries where applicable for use during periods of no

sunlight. A basic photovoltaic system is made up of a module, at least one appropriately sized battery, a charge controller, and an inverter for alternating current use (Falk, Durschner, & Remmers, 2013). The solar photovoltaic systems are attributed with very long useful lives since they have no moving parts that can be prone to wear and tear. Their life cycle maintenance cost are relatively low since the only component that needs routine care is the battery. They are basically environmentally friendly and create less air or water polluting emissions since no combustion processes are involved (Blanco, 1995).

As shown in Figure 2.3 geographically, Nigeria is well suited for solar power generation. Situated within the tropics, between longitude 3^{o} and 14^{o} east and latitude 4^{o} and 14^{o} north. The country receives about 16.7×1015 kJ of solar insolation on the average with temperatures ranging between 9.7 ^{o} C and 41.5^{o} C (based on Adegbulegbe, 1995; Federal Office of Statistics, 1998; Owogbure & Adedokun, 1998 as cited in Adeoti, Oyewole, & Adegboyega, 2001, p. 160).

Nigeria's potential for solar power is further buttressed by the submission that with:

> An average yearly incidence of solar energy on the ground of about 2,300 kWh/M2 (which translates to) a total incident energy of about 2,100 x 1012 kWh per year. The entire energy requirement of the country could, in principle, be met by solar if one percent of the available solar energy can be tapped at 0.1 percent conversion efficiency" (The Presidency. Nigeria, 1984 as cited in Akarakiri, 2002, p. 22).

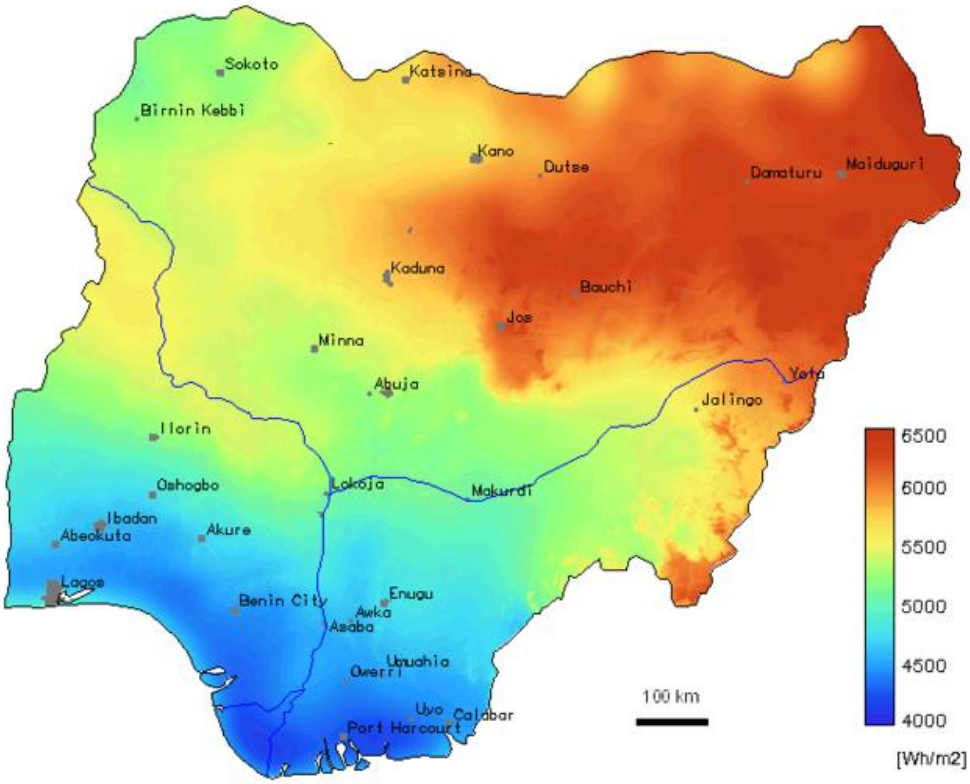

Figure 2.4 Nigeria's Yearly Average Daily Sums of Global Horizontal Irradiation (1985 and 2004)

Source: HelioClim-1 Ecole des Mines de Paris/Armines, 2006.

Sambo (2005, p. 15) emphasized solar energy as "the most promising of the renewable energy sources [in Nigeria] in view of its apparent limitless potential" due in part to the geographical location of the country. Its efficacy as an electric power resource in Nigeria cannot be disputed as electricity from solar power "may be used for power supply to remote villages and locations not connected to the national grid, and may also be used to generate power for feeding into the national grid" (Sambo, 2009, p. 18).

2.7 Renewable Energy and Rural Electricity in Nigeria

It's well-documented (for instance Akinbami, 2001; Ayoola, 2011; Oluwole, Olatunji, Ibikunle, Festus, Idowu, & Mike, 2012) that Nigeria, with its abundant fossil

fuel resources, also holds massive potential for renewable energy resources which can be harnessed for electric power generation, especially in the rural areas. These resources, as indicated by Ajayi and Ajayi (2013, p. 62), hold "opportunities to be utilized as standalone for community utilization and also for grid connection." Contrary to these expectations, it could be said that the existence of fossil fuel in Nigeria has made the country complacent in its renewable energy policy initiatives, especially with regards to rural electrification as the country is "predominantly dependent on fossil fuels, which accounts for over 64% of the main grid electricity sources" (Ikeme & Ebohon, 2005, p. 1215).

Although the intent has always been there, the actual harnessing of the abundant renewable energy resources in Nigeria for electricity generation for the nation in general and its rural communities in particular has never really been taken seriously (Eleri, 2002a; Eleri, Ugwu, & Onuvae, 2012). The nation's attention has been on the continuous development of the large hydro and fossil-fueled generation of electric power. The Nigerian electricity sector, since the early 1980s, already showed an inclination towards fossil fuel to the detriment of the abundant renewable energy resources. The Government's focus, as it seems, still remains the continuous use of fossil fuel for power generation in the country regardless of the advancement in research on the subject and prevalent global awareness of the benefit of renewable energy for rural electrification and development.

In Nigeria, rural electrification and development has always been part of the agenda in the policies of the various administrations that have led the country. This is evident in the existence of various programmes and schemes that have been put in place, as well as resources that have been expended over the past 50 years on numerous rural electrification and development programmes. Eleri, Ugwu and Onuvae (2012, p. 13) attributes this shortcoming to "non-implementation of agreed policy, legal and regulatory frameworks," coupled with a lack of commitment to effective implementation.

The lack of uptake of renewable energy technologies for rural electrification projects in Nigeria is not a representation of the level of awareness or commitment as a lot of resources have been committed to research and studies in this area by the Government (see Energy Commission of Nigeria, 2013a, 2013c). Disappointingly,

this research and studies on renewable energy in Nigeria have, however, been more or less restricted to pilot and demonstration projects, and just recently to mini community projects, termed constituency projects[4] (Dioha, 2012).

Ideally, it could be argued that providing rural dwellers with a connection to electricity could make a difference in their lives. However, due to the present electric power situation in Nigeria, as was highlighted in Chapter One, the option of grid connection of rural dwellers is not obtainable as the present available power in Nigeria is insufficient to serve the whole nation, and the mode of power delivery is poorly suited for that purpose[5].

From the foregoing, it is clear that the continuous disregard for renewable energy technology enabled decentralized power generation for grid extension in Nigeria should be a source of concern as it would appear that despite the recognition of its importance as a source of energy and an effective means of delivering electricity to rural areas (Okafor & Joe-Uzuegbu, 2010; Oluwole et al., 2012), it appears renewable energy technologies have attracted neither the requisite level of attention nor tangible and effective government commitment (Karekezi & Kithyoma, 2003). Also puzzling is the fact that though efforts at electric power provision to the rural areas by extending the national power grid has yielded low results, this strategy has continually been pursued. The fact remains that grid extension in Nigeria is besieged with many obstacles. Apart from inadequate power available for distribution and supply, the infrastructure is old and there are lots of losses during transmission (Nwosu & Nnamdi, 2013; Ugwu, Nwankwojike, Ogbonnaya, & Ekoi, 2012).

New developments have seen a drive towards including more renewable energy in the Nigerian energy mix as the Government has come up with a renewable energy master plan with policy directions on how to achieve more contribution from renewable energy. This Renewable Energy Master Plan (REMP) is a federal

[4] Projects instituted in Nigeria by politicians in communities where they are seeking political support or appreciation for said support.

[5] As opposed to the central grid system in Nigeria, "poor performance of the electricity power sector is uncommon with countries that adopted the sectorial model in their power industries" (Aliyu, Ramli & Saleh, 2013, p. 356 based on Ikeme & Ebohon, 2005 & Oseni, 2012)

government policy document showing the roadmap of how the country intends improving access to and harnessing of its vast renewable energy sources.

The following section provides a brief review of this master plan and its objectives.

2.7.1 Brief Review of the Nigerian Renewable Energy Master Plan

Efforts by the Nigerian Government towards recognizing the importance of renewable energy in the nation's energy mix saw to the development of a Renewable Energy Master Plan for Nigeria in 2005 through the Energy Commission of Nigeria (ECN) with the support of the United Nations Development Programme (UNDP). This document (the REMP 2005), which was later revised in 2012, had policy guidelines and renewable energy development strategies aimed at fostering the achievement of certain energy and development targets.

The 2005 Plan, which was deemed too voluminous, had short, medium and long term target periods of 2010, 2015 and 2025 respectively, with corresponding renewable energy contributions to electricity targets of 5 MW, 75 MW and 500 MW for Solar PV, 1 MW, 19 MW and 38 MW for wind power generation, and 56 MW, 600 MW and 2,000 MW for small scale hydro (see Energy Commission of Nigeria, 2005b, 2012). In order to have a more concise and precise document, the 2005 Plan was revised in 2012, producing a document specifically concentrating on "the renewable energy programmes of biomass, solar energy, hydropower, wind, emerging technologies and framework programmes with targets and timelines [restructured into] the short (2013-2015), medium (2016-2020) and long term (2021-2030)" (Energy Commission of Nigeria, 2012, p. ix).

Three main factors - potential as a long term sustainable energy source, environmental benefits, and potentials for job and employment creation - are highlighted as drivers of renewable energy development in Nigeria in the 2012 REMP. The 2012 REMP was set up to achieve six specific objectives (Energy Commission of Nigeria, 2012, p. 3):

1) to enhance national security;
2) to expand access to energy, especially in the rural areas;
3) to stimulate employment, economic empowerment and growth, and reduce poverty;

4) to increase the scope and quality of rural services, including schools, health services, water supply, information, entertainment and stemming the migration to urban areas;

5) to reduce environmental degradation and health risks, particularly to vulnerable groups such as women and children; and

6) to improve learning, capacity-building, research and development on various renewable energy technologies in the country.

Within the policy spectrum, the objectives of the renewable energy master plan are closely intertwined with the National Energy Policy (NEP) position on renewable energy development in Nigeria. Iloeje (2002, p. 118) highlighted the key elements of the National Energy Policy position on the development and application of renewable energy and its technologies:

1) to develop, promote and harness the renewable energy resources of the country and incorporate all viable ones into the national energy mix;

2) to promote decentralized energy supply, especially in rural areas, based on renewable energy resources;

3) to de-emphasize and discourage the use of wood as fuel;

4) to promote efficient methods in the use of biomass energy resources; and

5) to keep abreast of international developments in renewable energy technologies and applications.

From the above, it's safe to say, at least on paper, that in terms of policy, Nigeria has enough documented information to account for awareness of the importance of renewable energy as a means of complementing fossil fuels in boosting electricity supply in both the urban and rural areas of the country, as well as a clear cut understanding of the realization of the importance of renewable energy in rural electrification and development.

2.8 Renewable Energy Powered Rural Electrification and Development

The need to develop and promote the use of renewable energy sources for rural electrification, in an effort to develop our rural areas and expand the scope of

energy production and use in Nigeria or any other developing economy, should not be debatable. This is because the significance of the relationship between energy and development cannot be over emphasized. It "… is literally the fuel for economic processes and growth" (Negro, Alkemade, & Hekkert, 2012, p. 3836).

That rural electrification might not directly cause development as argued by Foley (1992) does not mean that rural communities should not be provided with electricity. Therefore, the discourse for providing affordable renewable energy powered electricity for rural communities should not be biased by such arguments that the aggressive campaign for renewable energy is only necessitated by western countries looking for markets for their products and technology (Obasi, 2014), or "that donor countries have vested interests in [renewable energy powered rural electrification] because there is a feedback link through purchase and procurement of equipment" (Smith, 1980 as cited in Ranganathan, 1993, p. 149).

Renewable energy based rural electrification options as indicated by Schmidt, Blum and Sryantoro Wakeling (2013, p. 581), are diverse "and vary greatly regarding the amount of provided electricity and consequently the potential for allowing for the productive use of electricity." Further cementing its attractiveness, renewable energy has been highlighted to be vital in making rural electrification more attractive to critics as part of a least cost energy mix item (Ranganathan, 1993).

Considering the level of maturity of the technologies available and the innovative business delivery models that have been implemented in most parts of the world[6], the dialogue should no longer be one of whether rural electrification is needed for development, but of the form in which delivering it sustainably will take. However, in spite of the stance this research seems to favor, which is a massive call for renewable energy powered rural electrification, it would be wise not to lose sight of the practicality and/or shortcomings of some of the renewable energy power generation options. This treatise strongly agrees with Foley (1992, p. 149) argument that:

[6] Husk Power Systems, India; MeraGao Power, India; Sunlabob, Laos etc.

> Where a renewable [energy] technology can demonstrate that it is the best available option, for example, where there is a good hydro site, it should, naturally, be chosen. But the standards of analysis should not be lowered in order to justify the use of expensive or inappropriate generating equipment simply because it does not rely on petroleum fuel.

This study also agrees with the notion that:

> When a government is seeking to promote access to renewable energy sources, it needs to implement policies that take into account factors such as affordability, disposable income, availability and the high quality of modern energy sources. (Barnes, Krutilla, & Hyde, 2005 as cited in Abdullah & Markandya, 2012, p. 103).

It acknowledges that implementing a rural electrification programme is daunting – from issues of high capital and operating costs as a result of the low population densities in rural areas, to meddling from politicians interfering "with the orderly planning and running of programs, insisting on favored constituents being connected first and preventing the disconnection of people not paying their bills" (Barnes & Foley, 2004, p. 2), not to mention the general attitude of the local communities.

In the face of these obstacles, a renewable energy powered rural electrification programme is expected to be effectively delivered. For renewable energy policies to be effective, they "are expected to deliver in three areas: energy security, climate change mitigation and economic development (job creation)" (Organisation for Economic Co-operation and Development, 2012b, p. 18), and they are advocated to play an important role in removing "barriers that can impede or even prevent the integration of renewable energy technologies into an energy system primarily designed for the use of fossil fuels" (Organisation for Economic Co-operation and Development, 2012d, p. 38).

In establishing the linkage between renewable energy and rural development, it can be argued that development opportunities arise from investments in renewable energy projects (Roberts, 2011). It is an opportunity for technology and knowledge

transfer as the expertise required to maintain the installations have to be passed along to the locals. This is further buttressed by the Organisation for Economic Co-operation and Development (2012e, p. 50) which emphasizes that:

> Renewable energy deployment can increase and stabilize rural incomes; contribute to the development of new products, new technologies, and new policy approaches, improving the overall innovation capacity in rural areas; empower local communities; and, finally, provide remote rural communities with cheaper sources of energy.

This study understands and accepts that renewable energy is very significant for rural development, but does not advocate it as a panacea for all rural development problems. It is in accord with the premise that for renewable energy to be an effective tool for rural development, it has to be compatible with "the new rural paradigm for rural development" (Organisation for Economic Co-operation and Development, 2012a, p. 90). This new paradigm for rural development is an approach that has competitiveness of rural areas, development of local assets and exploitation of unused resources as its objectives; it uses comprehensive and context specific strategies to target various sectors of rural economies (e.g. rural tourism, manufacturing, renewable energies and services). The new paradigm advocates investment – both public and private – in soft and hard infrastructure like education, employment, innovation, and transport by different levels of Government, as well as local stakeholders (Organisation for Economic Co-operation and Development, 2006).

The renewable energy literature in its entirety is replete with data and information of the technical potential of renewable energy technologies, but as affirmed by Jacobsson and Bergek (2004, p. 816), "the real issue is no longer the technical potential of these (and other) renewable energy technologies, but how this potential can be realized and substantially contribute to a transformation of the energy sector." Globally, "the future role of renewable sources of energy is portrayed as growing in relevance but limited in their overall impact" (Buss, 2006, p. 57). This strongly reflects the situation in Nigeria where the overall impact of renewable energy in electricity generation is close to minima or none existent.

While issues with renewable energy in the developed economies are more in the line of being perceived as alternative sources of energy, the case in less developed economies like Nigeria is more of renewable energy being the only feasible option, considering the level of deterioration of the existing option or the status quo. Within the Nigerian rural development context, the prevailing situation does not provide the luxury of viewing renewable energy as an alternative energy source of electricity as it is viewed in the developed nations. This is because, among other reasons like transmission problems, low generation capacity and losses, the existing fossil fuel and large hydro backed national grid does not have the capacity to handle both the urban and the rural areas (Ugwu, Nwankwojike, Ogbonnaya, & Ekoi, 2012). It is hypothesized that decentralized renewable energy powered electricity would more or less be a form of power delivery and not necessarily a competing alternative if renewable energy powered rural electrification in Nigeria is actually to be taken seriously.

It should be reiterated that renewable energy and its associated technologies are not being advocated by this study as alternatives out to replace an existing source of electricity per se. Renewable energy is seen as the only practical source available at the moment for adequate power generation for rural dwellers in Nigeria. The use of the present strategy (i.e. extension of the national grid) has been shown to be an effort in futility considering how long it has taken to have any meaningful grid based electrification extended to the rural areas.

2.9 Related Research on Renewable Energy Powered Rural Electrification and Development

This section looks at recent developments in the field of renewable energy for rural electrification and rural development. This is in no way an exhaustive list of studies related to renewable energy powered rural electrification and rural development, but a survey of studies that the author thinks could make meaningful contributions to the present study.

Several studies have been carried out in the area of renewable energy for electrification and its contribution to development – be it rural or urban. Jacobsson

and Bergek (2004) analyzed the development and diffusion of technologies that utilize renewable energy sources in Germany, Sweden and the Netherlands. They identified six challenges related to the management of the process of transforming the energy sector by identifying the central inducement and blocking mechanisms for the diffusion of renewable energy technology, and analyzing the dynamics of the transformation process in both successful and less successful cases.

Jacobsson and Bergek (2004) identified a set of challenges for policy makers attempting to influence the process of transforming the energy sector. They proposed that policy makers will have "to find a strategy whereby they can challenge and overcome opposition from incumbent actors in order to align the institutional framework to the new technologies" (Jacobsson & Bergek, 2004, p. 841). Highlighting the role advocacy coalitions could play in fostering a given technology, the paper further argued that such characteristics like high analytical competence, in-depth knowledge of relevant technological systems, coordination skills, patience, flexibility and political strength will have to be developed by policy makers by working with members of different technology specific advocacy coalitions.

While acknowledging that a substantial level of diffusion of renewable energy technologies have already been achieved, Polatidis and Haralambopoulos (2007), in their work on renewable energy systems, argued that the growth was not yet sustainable. According to them, numerous socio-economic and institutional barriers that need to be identified and addressed under a clear analytical agenda still plagued renewable energy technologies, and a means of surmounting these barriers was the establishment of the necessary policy portfolio consisting of a societal and technological platform developed for decision-aid and integrated evaluation of renewable energy systems.

Jacobsson (2008) analyzed the evolution of a specific renewable energy technology, bio-power innovation system (renewable energy from biomass), in Sweden. The paper paid particular attention to the current driving forces and obstacles to a large-scale diffusion of bio-power in that country and found that two very generic policy challenges in industrial transformation processes – continued high uncertainty and problems in securing a high legitimacy – were in play as obstacles to the realization of the substantial potential for bio-power. His conclusion was that the

general policy challenge is, therefore, to design policies that do not compound the 'normal' uncertainties for firms in the energy field, but reduce them for socially desirable technologies.

Bergek, Jacobsson, and Sandén (2008) noted in their paper, "'Legitimation' and 'Development of Positive Externalities: Two key Processes in the Formation Phase of Technological Innovation Systems", that a more powerful 'bottom-up' process of system growth can be obtained if overlaps are exploited. This, they argued, can be facilitated if managers and policy makers go against the norm and form broad based advocacy coalitions (management) as well as foster several technological innovation systems in parallel (policy).

Aberman, Schiffer, Johnson, and Oboh (2011), in their paper "Mapping the Policy Process in Nigeria: Examining Linkages between Research and Policy", highlighted some issues plaguing the general policy process in Nigeria. Based on Obadan and Uga (2002), they re-echoed the underlying notion that there was little interaction between policymakers and researchers in Nigeria. The implication of this being that meaningful discussion of available research findings, their suitability to policy-related problems and identification of other policy areas requiring research attention were severely lacking.

This disjoint between policy makers and researchers in Nigeria, as noted above, was limited not only to the policy maker–researcher dynamics, but also extends to the implementation of findings that are adopted. Most meaningful policy recommendations from researches are rarely acted upon by the Government. Concrete evidence of this is highlighted by further findings in Aberman, Schiffer, Johnson and Oboh (2011) who cited an example of a policy – the fertilizer policy – that was adopted as far back as 2006 by the Federal Ministry of Agriculture and Water Resources (FMAWR), but was yet to translate into any real policy action.

Aberman, Schiffer, Johnson, and Oboh (2011) also found that the existence of a strong political will, aided by the presence of an advocacy coalition to ensure that policies were successfully formulated and adopted, was essential. Government-based "champions" were critical players throughout the policy process; and that existing strong ties between researchers, who maintained an acceptably low profile, and government technocrats, helped to uphold credibility (legitimacy) and government ownership during the formulation of the policy.

Roberts (2011) painted a picture of how gloomy a life without electricity would be and how it is for the two billion of the energy poor residing in less developed rural regions of the world. As stated in the paper, without electricity, clinics cannot function, students cannot study, entrepreneurship is stifled, and income cannot be generated in an efficient and effective manner. The paper concluded that energy poverty must be addressed if the Millennium Development Goals are to succeed and if rural development is to take place.

Negro, Alkemade, and Hekkert (2012) presented a review of studies that have analyzed the troublesome trajectory of the development of different renewable energy technologies and its diffusion in different European countries based on the literature on innovation system failures. In seeking an answer to the main research question of the paper – Which systemic problems hamper the development and diffusion of renewable energy technologies? – they found from the literature that systemic problems hampered the rapid development and diffusion of renewable energy technologies and, therefore, needed additional attention from policy makers and other system actors that have an interest in speeding up the diffusion of renewable energy.

Mirsaeedi-Glossner (2011), in looking at the struggles of renewable energies in electricity generation in Iran, a country with similar characteristics of being endowed with significant renewable as well as fossil fuels like Nigeria, found that the inconsequential contribution renewable energy makes in electricity generation has been mostly due to the financial hurdles in the form of existing energy pricing and subsidization schemes in place in Iran, and which have not allowed renewable energies to become a viable alternative to fossil fuels in electricity generation.

Foxon, Gross, Chase, Howes, Arnall, and Anderson (2005), based on the analysis of current innovation systems in the United Kingdom (UK) for a range of new and renewable energy technologies, sought to generate policy recommendations for improving the effectiveness of the innovation systems. The study reinforced the importance of policy incentives in overcoming specific system failures, particularly those created by ‘gaps’ between policy measures.

In a paper aimed at investigating an array of renewable energy promotion tariffs on the promotion of renewable energy technology through decentralized processes in Senegal, Thiam (2011) used a simulation model based on a linear

programming approach to investigate decisions to invest in renewable energy sectors. Findings from the paper indicated that although tariff policies could encourage the promotion of renewable energy, policy-makers must keep in mind impacts of such tariffs on social welfare. It was the paper's position that incentive mechanisms must be provided under reliable institutional structures as such reliable institutional structures strengthen actor co-ordination and guarantees confidence between private actors and public entities during investment planning in renewable energy.

Martin and Rice (2012) used stakeholder theory to examine the developmental barriers, targets, policies and actions identified by firms and stakeholder organizations in the Queensland (Australia) renewable energy sector. The study found that renewable energy developments faced a range of socio-technical barriers that required timely actions in the areas of financial incentives, infrastructure enhancement, regulation reform, community-centered developments, technology and workforce investments, and information and education programmes.

Likewise, Ahlborg, and Hammar (2012) found that the main drivers to rural electrification in Tanzania and Mozambique were political priorities and development policies, while a similar study (see Mohammed, Mustafa, Bashir, & Mokhtar, 2013) that reviewed the potential for renewable energy resources for distributed power generation in Nigeria found that technological lag, deficient political will, economic uncertainty, poor level of awareness and educational background, financial corruption and bureaucratic ineffectiveness were the key challenges to renewable energy development.

The above studies and research highlight issues that are currently obtainable in Nigeria – the problems facing rural electrification, obstacles to renewable energy implementation and how they all tie into rural development. The corpus of studies from different perspectives have shown that while having its own country specific issues in regards to the implementation of renewable energy powered rural electrification, Nigeria is not exempt from the same generic issues as other countries.

2.10 Synthesis and Discussion of Reviewed Literature

"There is general consensus that regional development can scarcely be achieved without regional economic growth" (Galdeano-Gómez, Aznar-Sánchez, & Pérez-Mesa, 2011, p. 55), and as highlighted by Adejumobi, Adebisi, and Oyejide (2013, p. 105), the role of electricity in sustaining such growth as "a basic and integral component of the overall development of any nation" is also very vital. Though the relationship between electricity consumption and economic growth has still not been clearly ascertained as argued by several skeptics, that they are entwined is not in dispute (see Akinlo, 2009; Committee on Electricity in Economic Growth, 1986; Omri, 2014; Ozturk, 2010).

Foley (1992) had argued that rural electrification does not cause development and sees electricity as a derived demand occurring only when an area has reached a certain economic level. As definitive as his argument is, it can be established that his thesis does grant the linkage between electrification and development, with the issue only being the difficulty in precisely identifying the said connection. Not minding the above concerns, scholars like Ranganathan (1993) addressed earlier misconceptions of rural electrification as a catalyst for development, and findings from Ebohon (1996) based on data from Nigeria, support the view that energy plays a key role in economic development.

However, if the electricity-can-cause-development argument is to stand, its productive use by the rural beneficiaries has to be encouraged, as it is obvious that electricity would not cause development unless it is actually put to use. "It is for this reason that many recommend that priority be given to the productive use of electricity so that rural electrification can have an impact on development" (Ranganathan, 1993, p. 143).

Expressing concerns regarding the financial viability of rural electrification in many African states, given the high costs and the subsidies involved in maintaining existing tariff structures, Ranganathan (1992) proposed that with greater emphasis on local involvement, greater allocation of domestic resources, and better transfer of technology to improve operation and maintenance and reduce capital costs, rural electrification can be achieved.

Taking into account the fact that "conventional economic criteria for judging investments are not always thought appropriate for rural electrification" (Pearce & Webb, 1987, p. 329), the concerns emanating from the rural electrification and development discourse should not, however, overshadow the fact that for equity and inclusion, the rural dwellers should not be left out of the experience and benefit of electricity. This is because, as further emphasized by Pearce and Webb (1987, p. 329), ensuring that electricity is extended or delivered to rural areas have its associated non-quantifiable benefits:

> Including its bias towards helping the poor, its catalytic role in stimulating rural development, its role in reducing the adverse consequences of rural-urban migration and the enabling of improved literacy rates and its general contribution to 'political stability.'

Barnes and Foley (2004, p. 3) warned that the criteria for providing electricity for use by rural communities should not be distorted, as electrification "will only make a significant contribution to sustainable rural development when the other necessary conditions [for development] are present." The key argument, according to Ranganathan (1992), is to, therefore, structure rural electrification as part of rural development, rather than just a service which delivers the stand-alone benefit of electricity, and the application of renewable energy in this light will not only make this easier, but more cost effective.

The foregoing, however, can only come to fruition if it is backed by very strong governance and policy making, as well as implementation influenced by certain significant interest groups. From the point of view of Parsons, 1995, p. 461 as cited in Hill and Hupe (2008, p. 12), implementation is seen as "how policy is put into action and practice." This is in consonance with the general understanding that implementation, in most ways, has to do with the actual carrying out of, or seeing to the carrying out of public policy decisions.

It has been ascertained that "policy implementation in its entirety reflects a complex change process where government decisions are transformed into programs, procedures, regulations, or practices aimed at social betterment" (DeGroff & Cargo,

2009, p. 47). The tricky part is that the above change process has to be effected by key actors or even saboteurs for there to be implementation. These key actors, it might seem, can be said to be the 'missing link' between the energy policies in Nigeria and their actual implementation as observed in the case of an existent national energy policy and a renewable energy master plan that has not been put to effective use since 2005.

That the policy making process is seen as a highly political process which "involves intense lobbying over both policy goals and design of the institutional framework" (Jacobsson & Bergek, 2004, p. 817) holds true in this case is not in question. This is because without it, the notion of the concept of a renewable energy powered rural electrification programme in a country like Nigeria will never fly. This 'political' policy making process was described by Jacobsson and Lauber (2006, p. 257) as:

> Not a 'rational' technocratic process but rather one that appears to be based on such things as visions and values, the relative strengths of various pressure groups, perhaps on beliefs of 'how things work' and on deeper historical and cultural influences.

An institutional framework is therefore of importance to the renewable energy policy debate in that the legitimacy and acceptance of renewable energy technologies are strongly related to it (Jacobsson & Bergek, 2004) to the extent that misalignment would lead to barriers to it ever taking root as is the case with the renewable energy policy in Nigeria.

In sum, for there to be diffusion, or for a novel technology like renewable energy technology to gain any ground, existing institutions need to be adjusted or aligned to the new technology (Freeman & Louca, 2002) as "it is widely recognized that a variety of governmental regulations and institutional arrangements facilitate and inhibit the emergence of new technologies and industries" (Van de Ven, 1993, p. 216). This 'double-edged sword' conclusion is reiterated by Jacobsson and Bergek (2004, p. 825) in their inducement and blocking mechanism analysis which depicted government policy in issues such as renewable energy technologies adoption, as a

major inducement mechanism, as well as a block to some institutional functions. The relationship between the numerous actors within the policy field and a lack of legitimacy of renewable energy technologies on the other hand are found to also pose huge policy challenges (Jacobsson & Bergek, 2004).

With regards to legitimacy of a new technology, Jacobsson and Lauber (2006, p. 272) asserts that:

> Legitimacy of a new technology and visions of its role in future electricity generation are therefore not only a prerequisite for the initiation of a development and diffusion process but also a result of that very same process. Legitimacy and visions are shaped in a process of cumulative causation where institutional change, market formation, entry of firms (and other organisations) and the formation and strengthening of advocacy coalitions are the constituent parts. At the heart of that process lies the battle over the regulatory framework.

"Institutional change (and by implication its politics) is at the heart of the process whereby new technologies gain ground" (Freeman & Louca, 2002 as cited in Bergek, Hekkert, & Jacobsson, 2008, p. 4). Extant literature of studies in renewable energy technologies indicate that appropriate policies can act as the glue that supports positive linkages and actions between institutions and actors in communities (Jacobsson & Johnson, 2000; Komor & Bazilian, 2005 as cited in Martin & Rice, 2012), and that various government policies and actions can aid the growth of renewable energy supplies in regions and countries (H. Lund, 2007 & P. D. Lund, 2009 as cited in Martin & Rice, 2012, p. 120). For there to be any meaningful progress, it has been suggested, policies from various backgrounds will, therefore, have to complement each other in an integrated framework (International Energy Agency, 2008).

This analysis of nurturing renewable energy powered rural electrification activities and policies can be abridged along the argument by Bergek, Jacobsson and Sandén (2008, p. 585) that:

> A major policy issue is, therefore, to complement conventional science and technology policy measures with policies leading to the formation of early and protected market spaces. These are needed, not only to enable learning and to maintain a variety of voices and arguments, but also to enable experienced and trust based legitimacy as well as the buildup of 'packs' of entrepreneurs and associated advocacy coalitions.

By extension this study argues base on the same premise that complementing renewable energy policy with elements of the rural electrification and development policy would require an integration of knowledge from the various advocacy coalitions and a stronger platform to push for the diffusion of renewable energy technology in rural electrification and development in an economy highly fixated on fossil fuel like Nigeria.

2.10.1 Characteristics of Renewable Energy and how they affect its Application in Rural Electrification

Renewable energy as a source of energy comes in different forms, with each form having its own unique costs and benefits depending on the type of technology adopted. The consensus is that renewable energy produces no emissions, is clean, affordable, domestic, and effectively infinite. Harnessing renewable power invariably creates jobs and generates revenue for local communities (Organisation for Economic Co-operation and Development, 2012c).

Certain physiognomies of renewable energy can be said to influence their choice of being an energy source for electrification. These features can be looked at from two main perspectives – external and internal physiognomies – depending on the influence such features are seen to have on renewable energy or the concept of its use.

2.10.11 External Physiognomies

Aspects of renewable energy that can be termed external physiognomies bring about such influences that impact the choice of renewable energy as an electricity generating source from the outside. Paramount of these is the environmental/climate change mitigation requirement. With the elevated level of awareness of the harmful effect fossil fuels have on the environment, renewable

energy sources are now becoming more attractive and considered as better alternatives to fossil fuels due to low emissions and toxic pollutions.

There is now increased clamor for "the development and utilization of renewable energy … especially in the light of increased awareness of the adverse environmental impacts of fossil-based generation" (Oyedepo, 2012b, p. 2591). Another significant factor is the perceived stabilized price of renewable energy generated electricity. The price of power generated from renewable energy is to a certain extent stable and is not expected to fluctuate since the cost of renewable energy is tied to the initial investment at the onset and not to the source of energy.

2.10.1.2 Internal Physiognomies

The internal physiognomies in this study are regarded as those features of renewable energy that inherently impacts the choice of renewable energy as a viable energy source, mainly based on attributes directly associated with renewable energy. Favorable internal physiognomies are what makes the concept of renewable energy attractive for use in the area of rural electrification. One of such features is the infinite nature of renewable energy sources. Renewable energy sources "in contrast to fossil fuels, are environmentally friendly, ubiquitous, self-replenishing, infinite, and consequently considered world-wide as the way of the future" (Sesan, 2008, p. 2). Another characteristic of renewable energy which lends to decentralized electrification is that of being a domestic source of energy. Typically, renewable energy sources are domestic to the site of power generation. This feature forms part of what makes it a cost effective means of power generation as it cuts out the use of the elaborate transmission of the generated power.

2.10.1.3 Country Specific Issues

"Rural electrification has always been on top of the national agenda in Nigeria. The key challenge is to find ideas and approaches to bring electric power to more people, rapidly and in more cost-effective ways" (Eleri, 2002b, p. 180). Going by the above assertion and considering the favorable characteristics of renewable energy, it has been argued that renewable energy powered decentralized systems should be the approach to rural electrification and sustainable rural development in Nigeria (Ajayi & Ajayi, 2013; Oyedepo, 2014). This realization has not really found much standing in Nigeria as several structural and systemic constraints in the

electricity supply industry in Nigeria have impeded the success rate of the Government's interest in rural electrification in general (Eleri, 2002b).

While some scholars (for instance Ajayi & Ajayi, 2013, p. 64; Brew-Hammond, Mensah, & Amponsah, 2014, p. 307) have argued that the issues facing the use of renewable energy for rural electrification in Nigeria is that of policy implementation, others (like Chineke & Ezike, 2010, pp. 679-682; Eleri, Ugwu, & Onuvae, 2012, p. 13) have stressed it has more to do with the political will and support of those in power or the Government of the day. The fact remains that either concerns are not mutually exclusive as they both require proper orchestration for there to be any headway.

As no two countries are alike, due in part to the culture, geographical topography and even citizens, one can conjecture that individual countries have their own individual issues in regards to the use of renewable energy. Based on data from research, key among these issues as they relate to Nigeria is the culture of mismanagement of resources, which has been recognized as one of the paramount ills troubling its energy sector, especially the electricity industry (Uduma & Arciszewski, 2010).

There is also a weak motivation by the Government to develop renewable energy due to the nation's heavy dependence on fossil fuel. Though there are evidence of the Government's intention to generate electricity from renewable energy sources, so far, it has been seen that these intentions have not materialized into actual projects in the provision of electricity as government action has continued to support the fossil fuel and large hydro power strategy (Ajao, Ajimotokan, Popoola, & Akande, 2009).

A lack of economic incentives to attract investors, and a very blurry institutional structure coupled with corruption, has also been blamed for the barriers faced by the concept of a renewable energy powered rural electrification programme in Nigeria. As decried by Oyedepo (2014, p. 257), the country's "over-dependence and excessive fixation, on fossil fuel which has slowed down the adequate development of its alternative [renewable] energy sources of energy" for electricity generation has to change. The reality is that, though in principle there are mechanisms that could encourage the use of renewable energy technologies in the country, these have not translated into any tangible programmes or schemes.

Similar to suggestions in the literature (for instance Ahlborg & Hammar, 2012; Painuly, 2001), the Nigerian Government has instituted several generic actions to remove barriers, build human and institutional capacity, set up research and development infrastructure, create an enabling environment for investment, and provide information and mechanisms to promote renewable energy technologies. However, in spite of all these, the effect of the above barriers still overwhelms the Government's efforts.

2.10.2 Suitability of Renewable Energy Technologies for Rural Electrification in Nigeria

Statements acknowledging renewable energy "as one of the strong contenders to improve the plight of two billion people, mostly in rural areas, without access to modern forms of energy" (World Bank, 1999 as cited in Painuly, 2001, p. 73) have practically become clichés. In actual fact, in most developing parts of the world, for example Nigeria, where renewable energy has been promoted as a likely solution to rural electrification and development problems (Okafor & Joe-Uzuegbu, 2010), there still exist a considerable amount of issues militating against the use of renewable energy sources for developmental energy and electricity projects.

Based on the framework for identifying barriers to renewable energy technology diffusion proposed by Painuly (2001, p. 77), rural electrification in Nigeria can be said to meet the criteria for widespread application of renewable energy technologies. If issues linked with these criteria, which include an adequate resource base for the renewable energy technologies (solar, bio-mass, hydro, etc), available technologies and their development, commercial viability and financing (public, private, international), environmental impacts and benefits, socio-economic job impacts including job creation, and coverage of both centralized and decentralized options, are addressed, it is believed that a renewable energy powered rural electrification programme in Nigeria would be fruitful.

2.10.2.1 Perceived Facilitators of the use of Renewable Energy Technologies

"The concepts of 'drivers' and 'barriers' [or blocking mechanisms] are commonly used by actors in the field, to signify factors that enhance or hinder the

wished-for development" (Ahlborg & Hammar, 2012, p. 2). Perceived drivers or facilitators of the use of renewable energy can be said to constitute those attributes of renewable energy that could put renewable energy at an economic, regulatory or institutional advantage when compared to other forms of energy for rural electrification.

Renewable energy resources and technologies are sustainable mechanisms for rural electricity delivery and can serve as major drivers of rural development in a country (Müller, Brown, and Ölz, 2011, p. 16). The documented impact of renewable energy resources and technologies range from the enhancement of local micro enterprise and income generating activities in agriculture, manufacturing and small industries, to improvement in health and human development, as well as helping in curbing rural-urban migration problems (Flavin & Aeck, 2005; Ikuponisi, 2004).

Renewable energy technologies for rural electrification also help in cutting down the costs and challenges of delivering rural electrification via grid extension (Igbinovia & Orukpe, 2007). Given that conventional electricity energy generating systems rely heavily on fossil fuels, there are concerns for global pollution. Renewable energy provides a way around this predicament as a very good means of harnessing the benefits of rural electrification while minimizing environmental costs (Biswas, Bryce, & Diesendorf, 2001).

Although limited by climatic and organizational conditions like adequate water levels, wind, biomass, structure of urban development and land use, "the technological potentials of renewable energy technologies has been argued to be virtually many times that of current world energy requirement" (Johansson, 1993 as cited in Painuly, 2001, p. 75). This perception of renewable energy having the capacity to meet the entire energy requirements of the world is one advantage that could work in its favor as a source of power.

2.10.2.2 Perceived Inhibitors to the use of Renewable Energy Technologies

"Any technical, economic, institutional, organizational, political, social, or environmental factor impeding the deployment of a new technology" is described as a barrier or inhibitor (Wilkins, 2002 as cited in Ahlborg & Hammar,

2012, p. 2). Similarly, barriers or blocking mechanisms were described by Bergek (2002, p. 25) as "obstacles to the formation of powerful functions and, thus, to technology diffusion and capital goods industry development." Blocking mechanisms or impeding factors, tend to be interrelated (Ahlborg & Hammar, 2012) and "may be found not only in the nature of actors and markets, but also in networks and institutions, and are at times prominent features of the selection environment" (Bergek, 2002, p. 25).

A list of barriers were identified by Beck and Martinot (2004, p. 366-370). These include subsidies for fossil fuels which further extends the gap in cost between implementing fossil fuel projects and those of renewable energy, high initial capital cost of renewable energy projects, imperfect capital markets, lack of skills and/or information, poor market acceptance, technology prejudice, financing risk and uncertainties, as well as high transaction costs.

When it comes to the discourse on the use of renewable energy sources for rural electrification or electrification in general, the most cited barrier has been the initial capital cost of implementation (Martinot, 2001; Martinot, Chaurey, Lew, Moreira, & Wamukonya, 2002; Mohammed, Mustafa, & Bashir, 2013; Mohammed, Mustafa, Bashir, & Mokhtar, 2013). Regrettably, the presence of cheap fossil fuels, in comparison to the more expensive renewable energy, (Rahm, 2006) has also compounded this perception. Apart from a lack of information on the part of implementers, a lack of awareness on the part of the public is also perceived as a barrier to renewable energy (Dada, 2014). Dependence on renewable energy can also be hindered by other shortcomings like reliability of supply or intermittency in some cases (as renewable energy relies heavily upon the weather e.g. rain, wind, and sunshine), and difficulties as well as cost of generating and storing large quantity of power to maintain reliability of supply (Gowrisankaran, Reynolds, & Samano, 2011).

2.10.3 Entrenching Renewable Energy Technologies for Rural Electrification and Development in Nigeria

The present electricity situation in Nigeria is reminiscent of 1930s United States of America where back then nearly 90% of urban dwellers and only 10% of rural dwellers had access to electricity (New Deal Network, 2013). The similarity

even extends to the arguments for electricity provision by grid extension with some of those responsible for the supply of electric power in Nigeria, also arguing in most cases, that it is too expensive to string electric lines to isolated rural areas (Adeoti, Oyewole, & Adegboyega, 2001) or that rural dwellers are too poor to foot the electricity bills.

The bleak electricity situation in Nigeria is such that the country presently "produces only a few hours of electricity a day, forcing those who can afford it to rely on expensive diesel generators that drain billions of dollars from Africa's second largest economy and discourage foreign investment" (Reuters, 2013) . Ideally, the goal will be to increase both generating and distribution capacities, but this has not happened as it is not uncommon to have viable projects instituted but never completed. There are many such projects in the country – victims of the usual phenomenon of projects running over time and over budget, and never getting completed. A case in point is the proposed "building of a hydro plant in Zungeru, Niger state, (which according to experts) was first announced three decades ago" but just got actual green light in 2013 (Reuters, 2013).

It has been shown "that technologies such as solar photovoltaic, wind, and small-scale hydropower are not only economically viable but also ideal for rural areas" (Painuly, 2001, p. 74). However, despite this awareness and the maturity of the various renewable energy technologies, the use of renewable energy sources for electric power generation in developing nations, and most especially in Nigeria, has remained below par. That barriers to renewable energy technologies propagation exist is no longer in question. However, due to the robustness of existing technology, most of these barriers which are specific to the renewable energy technology have already been eliminated. Existing statistics (see International Renewable Energy Agency, 2015) have shown that cost-effectiveness, technical barriers, and market barriers are no longer serious issues as renewable energy as a power generating source is now becoming competitive cost-wise with fossil fuel generated power without support mechanisms like subsidies.

Nevertheless, country specific barriers such as institutional, political and regulatory barriers, as well as social and environmental issues still pose a serious threat to the propagation of renewable energy technologies. Hence entrenching

renewable energy as a viable source of electric power, therefore, calls for its legitimation in the first place. This legitimation of renewable energy and its associate technologies in the electricity provision sector in Nigeria, as studies have shown, requires strong government support and involvement (Oyedepo, 2014, p. 257), as well as a high level of advocacy (Agbemabiese, Nkomo, & Sokona, 2012; Shaad & Wilson, 2009). The liability of newness associated with renewable energy in Nigeria has to be addressed and the bureaucrats have to start trusting that renewable energy can actually deliver the expected benefits listed in the literature.

Just like Roosevelt (1935) stressed, government involvement and support is crucial, as no major energy transition has ever been accomplished without government support. This was exemplified by the establishment of the executive order creating the Rural Electrification Administration instituted by the Roosevelt Administration in the United States which "believed that if private enterprise could not supply electric power to the people, then it was the duty of the government to do so" (New Deal Network, 2013).

Apart from having the Government's active participation which borders on the will of those in power to want to promote renewable energy, other factors that could help in the process of legitimacy include the institution of policies that could reduce the barriers and boost the drivers of renewable energy. There should be a framework geared towards addressing such barriers as already identified by researchers like Painuly (2001), Bergek (2002), Beck and Martinot (2004) as well as Ahlborg and Hammar (2012). Table 2.2 is a summary of a list of some of the barriers.

Table 2.2 List of Some Barriers from Extant Literature

Source	Barrier
Painuly (2001)	Cost-effectiveness; technical barriers; and market barriers (such as inconsistent pricing structures); institutional; political and regulatory barriers; and social and environmental barriers
Bergek (2002)	Actors & Markets – Poorly articulated demand, 'local' search processes, increasing returns to adoption of established technology, market control by incumbents; Networks – Poor connectivity, too strong connectivity;

Table 2.2 (Continued)

Source	Barrier
	Institutions – Legislative obstacles, failures in the educational system, underdeveloped organizational power of new entrants
Beck and Martinot (2004)	Cost and pricing; legal and regulatory; and market performance
Ahlborg and Hammar (2012)	Institutions and actors performance; economy and finance; social dimensions; technical system and its management; technology diffusion and adaption; and rural infrastructure

2.10.3.1 Liability of Newness of Renewable Energy in Nigeria

When it comes to renewable energy powered electricity in Nigeria, liability of newness should not be an issue. This is because renewable energy in the form of micro hydro should have taken off much earlier, as the country was one of the earliest adopters of this technology for electric power generation. As mentioned in Chapter 1, the micro hydro renewable energy technology was introduced in Nigeria by means of a 60 kW micro hydro system which was used to generate electricity as far back as 1896 (Niger Power Review, 1985 as cited in Okoro & Chikuni, 2007, p. 52). The perceived problem of liability of newness with regards to renewable energy in Nigerian could be described as phantom at best. This is because this problem would not be in existence if the country had built upon or expanded the development of renewable energy powered electricity based on this initial idea, especially for rural electrification purposes.

Although more of an ecological than an institutional theory argument, the liability of newness – the propensity of young or new organizations or concept to have a higher rate of failure (Singh & Lumsden, 1990) – is derived from the Stinchcombe (1965) age dependence in organizational mortality hypothesis. Some of its shortcomings, as indicated by Wholey and Brittain (1986), include costs in defining roles, trust, and establishing as well as stabilizing relationships which a new technology labors extra hard to acquire.

Organizational forms or concepts that have high levels of reliability and accountability are said to be better favored by the selection process (Hannan & Freeman, 1984). So of great importance is the achievement of reliability and

credibility for this liability to be overcome. Renewable energy can overcome its liability of newness in the rural electrification field if renewable energy powered projects can be made to deliver high levels of reliability, deemed authentic by the beneficiaries and the deliverers of the project who are also accountable for the projects.

In line with Singh and Lumsden (1990), overcoming its liability of newness will ensure external institutional support that could help reduce the pressure of accepting renewable energy as a viable electric power generating option in a fossil fuel dominated society, as overcoming the liability of newness invariably implies an enhancement of legitimacy which in turn provides greater access to resources that can help sustain the use of renewable energy.

2.11 Framework of the Study

The framework of this study was fashioned in line with Camp (2001) description of using a conceptual framework as a structure of what has been learned to best explain the natural progression of a phenomenon that is being studied. This was decided to be more informative for this research as opposed to a theoretical framework which is more of an explanation about the phenomenon. A conceptual framework is more in line with qualitative research and provides an interpretative and flexible approach to understanding social reality rather than a causal or predictive one (Jabareen, 2009, p. 51). It is viewed as a tool that "explains, either graphically or in narrative form, the main things to be studied – the key factors, variables, or constructs – and the presumed interrelationships among them" (Miles, Huberman, & Saldana, 2013, p. 20).

In accordance with Bloomberg and Volpe (2012) suggestion that theories and prior research, as well as assumptions, are usually articulated as well in the conceptual framework, the role of theory was not undermined in constructing the framework used in this study. Theories and concepts from advocacy coalition and policy implementation from prior research formed a significant part of the conceptualization of the framework used in this study. From the review of concepts, theories and research related to renewable energy powered rural electrification and development

around the world and in Nigeria, combined with the researcher's own experiences and insights, several important factors were deduced and used to formulate this study's framework. The resulting framework helped focused and shaped the research process, informing the design of the methods, as well as influencing the data collection instruments used.

The dimensions of the framework focus on highlighting the areas that could best provide a better understanding of the phenomenon of the seemingly lack of interest in the use of renewable energy for rural electrification projects in Nigeria, and answering the associated research questions. They align closely with the research questions and show the mechanisms in play in entrenching renewable energy as an energy source for rural electrification in a predominantly fossil fuel dominated economy.

In trying to understand the factors that could influence the diffusion of renewable energy technologies in a fossil fuel-rich country like Nigeria, this study's framework provides the required understanding to the question of how being a fossil fuel-rich country has affected the large scale adoption of renewable energy technology for rural electrification and rural development projects, by looking at each category as either a boost or an obstacle that has to be overcome.

The dimensions of the framework are categorized into two main aspects – the administrative and the environmental. The administrative aspect of the framework illustrates the role of policy implementation and elements of the advocacy coalition framework as they affect the individual elements of renewable energy that could influence its acceptance or recognition as a legitimate energy source for rural electrification. The environmental aspect looks at the individual elements of renewable energy which could pose as issues in its choice as an energy source.

The environmental aspect of this framework consists of three key parts. First, the part that emphasizes the particular characteristics of renewable energy that can advance or deter its adoption. Here the physiognomies of renewable energy which are termed external and internal, as well as country specific factors that detail prevailing conditions as a result of the existence of fossil fuel in Nigeria, are looked at. Other than a general outlook, this end of the framework entails the aspects that show the characteristics of renewable energy and its associate technologies that could directly

or indirectly influence the promotion of renewable energy for rural electrification in Nigeria. It renders the dynamics between renewable energy and fossil fuel in the energy and rural electrification activities currently obtainable in Nigeria.

The aspect of the research that seeks to understand the role of policy makers and bureaucrats, and how they can be encouraged to support the use of renewable energy technologies in rural electrification and development in Nigeria and thereby fostering a sustainable renewable energy powered programme, is addressed by the elements of the framework like conscious government participation, improved bureaucratic effectiveness and creation of increased awareness. These aspects of the framework along with advocacy and liabilities of newness, all make up the part of the framework designated as 'factors for entrenching renewable energy for rural electrification'.

The perceived inhibitors and facilitators make up the perceptual factors aspect of the framework. They help to provide an understanding and interpretation of the part of the study that looked at the dynamics involved in accepting an alternate form of energy like renewable energy for rural electrification projects, the interaction between the abundance of fossil fuel and renewable energy sources in Nigeria and how they have affected the choice of modern renewable energy in rural electrification, and the perception of Nigerian policy makers and bureaucrats with respect to renewable energy technologies.

By providing a depiction of how a relatively unpopular concept like renewable energy can be accepted, and showing how the various factors can influence its institutionalization as a viable option for rural electrification, as well as understanding the sort of relationship that exists between the use of fossil fuel and renewable energy in a country where both are in abundance, this framework tries to simplify an otherwise cumbersome process. The framework of this study as a cognitive tool needed to make assertions and support knowledge claims (Rojewski, 2002) is summarized as shown in Figure 2.5

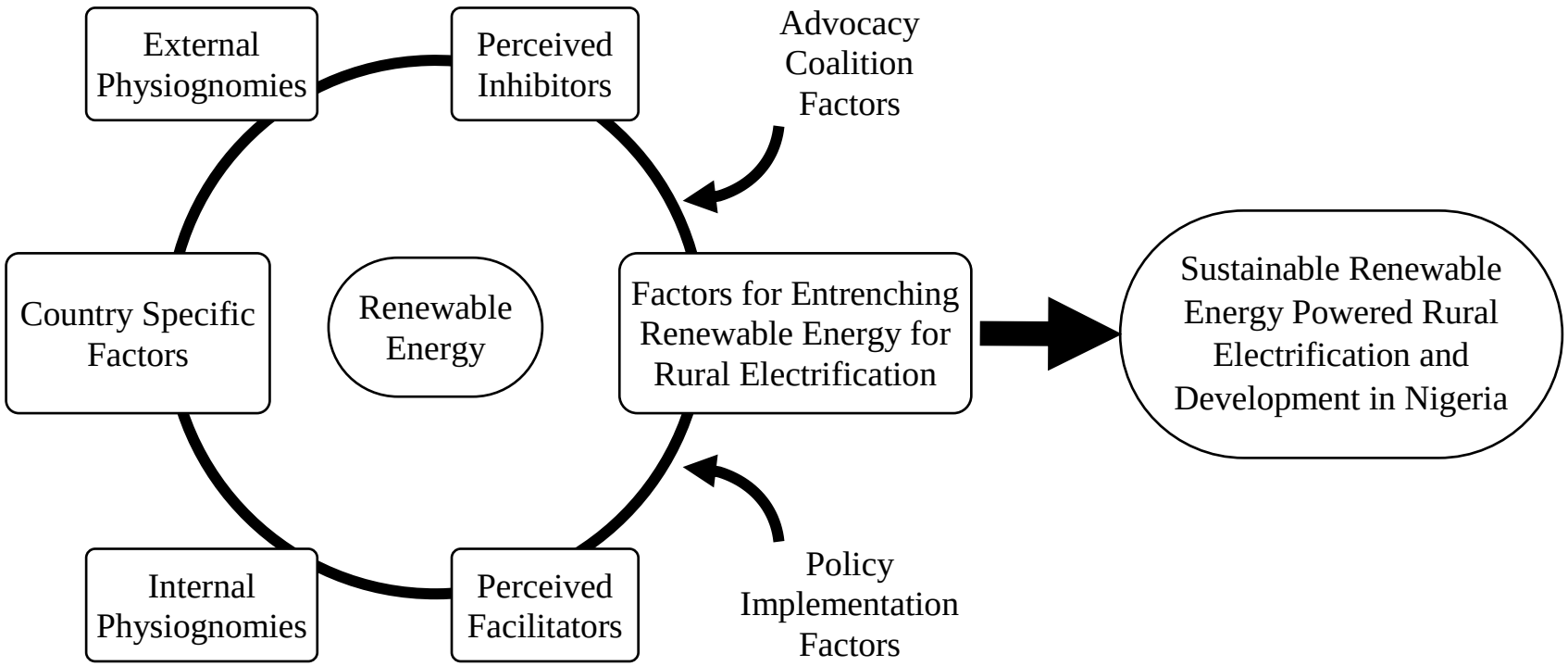

Figure 2.5 Framework of the Dimensions of this Study.

CHAPTER 3

METHODS

3.1 A Qualitative Research - Raison d'etre

This study sought to explore, from the perspective of a selection of key government officials responsible for the implementation of the Nigerian Energy Policy as it affects rural electricity, the effect that the availability and abundance of fossil fuel has had on the use of renewable energy technologies for electrification in rural development projects in Nigeria. A qualitative research methodology was adopted to help gain a better insight into how the various Federal Government Agencies under the Ministry of Power with the mandate of providing electricity for the nation saw the use of renewable energy, as well as to "explore where and why policy, (scientific) and local knowledge, and practice are at odds" (Marshall & Rossman, 2006, p. 53).

A qualitative research methodology affords this study leeway to explore the subject matter. Loosely based on the formalities specified by Bloomberg and Volpe (2012, p. 118), the methodology adopted follows the reasoning that a qualitative research methodology is best suited for:

> Understanding the processes by which events and actions take place; developing contextual understanding; facilitating interactivity between researcher and participants; adopting an interpretive stance; and maintaining flexibility in design.

3.2 Research Philosophy

Ontology, Epistemology, Methodology, Methods and Paradigm; philosophical facets which are key concepts in the philosophy of social sciences, "and questions

that lurk behind every research method and methodological approach" (Eriksson & Kovalainen, 2008, p. 10) have been indicated to be among the issues that need the most consideration at the onset of a research project. Explicitly or implicitly, social researchers usually work within the context of a particular set of ontological and epistemological assumptions, as well as theoretical ideas (Blaikie, 2009). It is good practice, therefore, to present one's research stance and ontological position as it is imperative for clarity and eradication of unnecessary debates and arguments.

According to Mkansi and Acheampong (2012, p. 132), "a major source of dilemma to research students in establishing their relevance to subjects areas and discipline" were matters of ontology and epistemology as they relate to the adopted methodology in a doctoral research. As confusing as they might seem, they are among the core concepts of the research process. Although they show themselves in the adopted methodology and approach, these philosophical terms are not always spelt out and "are often shrouded in mystery, partly created by the language with which they are explained" (Grix, 2002, p. 175).

Grix (2002, p. 177) posited that "ontology is the starting point of all research, after which one's epistemological and methodological positions logically follows." Ontological assumptions are concerned with what we believe constitutes social reality (Blaikie, 2000). They can be of objectivist inclinations which asserts that social phenomena and their meanings have an existence that is independent of social actors, or constructivist inclinations which asserts that social phenomena and their meanings are continually being accomplished by social actors – positions further emphasized by the positivist and interpretivist paradigms respectively (Bryman, 2012, pp. 32-35).

While ontology is the science or theory of being, epistemology, "one of the core branches of philosophy, is concerned with the theory of knowledge, especially in regard to its methods, [and] validation" (Grix, 2002, p. 177) as well as "the possible ways of gaining knowledge of social reality, whatever it is understood to be" (Blaikie, 2000, p. 8 as cited in Grix, 2002, p. 177). It is concerned with the nature and scope of human knowledge, the kinds of knowledge that are possible, and the criteria for distinguishing between scientific and non-scientific knowledge, as well as that for judging the adequacy of such knowledge (Blaikie, 2007, p. 4).

Epistemology, as the researchers' perceived relationship with the knowledge in question, can influence the methodology depending on whether or not the researcher is part of that knowledge or external to it (Holden & Lynch, 2004). This is because the researcher's epistemological view frames his or her interaction with what he or she is researching, and this also depends on their ontological position (Anfara & Mertz, 2014; Schuh & Barab, 2008). By extension, the research approach is taken as objective if knowledge is seen as being governed by the laws of nature, and subjective if knowledge is seen as being interpreted by individuals (Creswell, 2008; Lincoln, Lynham, & Guba, 2011).

An element of consistency between the ontological and epistemological assumptions is expected in the choice of a research method being either quantitative or qualitative. As indicated by Ormston, Spencer, Barnard and Snape (2013, p. 2), "researchers should maintain consistency between their philosophical starting point and the methods they adopt" because different methodological approaches are underpinned by particular philosophical or theoretical assumptions. Therefore, "maintaining consistency is seen as one way of producing more 'valid' findings" (Morse, Swanson, & Kuzel, 2001 as cited in Ormston, Spencer, Barnard, & Snape, 2013, p. 2).

Along these lines, objectivists who stress the positivist paradigm tend to go for quantitative methods as they try to produce causal explanations with no interpretation in the analysis (Gray, 2013). These methods are based on numeric data which are usually easy to replicate and produce results that are easily generalizable (Lincoln, Lynham, & Guba, 2011). On the other hand, the constructivists who advocate the interpretivist paradigm are inclined towards qualitative methods which corresponds to their ontological and epistemological position of a world that is only socially constructed and made up of knowledge that is subject to interpretations (Creswell, 2008; Lincoln, Lynham, & Guba, 2011; Marshall & Rossman, 2010).

Ontology and epistemology are the foundations on which a researcher's work is based, as they in one way or the other – implicitly or explicitly – shape the approach to theory and the methods utilized (Marsh & Furlong, 2002). A framework consisting of the above philosophical aspects of a research can be visualized, with each aspect affecting or influencing the other as established by Willis (2007, p. 8) when he stated that:

> A paradigm is not just a philosophy of science, such as postpositivism. It is also the related social science theory, such as behaviorism, and the associated research framework … At the basic or fundamental level there is a philosophy of science that makes a number of assumptions about fundamental issues such as the nature of truth (ontology) and what it means to know (epistemology).

In terms of philosophy of science, this research is aligned with a qualitative research methodology. Choosing a qualitative research methodology was based on the understanding that the researcher's ontological position is interpretivist, as the research is set up to examine the perception of government executives in the Nigerian electricity sector. Perception as a subjective process is not a quantifiable concept, and its measurement as such, requires a subjective epistemological position (Gray, 2013). An interpretive lens will better highlight the problems associated with the minima or non-existence of renewable energy in rural electrification projects in Nigeria from the perspective of the government officials tasked with the responsibility of implementing such projects.

3.3 Research Design

It is a fundamental requirement in research that in order to support the process of methodology description, it is crucial that the research paradigm is followed with an appropriate research approach. So in line with the ontological and epistemological domain in which this study has been positioned, and the corresponding methods which this position informs, it follows that of the two main research approaches - inductive and deductive - the inductive research approach is consistent with the selected ontological and epistemological domain chosen for the research design.

Furthermore, the deductive research approach is mainly associated with the positivism paradigm, while the inductive research approach is mainly associated with the interpretivism theoretical perspective (Gray, 2013; Saunders, Lewis, & Thornhill, 2009). It is a flexible approach sans the requirement of pre-determined theory to collect data "in the sense that explicit theories are not imposed on the data in a test of a specific hypothesis. Rather, the data are allowed to 'speak for themselves' by the emergence of conceptual categories and descriptive themes" (Suter, 2012, p. 346).

The inductive research approach, which is tied to the qualitative method, produces inductive arguments that gives the researcher the latitude of using observed data and facts to reach tentative hypotheses and define theory if necessary as per the research problem (Goddard & Melville, 2004; Neuman, 2006). It creates room for contextualization. A means that gives the researcher a way to "locate the actions and perceptions of individuals and grasp the meanings that they communicate" (Holloway & Wheeler, 2013, p. 5). As this research is mainly based on data from the perspectives shared by the participants, an inductive approach could well assist in the interpretive process.

Based on the ontological and epistemological positions presented and the understanding that the fundamental assumptions and key features that distinguish what it means to proceed from a qualitative stance fits well with this study, the researcher agrees with Bloomberg and Volpe (2012, p. 80), "that purely quantitative methods were unlikely to elicit the rich data necessary to address the proposed research purposes" of this study. The sort of questions that could elicit the most useful answers within the framework of a qualitative approach further raises the question of which genre or qualitative research tradition will give a better direction for the procedures in the research design and method to apply. Of these traditions – Hermeneutics, Action research, and Postmodernism/Poststructuralism (Bloomberg & Volpe, 2012) – along with the five traditions – Case study, Ethnography, Phenomenology, Grounded theory, and Narrative research – identified by Creswell (2012), a phenomenological research design was selected as the one best suited for this study.

A phenomenological research as indicated by Moustakas (1994) involves studying a small number of participants through extensive and prolonged engagement to develop patterns and relationships of meaning. "Phenomenology provides a structured approach toward deep understanding of a phenomenon as experienced by several individuals" (Bloomberg & Volpe, 2012, p. 33). It bores down to the description of what all participants have in common, with the basic purpose being to reduce individual experiences with phenomenon to a description of the universal essence (Van Manen, 1990).

The phenomenological approach emphasizes the importance of personal perspective and interpretation, making it great for understanding subjective experience, and gaining insights into people's motivations and actions (Lester, 1999). Phenomenology goes beyond description; "it is also an interpretive process" (Bloomberg & Volpe, 2012, p. 33) which enables it to be used as a "basis for practical theory, allows it to inform, support or challenge policy and action" (Lester, 1999, p. 1).

3.4 Information Needed to Conduct the Study

In seeking to explore and understand, from the perspective of the selected officials, whether a fossil fuel economy identity has had any effect on the application of renewable energy resources for rural electrification in Nigeria, five main research questions were posed. Of the four areas of information typically needed for most qualitative studies – Contextual, Perceptual, Demographic, and Theoretical (Bloomberg & Volpe, 2012) – the information needed for this study fell mainly into the perceptual and theoretical information categories as shown in Table 3.1

Table 3.1 Overview of Information Needed for the Study

Type of Information	Description	Method
Perceptual	Government officials' perceptions of the effect of fossil fuel on the use of renewable energy sources for rural electrification projects in Nigeria	Semi-Structured Interview
Theoretical	Information relating to rural electrification, and renewable energy,	Ongoing review of literature to prevent a "re-invention of the wheel" and also help support and provide evidence for claims made in the study

Source: Bloomberg and Volpe, 2012, pp. 105-106.

3.4.1 Unit of Analysis

It has been suggested that in defining the object of a research study, the researcher is specifying who or what they want to draw conclusions about. This aspect of the object of study – the unit of analysis – is very important as "the units of analysis have an impact on sample selection, data collection, and the type of conclusion that can be drawn from the research" (Durrheim, 2006, p. 41). In this study, perception is being investigated as a property of the individual government officials tasked with energy and rural electrification duties. The unit of analysis of this research is the perception of the government officials regarding their views on the effect fossil fuel has had on the adoption of renewable energy resources for rural electrification and development projects in Nigeria.

To achieve design coherence, it was important that the sampling and data collection strategies had to match the unit of analysis as this consistency was suggested to be of importance in guarding against errors in reasoning like ecological fallacy which could come about as a result of "drawing conclusions about a unit of analysis different from the unit studied" (Durrheim, 2006, p. 41). So in order to arrive at an acceptable conclusion from this study, the process of inquiry was structured to investigate and analyze data reflecting the perception of the individual government officials and not the officials themselves.

3.4.2 Methods of Data Collection

Qualitative research data typically originates with varying emphases from four key methods of data gathering: participating in the setting, direct observation, in-depth interviewing, and document analysis and material culture (Marshall & Rossman, 2010). For the purpose of this research, data used for the compilation of this dissertation originated from two of the above data gathering methods. These were in-depth interviewing and document analysis and material culture.

By using both data collection methods, this study partly fulfilled the requirement of triangulation – one of the tenets of qualitative research that "helps to balance out any of the potential weaknesses in each data collection method" (Gray, 2013, p. 37). This study would also have accessed the use of multiple sources and methods of data collection in ensuring research credibility and an increase in

trustworthiness (Denzin & Lincoln, 2011; Rossman & Rallis, 2011). Both methods were classified as primary and secondary data collection methods respectively based on the level of emphasis placed on them as explained in the following subsections.

3.4.2.1 Primary Data Collection

The primary data collection method in this research was the semi-structured in-depth interview. Interviews are conducted for various reasons: to understand individual perspectives, probe or clarify, deepen understanding, generate rich descriptive data, gather insight into participants' thinking and learning more about the context of the subject matter (Rossman & Rallis, 2003). As gathered from the review of the literature in the previous chapter, several issues in play when considering the implementation of a renewable energy powered rural electrification programme in a fossil fuel rich economy become significant within a specific context, and by discussing these issues with the participants as they came up, the interview sessions served as the perfect platform to hear the participants voice their concerns and situate such concerns within the context they were raised.

Following Patton (2002) categorization of interviews into three general types of (1) the informal, conversational interview, (2) the interview guide or topical approach, and (3) the standardized, open-ended interview, this research adopted the interview guide or topical approach. Marshall and Rossman (2010, p. 144) highlighted that this is the most typically used type of interview in qualitative studies. It is a bit structured - "the interview is scheduled, and the interviewer comes prepared with a list of topics or questions (which may or may not have been shared with the interview partner beforehand)." Furthermore, this choice of interview type is further justified by the procedure and the way it is carried out, and the fact that this method is closely linked to a fundamental qualitative research assumption that "the participant's perspective on the phenomenon of interest should unfold as the participant views it (the emic perspective), not as the researcher views it (the etic perspective)" (Marshall & Rossman, 2010, p. 144).

3.4.2.2 Secondary Data Collection

Document analysis was chosen as the secondary data collection method, both as a supporting tool to gather more information about the subject matter and as a triangulation tool to help ensure research credibility and increase trustworthiness.

Going by Marshall and Rossman (2010, p. 161) assertion that "the decision to propose gathering and analyzing documents or archival records should be linked to the research questions developed in the conceptual framework," document analysis of existing government documents, for instance, was taken as a good source for understanding what policies and mandates have actually been passed, as well as the level of commitment to renewable energy the nation already had in place.

Specifically, document analysis actually served as a source of additional information for answering the research question relating to the position of the Federal Government in regards the use of renewable energy in the electrification mix. In light of this, analysis of existing documents (e.g. Energy Commission of Nigeria, 2005a, 2005b, 2012) yielded relevant data about the effort of the Government so far, and likely projections on the role renewable energy is expected to play in rural electrification in Nigeria.

3.4.3 Interview Guide

The research was conducted by applying a semi-structured interviewing format of elites based on the interview guide or topical approach. Key government officials and engineers involved in rural electric power projects in Nigeria were interviewed in order to analyze their perspectives in regards to the effect of fossil fuel on the use of renewable energy sources for rural electrification in the country, as well as to explore their contribution to the implementation of the relevant policies associated with the existing rural electrification programme.

From the conceptual framework developed in Chapter 2, an interview guide that lists the topics and issues to be covered during the semi-structured interview was prepared (See Appendix C). The interview guide was meant to refresh the memory of the researcher during the interview, and was not meant to restrict the researcher to specific questions or the order/hierarchy in which the questions were asked.

Due to the reasoning that the purpose of key informant interviews was to explore a few issues in depth, the number of items listed in the interview guide was limited to nine under three key categories. This number is acceptable as it has been found that "when an attempt is made to cover a wide range of topics and issues with a

key informant, the discussion tends to become superficial. Fewer items leave more time to pursue leads" (Krishna, 1989, p. 6). The open-ended nature of the interview provided extra latitude for the participants to elaborate on their narratives and for the interviewer to ask more penetrating questions, as well as seek more details by asking follow-up questions. This also gave room for more issues or topics other than those listed in the interview guide to be covered during the interview sessions.

3.5 Population of Interest

This study involved a purposive sample of executives and engineers drawn from a population of some of the key Federal Government agencies involved in renewable energy, electric power and energy policies, as well as rural electrification in Nigeria. These individuals can be termed elites as they occupy positions of power and influence in their field. Elite individuals according to Marshall and Rossman (2010, p. 155):

> Are considered to be influential, prominent, and/or well-informed in an organization or community; they are selected for interviews on the basis of their expertise in areas relevant to the research and for their perspectives on, for example, an organization, a community, or specialized fields such as the economy or health policy.

Although valuable information can be obtained from these participants because of the positions they hold, and their ability to discuss issues from their particular perspectives, inherent bottlenecks do exist in this process. The challenges range from difficulties in gaining access to the elites, to the interviewer having to adapt the planned structure of the interview to suit the participants, as well as the elite having only a vague understanding of the subject matter (Marshall & Rossman, 2010).

However, these challenges are considered mitigated if the researcher relies on recommendations and introductions for assistance in making appointments, thereby reducing the problem of accessibility, and also being prepared, exhibiting "competence and credibility by displaying knowledge of the topic, or lacking such

knowledge, by projecting an accurate conceptualization of the problem through thoughtful questioning" (Marshall & Rossman, 2010, p. 156).

3.5.1 Sampling Issues

"Sampling is a very complex issue in qualitative research as there are many variations of qualitative sampling described in the literature" (Coyne, 1997, p. 623). For the purpose of this research, a blend of two non-probabilistic sampling methods were adopted. These sampling procedures were the purposive and snowball sampling procedures.

Purposive sampling is defined as a "judgmental sampling that involves the conscious selection by the researcher of certain subjects or elements to include in the study" (Crookes & Davies, 1998 as cited in Higginbottom, 2004, p. 11). However an issue with this procedure is the impression that this kind of sample is created based on the judgment of the researcher, which further compounds the problem of researcher bias already associated with the qualitative method.

"Snowball sampling is particularly useful in the study of deviant subcultures where respondents may not be visible, and routine sampling procedure may be impractical" (Bailey, 2008, p. 96) or in cases where respondents are "hard-to-reach, or equivalently, hidden populations" (Heckathorn, 2011, p. 1). Although the snowball sampling procedure involves utilizing well-informed people to identify critical cases (Cohen & Crabtree, 2006b), one major issue with the snowball sampling procedure, however, is its lack of rigor as the methodology is loosely codified (Bailey, 2008).

From the foregoing, the short-comings of the selected sampling methods can be minimized or remedied. The use of the purposive sampling procedure is justified and the judgmental, subjective component accommodated if they are based on clear criteria and are not ill-conceived or poorly considered (Lund Research, 2012). In using the snowball sampling procedure, indicating clearly why the snowball sampling procedure was adopted is very essential and it is imperative that snowball samples should not be considered to be representation of the population being studied as being a nonrandom technique; there is the likelihood of it not being representative of the population (Black, 2011, pp. 232-233).

3.5.2 Rationale for Selecting Participants

The complex and complicated nature of rural electrification programs requires a lot of coordination. Consequently, "uniting all efforts of government (planning, implementing, managing, and monitoring), private corporations (incorporation and innovation), and rural households (awareness) is necessary to achieve the desired goal of rural electrification" (Lahimer et al., 2013, p. 316). A case can be made, therefore, of the relevance of the staff of the agencies responsible for the implementation of a country's rural electrification programmes.

This rationale is further strengthened by drawing from the success story of a country like Thailand that has successfully implemented an enviable rural electrification programme based on the commitment of those directly involved in carrying out the projects. As noted by Barnes and Foley (2004, p. 3), "the extent to which the staff of the implementing agencies felt they were laying the foundation for the development and advancement of their country" was very important. This indicates that the way the staff of these agencies felt towards rural electrification and its realization was of paramount significance to how the projects were run and implemented.

As further indicated by Barnes and Foley (2004, p. 3), experience has shown that, though less tangible but even more important, "implementing agencies need dynamic leadership with a capacity to motivate staff and bring a sense of dedication to the task of rural electrification." So if there seems to be an issue with the implementation of renewable energy powered rural electrification programmes in Nigeria, a very good population to investigate would be the bureaucrats, especially the senior executives of the agencies responsible for such jobs.

3.5.3 Selecting Participants for Interview

The framework by Painuly (2001, p. 78) for the identification of barriers, advocates the importance of the stakeholders' perspective in the identification of barriers "as the perception of stakeholders on barriers may reveal the lacunae in existing policies and help in [the] identification of measures to overcome the barriers." In line with this, the stakeholders considered for this study were selected based on their status as energy and policy experts in Government, and senior bureaucrats in Federal Government agencies such as the Energy Commission of

Nigeria (ECN), Rural Electrification Agency (REA), and the Nigerian Electricity Regulatory Commission (NERC) (See Appendix D for a brief synopsis of these agencies.)

3.6 Data Analysis

Analyzing data from a qualitative study based primarily on a semi-structured interview data collection method calls for a high level of expertise in the processing and analyzing of data (Bloomberg & Volpe, 2012). Due to the corpus of data that can be generated in a qualitative research, the best practice is to embark on an ongoing analysis process (Mertens, 2014). Following Glesne (1999), analysis was carried out, in most part, simultaneously with data collection, and this was found to help focus and shape the study as it progressed.

In deciding on the analytic approach for this study, a phenomenological research of this sort, as indicated by Moustakas (1994), makes use of significant statements, generation of meaning units, and the development of an 'essence' description. The focus is on attitude and the response to the phenomenon under study, with the aim of achieving an analytic description of the phenomenon devoid of prior assumptions (Bloomberg & Volpe, 2012). A straight forward approach at achieving this was in the use of the thematic analysis method.

3.6.1 Thematic Analysis

"Arguably the most common approach to analysis of data in the social sciences" (Holstein & Gubrium, 1997 as cited in Roulston, 2001, p. 280). It "is a method for identifying, analyzing, and reporting patterns (themes) within data" while "minimally organizing and describing the data set in [rich] detail" (Braun & Clarke, 2006, p. 6). Though not necessarily unique, the allure of thematic analysis is its flexibility and capability to interpret various aspects of the research topic (Boyatzis, 1998).

Due in part to its flexibility, the thematic analysis method is deemed suitable for the purpose and nature of the present research, as it falls into the group of qualitative analysis "methods that are essentially independent of theory and epistemology, and [therefore] can be applied across a range of theoretical and

epistemological approaches." Through its theoretical freedom, the method also served as "a flexible and useful research tool, which can potentially provide a rich and detailed, yet complex account of data" (Braun & Clarke, 2006, p. 5).

In the course of the analysis, to make the data collected from the interviews more readily accessible and understandable, this study further followed the template, editing, and immersion/crystallization "idealized organizing styles for qualitative analysis" or classifications suggested by Crabtree and Miller (1999, p. 133). Following Bloomberg and Volpe (2012), the vast array of words, sentences, and paragraphs were reduced to what is of most importance and interest, and then transformed to draw out themes and patterns.

3.6.2 Justifying the use of the Thematic Analysis Tool

It has been argued that in order to enhance the value of a qualitative research interpretation, there is a need for more methodical analysis and greater disclosure. This, according to Attride-Stirling (2001, p. 386), "can be achieved by recording, systematizing and disclosing our methods of analysis, so that existing techniques may be shared and improved, and new and better tools may be developed." Another point of note was that if an inductive approach geared towards identifying patterns in the data by means of thematic codes was used in the analysis of the data from the various interview transcripts (as seen in Bowen, 2005), that inductive approach warrants "that the patterns, themes, and categories of analysis come from the data; (i.e.) they emerge out of the data rather than being imposed on them prior to data collection and analysis" (Patton, 1980, p. 306 as cited in Bowen, 2005, p. 217).

"Thematic analysis is not for purposes of generalization beyond the case but rather for a rich description of the (phenomenon) in order to understand the complexity thereof" (Bloomberg & Volpe, 2012, p. 31). "It can offer a more accessible form of analysis, particularly for those early in a qualitative research career" and differs from other analytic methods that seek to describe patterns across qualitative data (Braun & Clarke, 2006, p. 9). Furthermore, as opposed to other analysis methods that "share a search for certain themes or patterns across an (entire) data set, [thematic analysis searches for themes or patterns] within a data item, such as an individual interview or interviews from one person" (Braun & Clarke, 2006, p. 8),

thematic analysis can be an analysis "method which works both to reflect reality, and to unpick or unravel the surface of 'reality'" (Braun & Clarke, 2006, p. 9).

Given that, in this study, the focus was not on analyzing the discourse, narrative or phenomenon per se – which would have called for a theory bounded exercise – but rather on making sense of the perception of the participants as regarding their views on the issues facing the widespread application of renewable energy in rural electrification programmes in a fossil fuel rich country like Nigeria, the limited interpretative power of thematic analysis being a "mere description [tool] if it is not used within an existing theoretical framework that anchors the analytic claims that are made" (Braun & Clarke, 2006, p. 27) is considered to be of little influence on the findings of this study.

3.7 Overview of the Data Analysis Process

In this study, an eclectic blend of different approaches were adopted in the data collection and analysis process. Ideas and suggestions were adapted from various qualitative sources and previous work carried out by other researchers. The technique utilized for the presentation of data obtained from listening to the voices of participants were favored by those used by Ahlborg and Hammar (2012) and Groenewald and Schurink (2003), while thematic analysis was employed for the analysis of the data from the interview transcripts.

Ahlborg and Hammar (2012), following the study design proposed by Painuly (2001), which called for the use of literature survey, interviews with power sector actors, and in-situ observations, looked at the drivers and barriers to rural electrification in Tanzania and Mozambique based on grid extension, off-grid, and renewable energy technologies. Akin to the voice-centered method utilized by Brown and Gilligan (1992) which was an attempt to preserve the relationships that are central to the process of inquiry by maintaining voice and articulating differences, Ahlborg and Hammar (2012, p. 2) concentrated their data source to "those who are operational" by maintaining their voice.

In phenomenological studies, certain skills like listening, observing, and forming an emphatic alliance with the participant has been highlighted as being very

important, as they play a huge role in helping the researcher get beneath how respondents describe their experiences and understanding of the phenomenon under inquiry (Rudestam & Newton, 2007). Knowledge of this, largely informed the conduct of the interviews for this study. The use of these skills, to a large extent helped make the participants feel more comfortable about sharing their perspectives.

Though data analysis started in earnest after the completion of the interviews, preliminary analysis actually commenced during the interview process. Bearing in mind that in qualitative analysis, data are in the form of words as opposed to numbers (Bloomberg & Volpe, 2012; Miles, Huberman, & Saldana, 2013), the challenge was to find a systematic means of reducing the enormous amount of data (words) into manageable themes and categories, and the interpretation of those themes and categories. To help in this, the steps outlined in (Miles & Huberman, 1994; Miles, Huberman, & Saldana, 2013) were followed. These steps which facilitated the data condensation process include the following:

1) The affixing of several word codes to the transcripts of the interviews using the 'comment tool' in the Microsoft Word document

2) Noting reflections by the researcher and other remarks as additional comments

3) Sorting and sifting through the interview transcripts to identify similar phrases, relationships between variables, patterns, themes, distinct differences between subgroups, and common sequences

4) Isolating these patterns and processes, as well as identifying commonalities and differences

5) Gradually elaborating a small set of generalizations that cover discerned consistencies; and

6) Confronting these generalizations with a formalized body of knowledge in the form of constructs or theories

In essence, following the model by Graham (1997), the data – in the form of interview recordings – were collected, written up (transcribed), and reviewed line by line, typically within a paragraph. Using the highlighting tool in Microsoft Word, different highlight colors were used to represent the different codes (see Appendix G for a sample of the coding schema), and reflective remarks added as comments where

necessary (as shown in Appendix H: Sample Segment of Coded Interview Transcript). This process was more of an iterative process that entailed the systematical coding of data into as many themes and meaning categories as possible through first level coding that provided a method for summarizing segments of data (Strauss & Corbin, 1990).

Miles and Huberman (1994) emphasized the goal of coding as being the review of a set of field notes – transcribed or synthesized – and the subsequent meaningful dissection while keeping the relations between the parts intact. It is expected that as the categories emerged, the relationships between those categories and their theoretical implications will begin to make sense, and gradually meaning will start to crystallize and patterns will start forming. Generally, qualitative data analysis emphasizes the move from raw data to meanings or representation as indicated by Flick (2013, p. 5), who described qualitative data analysis as "the classification and interpretation of linguistic (or visual) material to make statements about implicit and explicit dimensions and structures of meaning-making in the material and what is represented in it".

The exact statements of the participants as they respond to specific interview questions make up the presentation of the raw data aspect of this study, while interpretation – which builds on the descriptive process made up of summary statements of respondents – is the aspect required to get to the expected meaning. "Interpretation is a complex and dynamic craft, with as much creative artistry as technical exactitude, and it requires an abundance of patient plodding, fortitude, and discipline" (Schutt, 2015, p. 323).

As prescribed by Miles, Huberman, and Saldana (2013), data analysis involved the three concurrent flows of activity: data condensation; data display; and conclusion drawing/verification. These three streams are presented "as interwoven before, during, and after data collection in parallel form, to make up the general domain called 'analysis'". Being a continuous and iterative process they "come into play successively as analysis episodes follow each other" (Miles, Huberman, and Saldana, 2013, p. 14) in a maze as shown by the model in Figure 3.1

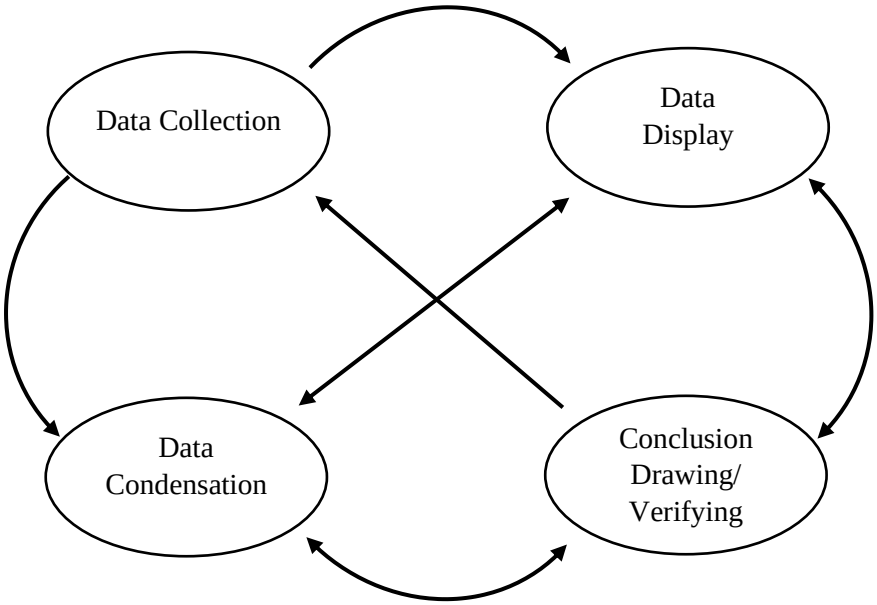

Figure 3.1 Components of Data Analysis: Interactive Model
Source: Adapted from Miles, Huberman, & Saldana, 2013, p. 14.

Due to the nonrestrictive nature of qualitative research in regards to when to stop data analysis, this study looked to the suggestions of Lincoln and Guba (1985), and Strauss (1987) as a guideline for ending the data collection and analysis phases of the study. They hinted that coding and recoding should be considered over, when the analysis itself appears to have run its course, or when all of the incidents can be readily classified, categories are "saturated," and sufficient numbers of "regularities" are deemed to have emerged.

3.8 Synopsis of the Research Process

In carrying out this research, an ongoing review of a selection of literature was conducted to study the contributions of other researchers and authors in the areas of energy, renewable energy, rural electrification and development. This was to keep the study abreast of achievements in these areas and create an up to date collation of information as the data was being collected in the field. On completing the defense of the proposal, approval was sought and clearance obtained from the department to go

to the participants. The clearance was in the form of an endorsed letter of introduction and informed consent form (See Appendix E and Appendix F) from the department to the participants outlining all procedures and processes needed to ensure adherence to ethics and standards, as well as requirements of confidentiality.

This study sought input from a purposive sample of senior energy bureaucrats and engineers from key Federal Government agencies involved in electric power and energy policies, rural electrification and development in Nigeria. No special criteria for eligibility for participation was stipulated other than the participant being a staff of, or involved in rural electrification project as either a senior executive of one of the agencies involved in energy, electric power and or rural electrification and development, or being a rural electrification contractor.

The first key respondent that was contacted helped to identify the initial participants and invited them to contribute to the study. Other than those participants that were formally invited by the first key respondent, contributors who expressed an interest in participating in the study were also accepted and interviewed in their offices. Due to the busy schedule of the participants, the interviews lasted approximately 40-45 minutes and were all audiotaped with the permission of the interviewees[7]

The interviews followed a semi-structured format that focused on the factors that could affect the choice of an energy option for electric power generation, the impact of government action and activities on the energy sector, as well as the rural electrification domain of Nigeria. The interviews were conversational. This allowed the participants to frame the flow of the interviews on their own terms. It became imperative to allow a more conversational style after the pilot test, in which it was found that the participants seemed more comfortable and willing to elaborate if left to talk about their experience and share their thoughts. For clarification of points raised by the participants, slight probes and prompts, as advised by the literature, were used (see Jacob & Furgerson, 2012; King & Horrocks, 2010).

[7] Permission for audiotaping was easily obtained in all but one of the sessions in which the respondent initially hesitated and didn't want the session recorded on tape. He however later gave his consent to record the later part of the interview.

Saturation began to be apparent after the 13th interview, as responses were now becoming repetitive and little or no new data were emerging from subsequent interviews. The final sample included 17 participants. This sample number, as indicated by Creswell (2012) and Smith (2007), is well within the acceptable requirements of a phenomenological study. As is the case with qualitative research, a sample of this size lowers the chances of the process being overwhelmed by the amount of data and increases the probability of the researcher being able to synthesize a meaningful analysis from a more in-depth interview than from a large quantity of interviewees.

The recorded interviews were transcribed by the researcher and the transcriptions which were stored as separate Microsoft Word documents were then reviewed against the tapes for accuracy before commencing the final analysis which consisted of segmenting the data and reassembling them with the aim of transforming the data into findings through coding. According to Charmaz (2006, p. 43), coding is the process of defining what the data describes. It "means categorizing segments of data with a short name that simultaneously summarizes and accounts for each piece of data" and shows how the data is selected, separated, and sorted to begin an analytic accounting of them.

The start of qualitative data analysis, which "entails segmenting and reassembling the data in the light of the problem statement" (Boeije, 2009, p. 93), comes down to coding, as everyone has to start by reading the data and then separating them into meaningful parts. Considering that initially the data may appear to be a bulky, diverse collection of accounts, coding serves as a tool in which to create order (Boeije, 2009). The segmenting of the data; which was largely achieved by means of open coding, and the reassembling of the data, achieved through selective coding in light of the problem statement, formed the core of the data analysis in this study. Axial coding was applied in-between segmenting and reassembling to complement the analysis process.

In carrying out open coding which was also described as "the process of breaking down, examining, comparing, conceptualizing and categorizing data" (Strauss & Corbin, 2007, p. 61), all data that have been collected were read very carefully and divided into fragments. This followed Boeije (2009, p. 96) emphasis that "open coding encourages a thematic approach since it forces the analyst to break

up the text into pieces, to compare them and to assign them to groups that address the same theme."

In line with Strauss and Corbin (2007, p. 96) description of axial coding as "a set of procedures whereby data are put back together in new ways after open coding, by making connections between categories," axial coding was carried out in the form of coding around several single categories or axes that occurred after the fragmentation of data was conducted in the open coding phase. Unlike during open coding where the reasoning moved from data to codes, during axial coding the reasoning was the other way round (Boeije, 2009).

Fundamentally, "axial coding relates categories to subcategories, specifies the properties and dimensions of a category, and reassembles the data you have fractured during initial coding to give coherence to the emerging analysis" (Charmaz, 2006, p. 60). Its primary purpose along with the reduction and reorganization of the data set, "is to determine which elements in the research are the dominant ones and which are the less important ones" (Boeije, 2009, p. 109). A flowchart based on Boeije (2009, pp. 108-109) as depicted in Figure 3.2, shows the steps in what made up the axial coding process of the analysis carried out in this study.

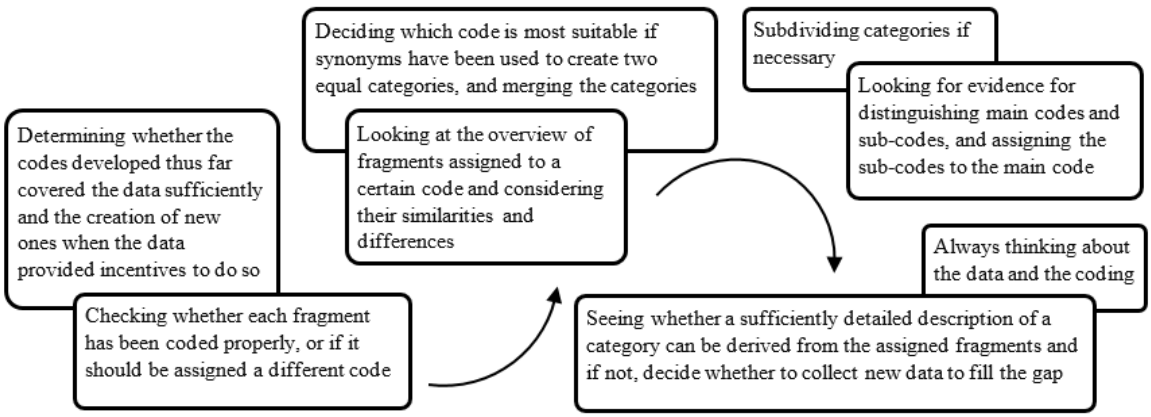

Figure 3.2 Flowchart of the Axial Coding Process

Selective coding which is aimed at integrating the loose pieces of earlier coding efforts is considered a logical step after the segmenting of data. It "refers to looking for connections between the categories in order to make sense of what is

happening in the field" (Boeije, 2009, p. 114). Just as open coding was used at the start of the analysis process, selective coding helped in finalizing the process. The coding process basically fulfilled two functions in the data analysis of this study. As highlighted by Boeije (2009, p. 119), it was important for data management "by reducing the amount of data, since only relevant sections are selected for storage and are assigned a summarizing and meaningful code", and as a way to explore and interpret the data as well as serve as a tool for mining new research areas.

It was observed that the three forms of coding were not isolated as the process often was intertwined. This was not of much concern though as open coding and axial coding, according to Boeije (2009, p. 119), "often merge into one another, as do axial and selective coding. It does not matter which activity one is engaged in at a given moment as long as you work systematically from data to the findings." The whole coding process being an iterative one was carried out on an ongoing basis with constant editing and revision.

As further suggested by Boeije (2009), simultaneously running data collection and data analysis benefitted both the explorative and explanatory aim of the qualitative research. This made for easy testing for accuracy of conjectures and prepositions about the connections between phenomena whenever new data from new cases were collected. Although the above forms of coding described are deeply rooted in grounded theory methodology, this study only adopted the use of coding in this form in order to have a systematic way of carrying out the analysis which goes a little beyond the use of significant statements, generation of meaning units and the development of an "essence" description (Moustakas, 1994).

Still keeping the focus of this study on the perception of the respondents to the phenomenon of a seemingly lack of interest in the use of renewable energy in rural electrification projects in Nigeria, while aiming for an analytic phenomenon not affected by prior assumptions (Bloomberg & Volpe, 2012), the use of these concepts from grounded theory should not be seen as an adherence to a set of rules which makes the process inflexible as feared by most phenomenological researchers, but as a means of presenting a more systematic analysis.

3.9 Issues of Trustworthiness

"One of the major distinguishing characteristics of qualitative research is the fact that the researcher attempts to understand people in terms of their own definition of their world" (Mouton and Marais, 1988, p. 70). With an insider-perspective focus rather than an outsider-perspective (the researcher's) focus, the truth-value of qualitative research is inherently emphasized. Trustworthiness is an important factor to maintaining accuracy and credibility in qualitative research findings, and verification is critical to evaluating the quality of qualitative research (Creswell, 2012). Going by Creswell (2012) suggestion of employing at least two verification procedures to ensure trustworthiness, this study used the strategies of rich, thick description and clarification of researcher bias or reflexivity.

Trustworthiness was further ensured by employing the evaluative criteria posited by Lincoln and Guba (1985). These criteria include credibility which entails a confidence in the 'truth' of the findings, dependability which shows that the findings are consistent and could be repeated, transferability which shows that the findings have applicability in other contexts, and confirmability which is a degree of neutrality or the extent to which the findings of a study are shaped by the respondents and not researcher bias, motivation, or interest.

3.9.1 Thick Description

Described by Lincoln and Guba (1985), as one way of achieving external validity, indicate that by describing a phenomenon in sufficient detail one can begin to evaluate the extent to which the conclusions drawn are transferable to other times, settings, situations, and people. "Thick description is a vehicle for communicating to the reader a holistic and realistic picture" (Bloomberg & Volpe, 2012, p. 113). In contrast with thin description, which is a superficial account, thick description refers to the detailed account of field experiences in which the researcher makes explicit the patterns of cultural and social relationships and puts them in context (Holloway, 1997). Towards this end, this study was structured to let participants speak for themselves, and the views of the participants documented in such a way as to provide an opportunity for the reader to enter into the study and better understand the reality of what was presented by the participants (Bloomberg & Volpe, 2012).

3.9.2 Clarification of Researcher Bias or Reflexivity

The perspective or position of the researcher shapes all research, be it quantitative, qualitative, or even laboratory science (Cohen & Crabtree, 2006c). According to Malterud (2001), a researcher's background and position affects what they choose to investigate, the angle of investigation, the methods judged most adequate for this purpose, the findings considered most appropriate, and the framing as well as communication of conclusions.

So bearing in mind Malterud (2001, p. 484) assertion that "preconceptions are not the same as bias, unless the researcher fails to mention them", a continued conversation throughout the narrative of this report regarding the researcher's position on a renewable energy powered rural electrification programme in Nigeria can be seen in this study. This presentation, it is believed, will help strengthen the participant's stories and offer a more candid reflection of the research.

3.9.3 Credibility

This criterion highlights whether the findings are accurate and credible from the standpoint of the researcher, the participants and the audience. It refers to whether the participants' perceptions match up with the researcher's portrayal of them (Bloomberg & Volpe, 2012). To ensure credibility, the researcher was upfront with the stance taken regarding renewable energy powered rural electrification, and used multiple sources of information to corroborate the evidence obtained. Apart from using multiple sources of information and highlighting the researcher's position on favoring the notion of a widespread renewable energy powered rural electrification programme in Nigeria, the referential adequacy technique, "a strategy for assessing and improving the quality of inferences" (Bergman, 2008, p. 109) to test the validity of the findings was also applied.

This technique involved the identification of a portion of data which was set aside and not analyzed initially, but used as a means of preliminary testing of the validity of other findings that had been analyzed (Cohen & Crabtree, 2006a). For instance, this technique came in handy during the analysis of two of the findings – political will and misplaced priorities – where some details in the earlier contribution of one of the participants regarding constituency projects was used to cross-check those later presented by two others.

3.9.4 Dependability

Similar to reliability in quantitative research, although not assessed through statistical procedures, dependability refers to whether one can track the processes and procedures used to collect and interpret the data (Bloomberg & Volpe, 2012). To ensure dependability, the researcher tried to show methodological rigor by creating an audit trail for this study. This was achieved by creating and storing facets of the research in folders and subfolders labeled with the various headings and subheadings of the dissertation respectively.

Not only did this technique help reduce the messiness of the experience, it also helped in organizing and providing a systematic approach to the development of the audit trail which was based on the six elements of raw data suggested by Lincoln and Guba (1985): data reduction and analysis products; data reconstruction and synthesis products; process notes; materials relating to intentions and dispositions; and instrument development. Following the example laid out in Bloomberg and Volpe (2012), each stage of the data reduction and analysis, merging or splitting of statements and descriptors, and clarification of themes and categories were fully documented in a process as shown by the Sample Coding Scheme Development Chart in Appendix I.

3.9.5 Transferability

One key feature of qualitative research is the expectation that its findings are not generalizable but most likely applicable in other settings apart from the one under study. Transferability is all about “the fit or match between the research context and other contexts as judged by the reader” (Bloomberg & Volpe, 2012, p. 113). In this study, the issue of transferability was addressed by way of thick description which gave the discussions an element of shared or vicarious experience. The use of depth, richness and a detailed description of the concepts fulfilled the requirement of a qualitative claim to relevance in some broader context (Schram, 2003)

.

3.9.6 Confirmability

The concept of confirmability is said to correspond with the notion of objectivity in quantitative research. It demands that the reported findings be the result

of the research and not the outcome of the biases and subjectivity of the researcher (Bloomberg & Volpe, 2012). Confirmability, as suggested by the literature, was ensured with the presentation of a clear methodological rigor, including ongoing reflection by way of journaling and memo, as well as a record of field notes and transcripts which were used to show the series of events that led to the emergent findings.

3.10 Ethical Considerations

Ethical issues cannot be overlooked in qualitative research. They "can indeed arise in all phases of the research process: data collection, data analysis and interpretation, and dissemination of the research findings" (Bloomberg & Volpe, 2012, p. 111). In this study, ethical issues were deemed mitigated with the provision of very clear explanations of the purpose of the research. Coupled with this, the nature of this research did not really pose any serious ethical threat to any of the participants as the required data were not of any sensitive nature.

Nonetheless, safeguards like the use of an informed consent form was a priority employed throughout the study to ensure that the rights and confidentiality of the participants were protected. In line with keeping the names and identity of the participants and organizations confidential, acronyms were used to identify the participants and cautionary measures were taken to ensure secured storage of research related records and data.

3.10.1 Researcher's Role

The role of the researcher in a phenomenological study is to discover the inner reflection of the participants that oftentimes goes unnoticed in everyday conversation of what is being discussed (Merriam, 2002). The use of a semi structured interview, as a tool for gathering data, provides the opportunity for the participants to drive the conversation and share their voice as they describe their experience.

Merriam (2002, p. 7) suggested that "in order to understand the essence or structure of an experience, the researcher temporarily has to put aside, or 'bracket,' personal attitudes or beliefs about the phenomenon." Effort was made to fulfil this

expectation during the interviews by compartmentalizing all personal feelings, biases and thoughts from the study in order to fully understand the phenomenon as it was presented by the participants. This was because the ultimate goal was to capture the themes, experiences, and feelings that surrounded the phenomenon being investigated and not the researcher's bias.

3.11 Summary and Recap of the Qualitative Research Process

The use of past research as a guide ensured that the methods adopted for developing the design, as well as those used in conducting this study were founded in sound qualitative research principles and ethical considerations. To ensure the trustworthiness of the findings, the selection of participants, data collection and analysis were guided by the requirements of the chosen ontology and epistemology of this study. It was hoped that valuable insights and perspectives that could positively impact the energy and rural electrification sectors in Nigeria would be gathered from the findings of this study.

In spite of being an overwhelming and tedious experience, the use of a qualitative methodology for this study provided the most appropriate structure and research approach to obtaining intricate data for a study such as this. A qualitative process best served the purpose of facilitating an in-depth study of a phenomenon associated with a topic that has previously been examined mostly through quantitative means. By engaging the participants during one-on-one interview sessions, this study was able to explore the perceptions of the participants and gain better understanding of the phenomenon from the meanings the participants ascribed to their experiences regarding the implementation of renewable energy powered rural electrification projects in a fossil fuel rich economy like Nigeria.

Following a qualitative paradigm availed this research process the flexibility of elaborating on the responses of the participants during the interviews. Making it possible to explore more through the use of additional probing questions relating to specific points raised. As indicated by Bloomberg and Volpe (2012), the qualitative analysis of this study called for data reduction and data display, with interest primarily on the language of the participants or texts. It implies "the search for patterns in data

and for ideas that help explain why those patterns are there in the first place" (Bernard, 2011, p. 338).

The data collected from multiple data sources were summarized in a dependable and accurate manner. Interest was on the language of the participants and texts, with work done on "the data (words) to identify units of information that contribute to themes or patterns – the study's findings" (Bloomberg & Volpe, 2012, p. 137). The expectation is for the findings to provoke the realization that the seemingly complicated nature of providing rural electrification by means of renewable energy sources was not so daunting.

Limiting the data collection to a selection of senior executives in the bureaucracy, ensured that this study focused on those deemed to be best suited for the job of making meaningful changes in the renewable energy powered rural electrification arena. This is because their concerns and perspectives were what was expected to form the basis of the findings and subsequent recommendations. In the next chapter, excerpts from the semi-structured interviews and the narratives of the 17 participants in this research are presented. Their narratives, which offer a unique insight to the issue of the low adoption of renewable energy for rural electrification in a fossil fuel rich economy like Nigeria, are summarized but presented in their individual voices.

CHAPTER 4

PRESENTATION OF FINDINGS

4.1 Overview of the Analysis Process

This phenomenological study was designed to explore based on the perceptions of senior energy bureaucrats in selected Federal Government agencies tasked with the responsibility of providing electricity for rural communities in Nigeria, the perceived lack of uptake of renewable energy and its associate technologies for rural electrification projects, and the effect the existence of fossil fuel has had on the use of renewable energy resources for rural electrification in the country. The vision is that a better understanding of the dynamics between the already established fossil fuel resources and renewable energy – which is still finding its feet – will lead to a more informed case for making renewable energy more attractive for electricity generation, especially for rural electrification projects in a fossil fuel dominated economy like Nigeria.

Designed to examine the topic qualitatively and explore through the narratives of the various participants, the study produced the following key findings which are grouped within five key themes and several sub-themes:

1) Factors for entrenching renewable energy for rural electrification;
2) Perceptual factors that influence renewable energy deployment;
    (1) Inhibitors
    (2) Facilitators
3) Internal physiognomies of renewable energy that influence its deployment;
4) External physiognomies of renewable energy that influence its deployment; and
5) Country specific factors related to renewable energy and rural electrification.

The interview questions discussed were designed to stimulate responses from the participants that provided data about how the participants actually "think and feel in the most direct ways" (Bentz & Shapiro, 1998, p. 96 as cited in Groenewald & Schurink, 2003, p. 97). This chapter presents these findings which were obtained from in-depth interviews of the 17 participants. For ethical reasons, acronyms are used as identifiers, as shown in Table 4.1, to shield the identity of participants and their agencies. The same acronyms are hereafter used to identify the voices of these participants throughout the narrative of this study.

Table 4.1 Demographics of Interviewed Participants

Agency	Identifier	Participant(s)	Marker
Energy Commission of Nigeria	ECN	3	ECN1-3
Ministry of Power	MOP	7	MOP1-7
Nigerian Electricity Regulatory Commission	NERC	2	NERC1-2
Rural Electrification Agency	REA	2	REA1-2
Rural Electricity Contractor	REC	3	REC1-3

The perspectives obtained from the participants regarding the phenomenon of the perceived absence of renewable energy and its associate technologies in rural electrification projects, as well as the apparent effect the existence of fossil fuel has had on the use of renewable energy sources for rural electrification in Nigeria is as varied as the participants themselves. The key findings obtained from the in-depth semi-structured interviews are based on statements from the participants which are classified under 35 themes. These are further grouped into five key categories that make up the findings of this study, which relates to the different aspects of the framework of the study that was presented previously in Chapter 2.

4.1.1 Context from which Themes Emerged

The perspectives expressed by the participants regarding the phenomenon of a lack of adequate uptake of renewable energy sources and their associate technologies for rural electrification projects in Nigeria and the ostensible influence the existence of fossil fuel might have had on this phenomenon, was diverse in scope. Though, in

earnest, renewable energy was seen as the way to go, achieving a renewable energy powered rural electrification programme in Nigeria, as agreed by the participants, has been an uphill task in itself.

The perception of most of the participants was that despite the effort that has been put into pursuing a higher uptake in the use of renewable energy in rural electrification in Nigeria, a lot still has to be done. The very important role of the Government and the significance of a well-structured policy stood out among most of the responses. The responses also emanated from the shared notion that the bureaucracy has to be more involved in the quest to increase uptake in the use of renewable energy for rural electrification in Nigeria as they were pivotal in the energy sector by virtue of their responsibilities and duties as technocrats in the various ministries.

Interestingly, a couple of the respondents were reluctant supporters of a renewable energy powered electricity programme, pointing out the robustness of fossil fuel as an important advantage over renewable energy that will always hinder its uptake. Their perception was that the deficiencies of renewable energy and the constraints experienced regarding its deployment and use are too significant compared to the robustness of fossil fuel powered electricity generation.

4.1.2 Coding of Acquired Data

Different colors were used to highlight important segments of data as the transcripts were being read (as shown in the sample of the coding schema in Appendix G). Segments and/or units of the texts that were referenced by highlighting them as well as chunking them in groups made up the initial codes. As recommended by Miles and Huberman (1994), as well as Strauss and Corbin (1990), these codes were then organized into themes with the aim of making sense of the data and looking for patterns.

Following Bloomberg and Volpe (2012), the framework of the study presented in Chapter 2 was used as the backdrop of the coding scheme/legend by assigning codes to each category and subcategory (or descriptor). The coding scheme was based on preset themes gathered from the literature review as well as during the course of data collection and analysis. These preset themes serve as descriptors that help relate each category of the framework to the study's research questions.

Saldaña (2012, p. 267) described a theme as “an extended phrase or sentence that identifies what a unit is about and/or what it means” and categories as families of coded data that share some characteristics. Coding is the “critical link” between data collection and their explanation of meaning (Charmaz, 2001 as cited in Saldaña, 2012, p. 3). It “is essentially a system of classification – the process of noting what is of interest or significance, identifying different segments of the data, and labelling them to organize the information contained in the data” (Bloomberg & Volpe, 2012, p. 142).

A Code, as succinctly defined by Saldaña (2012, p. 4), is:

> A researcher-generated construct that symbolizes and thus attributes interpreted meaning to each individual datum for later purposes of pattern detection, categorization, theory building, and other analytic processes.

The codes served as a means of representing chunks or segments of data that were considered relevant to this study. Although it seems the procedure adopted in this study was based on using predetermined coding categories, which means the author “run[s] the risk of analyzing data by coding text units according to what [the author expected] to find” (Bloomberg & Volpe, 2012, p. 143), effort was made to try not to force the analyzed data into the predetermined coding categories by reading through the transcripts and taking note of the language and the implied meanings the participants wanted to pass across.

4.1.2 Emergent Themes of the Study

Considering that qualitative research is about discovery, keeping an open mind, carefully looking at the data, while seeking to uncover important insights regarding the phenomenon that is being researched is very essential (Bloomberg & Volpe, 2012). It has been recommended that in order to make sense of the corpus of data gathered, the goal is to look for patterns, which are subsequently coded into themes or categories (Miles & Huberman, 1994; Strauss & Corbin, 1998). Following this recommendation, without making any prior assumptions, themes in this study were allowed to emerge from the data in an inductive fashion.

From organizing the data, generating categories, identifying patterns and coding the data as suggested by Bloomberg and Volpe (2012), 35 themes, as shown in Table 4.2, emerged from this study. The themes and the participants from which they were obtained are represented in the left and right columns respectively. The following part of this section elaborates on the findings and how they emerged.

Table 4.2 Interview Data Summary Table

Themes	Participants																	
	ECN1	ECN2	ECN3	MOP1	MOP2	MOP3	MOP4	MOP5	MOP6	MOP7	NERC1	NERC2	REA1	REA2	REC1	REC2	REC3	TOTAL
External physiognomies of renewable energy																		
Environmental/climate change mitigation requirements	✓	✓		✓	✓	✓			✓		✓							7
Catalyst for stimulating rural development		✓			✓						✓			✓				4
Energy security			✓	✓		✓			✓		✓			✓				6
Energy politics	✓		✓	✓		✓					✓							5
Perceived value of RE				✓	✓	✓	✓	✓			✓	✓	✓	✓	✓			10
Energy policy and frameworks				✓	✓	✓		✓	✓	✓	✓	✓	✓	✓				10
Topographical considerations					✓		✓	✓	✓		✓	✓	✓	✓				8
Internal physiognomies of renewable energy																		
Clean energy	✓				✓				✓									3
Domestic source of energy	✓				✓			✓	✓			✓						5
Abundant supply			✓		✓			✓	✓	✓	✓	✓			✓			8
Cost effectiveness	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓			13
Appropriate technology	✓		✓		✓			✓	✓		✓	✓		✓	✓	✓		10
Country specific factors related to renewable energy and rural electrification																		
Underutilization of excess resources		✓	✓		✓						✓	✓		✓				6
Nonexistent renewable energy policy	✓	✓		✓	✓	✓		✓	✓	✓								8
Deficient electricity industry	✓	✓	✓	✓	✓				✓		✓	✓	✓					9
Antiquated Process	✓	✓									✓	✓				✓		5
Endemic corruption						✓						✓		✓		✓		4
Lack of continuity in government progrmmes		✓		✓	✓			✓					✓					5

Table 4.2 (Continued)

Themes	Participants																	
	ECN1	ECN2	ECN3	MOP1	MOP2	MOP3	MOP4	MOP5	MOP6	MOP7	NERC1	NERC2	REA1	REA2	REC1	REC2	REC3	TOTAL
Perceptual Factors – Facilitators																		
Political will	✓	✓	✓		✓	✓		✓			✓		✓	✓				9
Government incentives	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				13
Human capacity	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓		14
Better coordination	✓	✓	✓		✓			✓			✓	✓	✓	✓				9
Commitment of the local communities	✓	✓	✓				✓				✓			✓	✓		✓	8
Funding		✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	13
Perceptual Factors - Inhibitors																		
Knowledge/ Technological lag		✓	✓	✓			✓	✓	✓		✓	✓	✓	✓	✓	✓		12
Poor level of awareness	✓	✓	✓	✓	✓		✓	✓			✓	✓		✓		✓	✓	12
Perception of RET			✓	✓	✓	✓	✓			✓	✓	✓		✓	✓			10
Misplaced priorities in RE projects			✓		✓						✓	✓	✓	✓		✓		7
Fossil fuel – RE dynamics	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓			13
Bureaucratic ineffectiveness	✓	✓	✓		✓	✓		✓				✓		✓		✓	✓	10
Factors for entrenching renewable energy for rural electrification																		
Advocacy	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓				12
Overcome liability of newness							✓		✓	✓			✓	✓				5
Improved bureaucratic involvement	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓		✓		✓		12
Conscious government participation	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		15
Increased awareness	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		14

4.2 Finding 1: Factors for Entrenching Renewable Energy for Rural Electrification

An overwhelming majority of the responses mentioned themes associated with this category. The responses indicated that these factors are crucial to the process of legitimizing and institutionalizing renewable energy as a viable option for rural electrification projects in a fossil fuel rich economy like Nigeria. The factors that emerged include serious advocacy, efforts to overcome liabilities of newness, improved bureaucratic involvement, conscious government participation and increased awareness.

This finding is noteworthy in terms of the large number of responses from the participants associated with it, and how relevant the issues in this categories are to achieving a renewable energy powered rural electrification programme. A detailed breakdown of the data summary table for this finding is shown in Appendix L.

4.2.1 Conscious Government Participation

Based on the responses, a vast majority of the participants (15 of 17) accentuated the notion that a conscious participation from the Government was required for renewable energy to gain a strong footing in rural electrification in Nigeria. The prevailing culture of Nigerians encourages this – an element of expectation that getting things done was the sole responsibility of the Government. As remarked by one of the participants, NERC2: "even if you are going to do renewable energy powered rural electrification, ehhh government has to shoulder the bills because that is the belief of the Nigerian people."

This view, that the Government has a lot to do with ensuring the successful uptake and sustainability of a renewable energy powered rural electrification programme in Nigeria was further conveyed by some other participants, as seen in the following statements:

> I think the motivation [for the use of renewable energy] will come from the Government. Especially in pilot projects, understand? When they go to rural areas and implement renewable energy technologies, that one will motivate investors to also go, seeing the one that has been implemented by the Government. [MOP7]
>
> But it's just the government will. If the president decides today that we are going on renewable, there is nobody who will stop it … The government machinery will be set in place to make renewable work in Nigeria. So it's more of the government will. [MOP2]
>
> because renewables are technologies that you must have a deliberate commitment to drive. Especially looking at the cost element, advancement in technology and so on. [MOP1]

MOP1 also saw the need for a deliberate involvement by the Government from the perspective of cushioning the high cost of implementing renewable energy projects. In like manner, REC1emphasized that "the key to renewable energy technologies is financing, and it's Government that will do that one." This comment echoed NERC2's observation, who noted: "Now let's narrow on PV. PV is very expensive and we are not producing it in Nigeria. So the best way for us, is to get Government to move into it."

Government participation in renewable energy powered rural electrification is seen as one way of sustaining such projects. MOP5, who drew a parallel with the stance the Nigerian Government has taken with electricity in general, highlighted this, stating: "One of the things that will make it sustainable, the Government has started moving in that light or that path … electricity industry in the country has been privatize." Citing an ongoing electrification programme, ECN2 further highlighted the positive effect government participation could have with respect to financing renewable energy projects. He concluded that: "… the only thing is that Government can provide money for pilot projects. Which they are doing in the street lighting projects in the 'Operation Light up Nigeria' programme."

REA2 pointed out other initiatives by the Nigerian Government to promote both conventional and renewable energy powered rural electrification. He

acknowledged that “the Rural Electrification Agency, already is mandated to carry out rural electrification development in both grid and none grid systems.” While also highlighting the Government’s effort in creating the rural electrification fund, he explained further that: “we also have what is called the rural electrification fund, an area whereby we expect private partners to come to partner with us.” REA2, however, decried the lack of genuine commitment presently shown by the Nigerian Government in regards to the use of the abundant renewable energy sources in the country. Implying that a reverse of this trend would be beneficial to the institutionalization of renewable energy in the country, he called for more pilot and demonstration schemes, stressing that:

> We need the government to make attempts to actually try these technologies in the remote areas ... So if that is done, I think it is the willingness, the determination to make attempts, and then maybe you do some one, two, three pilot programmes and you will be able to get somewhere ... You know there should be a deliberate effort. [REA2]

Government participation for the propagation of renewable energy powered rural electrification in Nigeria from the perspective of some of the participants was more of a getting-it-done-because-the-government-wants-it-done belief. This could be gleaned from such comments like: “the Government should take the lead. That is what I am saying” [MOP7], and “a serious government, okay, on seat, will do it and it will move faster” [REC2].

Another participant, MOP3, further substantiated the notion of government deliberate action actively facilitating a programme, by citing an example of how the policy document on renewable energy came about because it was ordered by the President. Describing the circumstances, he elaborated that: “... the reason why we had that, the President gave a marching order that by June he wanted us to, you know, he wanted the house that latest by June, we should have the policy document on renewable energy” [MOP3].

4.2.2 Create Better Awareness

Creating better awareness of the idea of having renewable energy powered rural electrification schemes in Nigeria also made up a vast majority of the responses from the participants. Better awareness, both at the government/bureaucratic level and at the rural community/recipients level, was emphasized by 14 of the participants as one of the key means through which the application of renewable energy and its associate technologies could be entrenched in the Nigerian energy and electricity arena.

Most of the responses showed that though there already exist some elements of awareness and enlightenment in regards to the viability of renewable energy for power generation in Nigeria, a lot more was yet to be done in light of the issues facing renewable energy. The importance of creating increased awareness can be seen in comments by ECN1, who saw awareness as a means of showcasing the feasibility of renewable energy projects when he surmised in his response that: "the execution of pilot projects for people to see; demonstration projects that these things are working, that is it."

Other comments by some of the participants highlighting the emphasis placed on increasing awareness include:

> To create awareness, we have also done some feasibility studies and we have done some pilot projects and also like I just, I told you earlier, we have done some solar street lights. [REA1]
>
> The Ministry of Power is responsible for policy making in the country and ehhh of course that is to guide the Government in ensuring effective policy to encourage the use of renewable energy which is what we are doing by the time the policy becomes more effective, and awareness is created we will be able to see the advantages of renewable energy. [MOP6]
>
> We have also been able to encourage the penetration of solar through constituency projects which are street lighting, solar water pumping, solar power for clinics, which we have been doing computer centers in schools and so on.

> What we have been doing was try to promote, create awareness for the use of renewable energy for power generation and we've been successful in that business men, make them aware that this is possible alright and Government is asking them to come and collect licenses if they want to build power stations. [ECN2]

Another participant, ECN3, pictured increased awareness as both acquiring and impacting knowledge. His view was that project developers were paramount in seeing to the success of the application of renewable energy technologies. According to him:

> We will continue to conduct research, generate new ideas, new information and pass these on to project developers. So these are the things we can do while we continue to keep abreast of developments in the renewable energy sector globally, so as to acquire more knowledge, more awareness, more skills about how to develop policies to improve the system. [ECN3]

Similar to the view by ECN1, who expects increased awareness to also be focused on the beneficiaries as can be seen in this comment: "so they have to also educate the communities", MOP4 noted that with regards to the management and usage of the renewable energy powered electricity, "generally they [the recipients] need awareness because some people when they give them okay use 10 Watts, people are using more than 10 ... You know we need orientation. We need orientation so that they will see the difference."

Another participant, MOP2, saw increased awareness as a tool to help streamline the numerous and conflicting information about renewable energy that has somewhat stifled its acceptance among Nigerian energy bureaucrats. According to him, "Nigeria has heard so much that at times to take a decision becomes difficult so better awareness will help reduce this over flux of information."

REA2 extended his argument for the creation of better awareness on how the use of the abundant renewable energy sources could be expanded for power generation along the lines of a re-orientation of the Nigerian education curriculum,

stating that “the curriculum in the universities in Nigeria should take renewable energy option serious, for our own graduates to begin to understand that it’s not only grid system alone that should be considered in electricity generation.

4.2.3 Advocacy

Closely linked to issues relating to the increase of awareness are activities that have to do with issues of advocacy. A majority of the responses from 12 of the participants indicated that for renewable energy to play any significant role in rural electrification in a fossil fuel rich country like Nigeria, it would have to be supported by a very strong coalition of advocates, especially among the stakeholders. Advocacy was deemed to be required among the stakeholders as a means of promoting renewable energy and reducing the challenges of promoting it. Some of the responses that support this notion include:

> We have tried to create awareness through meetings and discussions we have what is called the power consumer forum – electricity consumer forum. These are meetings, regular meetings we do. It’s a town hall meeting where we discuss various issues about the metering, about policy of government, about regulation, how it is done and what are their rights, and what are their places. [NERC1]
>
> There has to be strong advocacy for these renewable energy powered electricity projects, for them to gain ground and there has to be total buy-in by the communities. [REC2]
>
> For renewable energy electricity to gain ground in the communities, the beneficiaries have to clamor for it through their political representatives that this is a good way to provide us with electricity. [REC3]

MOP2 saw the possibility of advocacy only if there is a champion for the course. According to him, an important challenge faced by renewable energy is not having someone who can act as a voice strong enough to break the perception of the powers that be towards the use of renewable energy for rural electrification. According to him, “if somebody can get these key people to agree, you understand?

Or to adapt the renewable energy thing, the country will start singing that song immediately."

Citing a recent occurrence, he elaborated further:

> You see let me give you another example. When we started the energy efficiency, how did they get government's attention? It was basically because through ECOWAS, we were able to get some of the key people outside of this country, to go to Cuba to see how these bulbs worked and how they had implemented it. [MOP2]

Responding to what the Rural Electrification Agency (REA) has been doing to encourage decentralized electrification in the rural areas of Nigeria, REA1 indicated that the Agency had done a lot in line with advocacy and enlightenment. Stressing how important advocacy was to his agency, he highlighted that as part of efforts to create more awareness and ensure the success of the agency's pilot projects, "we have been doing advocacy".

4.2.4 Improved Bureaucratic Involvement

Twelve of the participants indicated that improved bureaucratic involvement in the renewable energy development and rural electrification process would go a long way to ensure that renewable energy finds its place in rural electrification projects in Nigeria. Some of the concerns raised reflected the shortcomings in the activities of the bureaucrats in the various agencies related to renewable energy development and rural electrification.

MOP2 astutely pointed out why it could be said that involvement by the bureaucrats is subdued or very passive. To him, no matter how much the bureaucrats would want to be involved, their efforts would always be constrained by the final say from the people in power. A major area of involvement by the bureaucrats, as indicated by most of the participants, was in the aspect of ensuring standards and regulations. This was reflected in the following responses highlighted below:

> Standards and quality for example Ensure that standards of those panels are, are what they are supposed to be. If there's no regulatory body then there will be so much fake. [NERC1]
>
> Now, policy here, we are not, in the first place, we are not policy makers. We take policy and come up with regulations to ensure that it works. [NERC2]

Responses from other participants indicated that each agency is invested in different degrees in seeing to the widespread use of renewable energy for rural electrification in Nigeria – the issue being to what degree? Most of the participants felt that their agencies are already well invested in the successful adoption of renewable energy. Among these were ECN2 and NERC1, who stated respectively that:

> One of our function is to develop the market, which we have been doing. We are trying to encourage individuals to come into it and build, and that has been the reason why we formed those organizations, alright? [ECN2]
>
> Then we also try to bring down the cost of accessing renewable energy by producers as our own incentive to encourage them. [NERC1]

Acknowledging that being fully involved in the process of promoting the use of renewable energy technologies is important for its propagation in Nigeria, ECN2 highlighted the accomplishments of his agency, stating that:

> We were also able to set up Jathropha farmers association for production of biodiesel … the World Bank gave us assistance in the development of biodiesel using Jathropha Caucus. So these are some of the things we have been able to do.

Although most of the participants were able to establish the involvement of their agencies in seeing to the successful propagation of renewable energy programmes, it was obvious that the commitment of the agencies to these

programmes are not very strong as most of these agencies look up to other agencies to get the job done. This was inferred from such responses like this comment by ECN1:

> This document that I have given to you is what ECN has done. All the resources are there, the opportunities are there, the timelines are there, the targets are there. Is it clear? The objectives, everything is there and this has been passed to the Federal Ministry of Science and technology. You see it. We are now asking them to take it to the Federal Executive Council. So that they will look at it, approve it and send to the national assembly. So the Commission has done all that they need up to date.

The need to improve the commitment of the agencies to a renewable energy programme was not lost on the participants. Most of them were quick to emphasize the importance of building on what has been achieved so far, as seen from the following comments:

> So if we can work on human capacity, our own capacity – engineering capacity, then even government policies too ... I know it's not all that easy because the challenge is enormous but with constant improvement we can achieve this. [ECN3]
>
> So the Ministry of Power is now re-focusing, having undergone the power sector reform which started effectively in 2005 … So the position has really changed and so many things are being done to drive the process, particularly with respect to policies and frameworks, regulatory frameworks and so on. [MOP1]

In keeping with the idea of improved involvement of the bureaucrats in the renewable energy development process, while also acknowledging the challenges, MOP3, drawing attention to how a more proactive stance based on an informed human capacity is being taken by his ministry, elaborated on their current activities regarding interactions with investors. He stated that, "when the investors come as it's expected, we are supposed to advise Government on policy issues and guide them and

oversee what they are doing." According to MOP3, they also participate in such functions like mediation and facilitation of access to State Governments by investor.

4.2.5 Overcome Liability of Newness

Only a few of the participants provided responses that had to do with the issue of overcoming the liabilities of newness as a means of institutionalizing the use of renewable energy for rural electrification in Nigeria. Their view was that due to its novelty, very few people within the decision making arena are actually aware of the practicality of renewable energy technologies in rural electrification. As such, many do not see renewable energy technologies as a sustainable means of electric power generation. This notion was reflected in comments like:

> Now this is another option that is very new and strange to most of the technical people in this country, and the policy makers ... renewable energy is new and our attitude to imbibing new technologies is usually slow. [REA2]
>
> What I've seen, renewable energy is a new thing to rural development now that's a problem. [MOP4]

Although mostly portrayed as a liability, the issue of the novelty of renewable energy technologies in Nigeria was, however, seen by some of the participants as an advantage to its development. According to REA1 "… what I can say is I think we are an emerging and developing market in that area we have a lot to gain." The novelty of the concept and the newness of the associated technology was also seen as a boost for trying out the concept. This was expressed by MOP7, who pointed out that: "You know, this is a new technology. We are coming into it now ... For now I don't have full knowledge about the strategies that Government is using, but we are hoping one day to have all these on ground".

4.3 Finding 2: Perceptual Factors

Perceptual factors were classified under two categories: those perceived to be inhibitors and those perceived to be facilitators of the widespread adoption of renewable energy for rural electrification projects in a fossil fuel rich country like Nigeria.

4.3.1 Inhibitors

Perceptual factors that were perceived as inhibitors were those factors that the participants portrayed as being detrimental to the adoption of a renewable energy powered rural electrification programme in Nigeria. Appendix M presents a detailed breakdown of the data summary table for this finding. It should however be noted that one of these factors, fossil fuel-renewable energy dynamics, was quite unique in that, though it was perceived as an inhibitor, close examination showed that it also possessed facilitating attributes depending on the context in which it was perceived.

4.3.1.1 Fossil Fuel–Renewable Energy Dynamics

With respect to the fossil fuel-renewable energy dynamics, a majority of the participants (13 of 17) reflecting on the dichotomous state in which energy exist in Nigeria commented that fossil fuel has had a somewhat adverse effect on the development of renewable energy for electricity generation in Nigeria in general, and in rural electrification in particular. This notion was noticeable in such comments like:

> The abundance of fossil fuel has really affected us negatively. [MOP5]
>
> as you see, we have abundance of fossil fuel, which is making us lazy to accept that we should move to greener energy. [NERC2]
>
> Actually, fossil fuel has delayed the massive deployment of renewable energy in Nigeria; because we have the resources here in Nigeria and it's being exploited and that is the resource which people know and which government generates a lot of revenue from. [ECN1]
>
> The political will to actually use renewable energy ... over the years it has been a problem because of the preponderance of fossil fuel. [ECN2]

The conception that the abundance of fossil fuel in Nigeria has created a mindset among Nigerians of it being the only means of power generation was also echoed in most of the responses. REA2 expressed this view when he commented that: "You know initially before now most of the sources of electrical energy in this country is from the fossil fueled national grid… and it's like a tradition." This was also highlighted by NERC1, who pointed out that "we are already built up with the mentality that if you need power, it has to be hundreds of megawatts" and that "because of our history of reliance on fossil fuel, most of our power plants have been large power plants on fossils ... you find that if we are talking about power, it must come from either fossil or large hydro." He emphasized that the country's relationship with fossil fuel has mostly dictated how electricity generation and usage is viewed in Nigeria. Stating further that:

> On a general note, it's true that we are a fossil fuel blessed nation and because of that we have tend to think that energy comes primarily from fossil fuel, but electricity does not only come from fossil fuel, ... So now when you talk about power in Nigeria we will think in terms of 100 MW and above. Most of the power plants we have are 100 MW and above. These are easily possible with fossil fuel – gas projects and also large hydros, but for renewables like solar, wind it is difficult to start talking of 100 MW projects.

Other participants also commented on how far spread the influence of fossil fuel has been in the electricity industry. For instance MOP2, who indicated that: "in the power sector road map, where government clearly stated that we won't give much attention to renewable energy, you understand ... It will only consider it, it won't neglect it but much of the attention will be on fossil fuel." This attention by the Government on fossil fuel has given it more advantage than other sources of energy as noted by another participant:

> Okay, I would say we have fossil fuel in abundance and it is heavily subsidized by Government and that has given it a comparative advantage that has affected the rapid research and development of other sources of energy like renewable sources of energy. [MOP5]

However, as indicated by some of the responses, it is possible for both energy sources to coexist. In MOP2's opinion, where it is more effective to use fossil fuel for electricity generation, fossil fuel should be used, and renewable energy should be used where it is more effective to use renewable energy. . According to him, the line of thought should be along "… what can deliver this power quickly and easily, and affordably? How easily can you get it?"

ECN3's position is to follow the trend of gradually weaving renewable energy into the energy mix. He stated that:

> We have no alternative than to use gas because many countries that developed renewable energy too, had to leverage on something to be able to develop. So we just have to use gas in the meantime while we gradually diversify our sources of energy.

Highlighting why renewable energy has to go along with fossil fuel in electricity provision in Nigeria, especially for the rural dwellers, ECN3 further emphasized that taking into consideration the importance of such factors like availability, accessibility and affordability in energy option selection for power generation, renewable energy is an attractive option for Nigeria to consider. He highlighted that:

> Although we have fossil fuel and natural gas, we have natural gas, but one of the challenges we are facing now the natural gas is not even available to generate electricity … and fossil fuels even in the villages do not so much get to rural areas.

In like manner, ECN2 was of the view that the existence of fossil fuel within the Nigerian context should not really hurt the development of renewable energy. In his opinion, with the price of fossil fuel spiraling, and considering that most of the fossil fuel in Nigeria is exported, the existence of fossil fuel should not disturb the development of renewables for the local market. He alluded that there was another explanation as to why renewable energy has not taken off. The problem for the lack of

use of renewable energy according to him was not necessarily "because fossil fuel discourages us from using renewables" [ECN2].

Some of the other participants also highlighted a special relationship between the abundance of fossil fuel and renewables, and why both should be developed for electricity generation. They stressed the finite nature of fossil fuel and how this should encourage the development of the inexhaustible renewable energy sources in Nigeria, as explained by MOP3, who stated that "… actually we've been on this fossil fuel and you know fossil fuel is exhaustible and renewable energy is inexhaustible," and developing both should be more synergetic than disruptive for the nation. The idea of developing both in tandem, was also portrayed by two other participants who noted respectively that:

> We are thinking of tomorrow – what of if we don't have fuel tomorrow – crude oil tomorrow? are we going back again to solar or renewables? ... we can use it in between, in case, we can still use it but we cannot depend much on it like that. [MOP4]
>
> because the fossil fuel will eventually might not be available but these nature, natural things is always there and they can be tapped into. Therefore they are much more apt in this generation for power generation and for even household use because they are always there. [MOP6]

The dynamics between renewable energy and fossil fuel within the Nigerian energy context, according to MOP1, should not necessarily be contentious. Both energy sources should be able to co-exist in the quest for providing adequate power for the nation. He reiterated that:

> You know like I have said earlier, these things are quite relative, there are areas where renewable energy is the preferred option because of its competitiveness over fossil fuel and there are areas where clearly it is better for you to extend the grid.

4.3.1.2 Knowledge/Technological Lag

Most of the participants (12 of 17) mentioned the level of knowledge and technological expertise in the field of renewable energy as a major inhibitor to the advancement of renewable energy in Nigeria. REA2 indicated that "as a matter of fact, one of the major things that militate against renewable energy technologies is the lack of the knowledge on renewable energy … they just rush into it without having an in-depth knowledge."

This shortcoming in the level of knowledge and technological know-how was portrayed by most of the participants as a deficiency in human capacity. This was in terms of technological know-how and knowledge of renewable energy technology as seen in the following comments:

> Capacity that is our own capacity – engineering capacity, project delivery capacity, maintenance capacity, cost – all these are factors that could militate against deployment of renewable energy in Nigeria, especially in the rural areas ... So the capacity is very, very important. Building capacity – because many a times when I think of the problems we are having in Nigeria, well capacity – lack of capacity is one of them. [ECN3]
>
> Yes, I think the other big one is capacity. The ability to have the quality set or drive of people human resource that can drive the process ... It is not very common in Nigeria to have I mean people on the ground that understand the intricate nature of this renewable energy promotion issues in terms of how they are sustainable, looking at all the odds against renewables. So generally this is one challenge – capacity, yes human capacity. [MOP1]
>
> So most of the renewable energy equipment are being imported – the solar, even your solar water heaters which is the easiest for us to even manufacture in this country is being imported; all turbines – wind turbines, small hydro turbines, all of them are being imported. So that is one barrier that we have not been able to overcome. [ECN2]

While some of the participants clearly acknowledged this problem, for instance REA1, who observed that "… also in the area of research and development,

we are lagging behind", and MOP6 who stated that "emm the present challenge, the major challenge is that we don't even have this technology here on our own. We've not been able to ehhh we don't have the manufacturers, we don't manufacture any of them;" others like REC1, who pointed out that "… if we don't go into the provision of the technology locally, we can't meet up", hinted that fixing this issue is imperative to the success of adopting renewable energy in rural electrification in Nigeria at a larger scale.

The effect of knowledge and technological lag according to the participants has also been felt in the area of the cost of renewable energy development in Nigeria. It has contributed to a higher cost due to the fact that equipment and components, which ought to be manufactured locally, tend to be sourced abroad. NERC1's comment that, "unlike in the west where it is already getting competitive we don't have capacity for manufacture … we are importing them so that leads to higher cost," underscored this concern.

Other than increased cost, the lack of knowledge was also seen as a major issue as it concerns the appropriateness of the imported technology for deployment locally. This point was echoed by NERC2 who, while pointing out that due to lack of knowledge, other than cost, the imported technology, most of the time are not appropriate for the site, added that "… unfortunately the cost is not helping matters … we are not producing solar PV, we are not producing the batteries." Knowledge and technological lag, in MOP5's view, has also led to wastage, as so much time and resources are being expended on repeating pilot and demonstration projects. According to him, "… that's why it looks as if those making the argument for pilot projects, they are trying to score a good point because when you look round, the people you see in the institution they know little or nothing."

Another issue raised by REC2 in regards to knowledge and technical know-how was that "the constraints that rural electrification have when it comes to contractors is that those that win bids are almost always the contractors that are not familiar with the job." This, according to him, has led to "the problem of quacks coming in." Better technical know-how will, therefore, not only minimize wastage, reduce cost and improve the quality of electrification projects, but according to another participant, "you know once you have the knowledge, then the fear of the unknown is highly reduced." [REA2]

4.3.1.3 Poor Level of Awareness

Another factor most of the participants (12 of 17) saw as an important issue when it came to the use of renewable energy for rural electrification projects in Nigeria was that of the poor level of awareness across the board. As indicated by ECN1, awareness is really essential for the uptake of renewable energy and its technologies, as well as in preventing situations "where people are ignorant of what the technology is all about and the advantages they can derive from renewable energy."

The perceived low level of awareness of renewable energy for rural electrification in Nigeria was further expressed in such comments like:

> Renewable energy is not well known in Nigeria, though activities in renewable energy started as far back as 1982, when two national centers were created by the Federal Government to conduct research and development in the field of renewable energy. [ECN1]
>
> Most of the political leaders have really not much information until recently about other sources [of power generation]. So that guided the focus of developing what you know first. [MOP1]
>
> So I think those are the major factors and then another factor that is important is awareness. Lack of awareness is another serious factor. Even when you are aware – because the type of awareness I am talking about is you may hear that there is renewable but you have never seen it – some people have never seen a solar panel. So if you have never seen it, how will you use it to generate power? So that is the problem. [ECN2]

Other than being just an issue affecting implementation from the government angle, awareness was also seen as obliviousness on the part of the beneficiaries or rural community dwellers. This is underscored by ECN2's comment that "It's not the awareness of the government but the awareness of the people … Alright? It's the awareness of the people." Lack of awareness, as it affects the beneficiaries of rural electrification projects, was also highlighted by ECN3, who elaborated by citing a personal experience:

> I mean it was not functioning at the time and that was barely six months after installation … when we got there the issue was maybe a problem of less than 5,000 Naira, that you can solve with less than 5,000 Naira but the people there didn't know. They didn't know what to do, they didn't know who to call, who to even contact. [ECN3]

4.3.1.4 Perception of Renewable Energy Technology

How renewable energy and its associated technologies are perceived was portrayed as an inhibitor to their uptake in rural electrification efforts in Nigeria by more than half of the participants (10 of 17). The general understanding was that renewable energy technologies should be an option adopted for filling the electric energy gap left by the national grid as a supplement, or as complement to the grid, as the case maybe.

Emphasizing that the Government does not have the luxury of choosing from alternatives at the moment, MOP1 stated that "Rather, whatever we have should come in … we are using renewables as a means of adding power where they are a better option." Elaborating further on his perception of renewable energy technologies and what should influence their choice in rural electrification projects, he stated:

> I personally believe that renewable energy is the way to go. That's my personal opinion. Having said that, I understand the challenges we have as a nation. It's not about adopting one technology at the expense of others but rather making sure that where ever it is best for renewables to be adopted, it is adopted and then where ever other options are best in terms of technical feasibility, economic viability and financial profitability of the project, the choice should be purely on viability. The choice. That's my own personal opinion. [MOP1]

MOP2, a strong proponent of the continual use of fossil fuel whose general perception was that renewable energy, for now, seemed "to be a luxury", was of the thought that the use of renewable energy should be dictated by situational forces especially of the locality in question. MOP4 raised the issue of rural dwellers

perceiving renewable energy technologies and the associated electricity from it as a social benefit that they should get for free. He poignantly pointed out that "those rural dwellers they want something free from the government forgetting that they need accessories that the Government cannot continue to finance.

Commenting on the perceived factors that could influence the widespread uptake of renewable energy for rural electrification in Nigeria, NERC2 indicated that:

> The scale of renewable energy projects is another issue … Nigerians like everything big. We will like to have renewable energy that will do the same work as grid connected. I will like to have air condition, be able to do some ironing, heating … which with renewable energy, is very difficult. [NERC2]

The issue of scale was also raised by REC1 and NERC1, who stated respectively that:

> You see in renewable energy, you can't generate a lot. Like the Government has tried its best, even in Abuja, there is a pilot scheme for street lighting – round Nigeria – wind powered bore-holes and so on … You see there, they are for the communities. You can charge your phones and you have points that you can charge your phone and it's delivered in the houses; maybe two, three bulbs and so on and so forth. [REC1]
>
> There is this lack of appreciation of the fact that small power can do a lot in solving problems in rural area and relieve the bigger problems in the cities. For example if the rural areas, all the rural villages get power from solar, from wind as the case may be. The level of electrification in Nigeria would have increased. [NERC1]

MOP5 was of the view that the privatization of the electric power industry in Nigeria was an added opportunity for the development of renewable energy for electricity generation in an off-grid manner. He suggested that due to the abundance of renewable energy sources, especially in the rural areas, it was definitely

the most sustainable means to get power to the rural areas "… as that might be the way to go because none of those investors will be looking at the rural areas due to cost." [MOP5]

The state of renewable energy development in Nigeria for rural electrification, as expressed by REA2, was that "the development of renewable energy was very very slow, very low." Confirming the dearth of renewable energy in electricity projects in Nigeria, he asserted conclusively that, "in fact I can hardly really pinpoint serious development or erection of renewable energy option for rural electrification in this country."

Nonetheless, though not without some challenges, a promising outlook for renewable energy powered rural electrification was portrayed by some of the other participants. While stressing the challenges, ECN3 acknowledged the use of renewable energy, commenting that though "the use of renewable energy in the rural areas is okay … yes we have a lot of potentials, but there are also challenges." Another participant, MOP2, indicated that the people's perception of renewable energy technologies is improving, elaborating that "the major concern for Nigeria for now and why we want to look at renewable energy are one; it's the understanding that people are beginning to have."

The challenges that have made renewable energy technologies to be perceived as not being a suitable option for rural electrification in Nigeria, as further indicated by the participants, extended across different aspects from inferior imported materials and equipment as highlighted by MOP3 as a red flag that "shows a bad signal to the public that this thing doesn't work, but if you go outside this country, like in Germany you see these things working perfectly", to unreliable local technology as pointed out by MOP7 while explaining that:

> For us to promote the deployment of renewable energy in the rural areas, yes, first of all we must have very reliable technology, that when they deploy in the rural areas, it can work for a very long time because most of the renewable energy projects, sustainability is problem. You know, especially consider solar energy, you go and install solar panels with batteries and after sometime the battery will be … the life span of the battery, it will get dead.

This concern was also shared by NERC1, who remarked that for renewable energy to actually take-off, efforts should be made to ensure that "the quality are such that it will give confidence to those using it, because … If quality is not there, the end user will not have confidence in using them or even using more."

REC1 remarking along the lines of the life cycle cost of renewable energy projects – that renewable energy projects, cost wise, are very beneficial on the long run – indicated that renewable energy was also perceived as a very good option being that they are nature-driven. He elaborated, stating:

> You see renewable energy is natural. It doesn't end. Fossil fuel, one day we [will] wake up in this country, the crudes are gone … unlike crude oil though it's natural but it's in a [finite] quantity, but in as far as the sun is shining, and the wind is blowing, renewable energy will never come to an end. [REC1]

4.3.1.5 Bureaucratic Ineffectiveness

Another notion expressed as an important concern by more than half of the participants (10 of 17) was that of bureaucratic ineffectiveness which stems from a perceived weak institutional structure. The situation, as explained by these participants, was that Nigeria lacks strong institutions or well-structured institutional frameworks administering the requisite requirements needed to jump-start and sustain a renewable energy revolution in the country.

REA2 emphasized this concern when he asserted that "our institutions presently they are not too strong. They are not too rigid defined organizations. It's so unfortunate, you find our Government wasting money, or energy in attempting to do renewable energy." Other participants, for example MOP1, attributed the perceived weakness in the institutional framework to be as a result of a lack of capacity: "I think it's more to do with capacity. If you have the right quality of people, things will be done right."

This view was also shared by MOP5, who decried the never-ending practice of pilot projects when it came to renewable energy deployment in Nigeria, suggesting that a better situation could be achieved. He stated:

> Once we have strong institutions with good archives and data … definitely we've gone beyond pilot projects but the challenge we have here is that we don't have too many strong institutions, and most of all these things revolve round people. [MOP5]

Bureaucratic ineffectiveness, according to some of the participants, has also resulted from government behavior. As was implied, the bureaucrats are constrained by what the Government of the day wants. MOP2 indicated that the bureaucrats are supposed to promote government policies "but that is not usually the case … When you are taking that direction, government will come and say no, we want this." Other comments indicating how government behavior has translated into an ineffective bureaucracy include:

> At the end of the day we don't get money for that from the budget office, so we get far less than what is budgeted. So maybe they will say … I am earmarking 200 million for you but at the end of the day how much will they release? So what is approved, appropriated and what is released will be far less than what is required. [ECN3]
>
> and the problem I can tell you, ehhh we don't know, how do I put it. When you import equipment for small hydro and it lies on the ground for 30 years. [ECN2]
>
> The policy for renewable energy has not even been presented to the federal executive council. [ECN1]

Bureaucratic ineffectiveness was perceived to be of immense concern by the participants in that it affects almost all the aspects of implementing a renewable energy programme. As observed by MOP3, bureaucratic ineffectiveness further weakens the institutions which consequently create room for lapses and oversight by government personnel, especially in areas of ensuring standards and certifying quality of imported renewable energy products. He further indicated that:

> A lot of people go outside and import so many things that when they bring and install, you see that the ratings and all these things may not be to international standard that can stand the test of time ... So issue of inferior material and also unqualified personnel that handle the aspect of installation of renewable energy is a very big challenge.

According to REC2, the system is designed to fail as it is wrought with too many constraints which emanates mostly from the authorities. He stated that "in rural electrification when it comes to contractors … Government officials make things very difficult for contractors." Explaining further, REC2 highlighted the issue of monitoring power infrastructures and the associated hurdles. He elaborated:

> Assuming that one of those poles fall down, do you know where the transmission is heading to, you don't know? And before somebody now wakes up in Abuja or from somewhere else to go and discover it, they will sit on their table and start deliberating: who will go, budget, the vehicle is not in good shape, there is no money to send the people there and if you send the people there, the terrain is bad etc. [REC2]

This concern was further echoed by REC3, who stated that an ineffective bureaucracy has compounded the difficulties faced by contractors in regards to getting paid for projects. "The people in charge normally make the payment stressful for the contractors and sometimes you discover that you spend more time chasing payment than doing the actual job." [REC3]

4.3.1.6 Misplaced Priorities in Renewable Energy Projects

Misplaced priorities in assigning renewable energy projects was highlighted by a number of the participants (7 of 17) as another issue hindering the widespread uptake of renewable energy powered rural electrification in Nigeria. Given the responses from the participants which portrayed in varied degrees a clear misdirection of focus by the authorities in regards to deploying renewable energy powered rural electrification projects, it is not surprising that Nigeria has little to show for all the effort. Some of these responses include:

> We have done quite a lot of solar in some communities. I know even last year we had some projects in solar street lights. I think we have limited ourselves to that yet … In the past we have done some projects with renewable energy, but those ones were all case studies, but solar street lights, we have done quite a lot. [REA1]
>
> Presently what we are doing is just, doing the legislative jobs. That is the constituency projects … a National [Assembly] member would, because of political eh politics so to say, will say I want to give this place light. Whether that is not their priority or not but he wants to do it, the purpose is for his own political aggrandizement. [REA2]
>
> Most of the projects that are done for them are just donations so they don't have to pay to spend anything, but then they do not serve the purpose. Like all the ones, all we are doing is maybe street lighting, then maybe boreholes, few boreholes, but what of the lighting to their own homes? [ECN3]

The misdirection of focus was also expressed in the remark by NERC2, who stated that "unfortunately for rural electrification projects we are not doing rural electrification, we are just doing grid extensions". Implying that whatever decisions that are taken, are almost always detrimental to the use of renewable energy as it will always be in tune with grid extension mechanisms which are based on the fossil-fueled generation of power.

REC2 indicated that the use of renewable energy could only be fully implemented if all the enabling factors are properly prioritized. He stated "you cannot push for renewables since contractors want to make profit." The involvement of the private sector was also expressed by NERC1, who observed that it was a private sector led system that could actually bring about rural electrification and development. Emphasizing that the private sector would be better focused than the Government, he stated:

> What government installed, after a while it will lose the vigor. This is because most government projects don't have maintenance programme for them.

> Many projects, government projects have been done and after a while they are abandoned … once the project has been installed, the contractor has left the site, that's all. But if the private sector installed it, he maintains it because it is his project – he has invested in it and wants to make profit over time, so he has to keep servicing it. That's why it's better to have the private sector in the development of renewable energy in Nigeria.

4.3.2 Facilitators

As opposed to factors perceived as inhibitors, factors perceived by the participants and portrayed as being beneficial to the adoption of a renewable energy powered rural electrification programme in Nigeria were classified under this theme. From the responses, it is deemed by the participants that by sustaining these factors, renewable energy had a better chance of cultivating a wider reach in the rural electrification sector in Nigeria.

The factors that emerged as facilitators from the interviews with the participants ranged from human capacity development, government incentives, funding, political will, better coordination, to the commitment of the local communities. A detailed breakdown of the data summary table from the interviews for this theme is shown in Appendix N.

4.3.2.1 Human Capacity Development

A vast majority of the participants (14 of 17) acknowledged the importance of human capacity development of those in the bureaucracy as vital to instituting renewable energy powered rural electrification in Nigeria. Human capacity development, as it was portrayed by most of these participants, encompassed knowledge of relevant technological systems, high analytical competence and training. The general perception was that despite recent advancement in knowledge of renewable energy systems globally, Nigeria still lagged seriously behind other countries and needed to intensify efforts in order to catch up.

The lack of knowledge of renewable energy technologies was highlighted as a major factor that has strongly militated against the widespread use of renewable energy technologies for rural electrification in Nigeria. According to ECN1, renewable energy technology has not really been popular in Nigeria, despite

efforts by the Federal Government to promote it. ECN2 indicated that a big constraint is that Nigeria lacked the technological capacity to sustain renewable energy projects. He explained further, stating:

> Then the other is what I can call human capacity development, alright? When you are talking of renewable energy we don't have the capacity to; I mean in terms of technology, we don't have the capacity to produce or manufacture in the country which is also a problem ... we don't have the technological capacity.

A lack of local technical know-how on the application of renewable energy technologies, as hinted by most of the participants, has not only slowed down the advancement of renewable energy technology in Nigeria [MOP1], but has also lengthened the decision making time for the selection of the most appropriate technology to use [MOP2]. It has also hindered interest and motivation towards the exploration of the abundant renewable energy sources for rural electric power generation, and has further compounded the problem of cost and quality as highlighted by NERC1, who remarked that "here we have to pay for the cost of importation, then also, the issue of how do we ensure that standards are maintained?"

The low level of human capacity development, as reflected in the lack of knowledge of relevant technological systems as observed by REA2, has also led to "the availability of quacks in the field who attempt to do certain things believing that they know it." Knowledge of relevant technological systems, it has been shown, is necessary for boosting renewable energy adoption, and it is required for both government officials and contract or project implementers. This was further emphasized by REA2 who indicated that having adequate knowledge of the relevant technological systems for instance, will make such personnel "able to help the policy makers identify and maintain standard of what should be used in the field."

Knowledge of relevant technological systems and high analytical competence of those in charge of administering the rural electrification programme in Nigeria was also seen by REA2 as vital. He emphasized that:

> Now it goes to say that they must understand the engineering aspect of it very well, the different components, identify the commercial components, the different components in the market, how to integrate them to become very sound systems … we need to check the data that is usually presented to us. We need people who have better ways of confirming the data that really constitute the inputs to make these systems work in the renewable energy option.

MOP7 also highlighted how developing human capacity in the area of renewable energy could further legitimize its efficacy as a viable energy option. According to him, "for us to promote these technologies in our rural areas, [we have to] have very reliable technologies and know-how ... not to go and install wind turbine in an area that doesn't have high wind speed" [MOP7]. This knowledge, according to MOP5, is not farfetched:

> We are not re-inventing the wheel. The wind turbine is there. It's just for us to understand it; the usage, develop human capacity for little maintenance and management … So it's just to develop little capacity, which our educational structure at the moment can find human resources to manage.

The importance of human capacity was further stressed by another participant (MOP3), who indicated that the development of the renewable energy capacity of government officials is essential in helping to weed out fake products. He stated:

> Yes, the challenges here is that we need to build capacity. Which is very important ... even when they bring equipment, when you see, you will know which one is the genuine one, which one is the fake one and all those things. Without the capacity building, you won't know. [MOP3]

Nigeria, according to MOP3, can make headway in knowledge acquisition within the shortest possible time. "We have to get, you know well trained

so that we have the knowledge of the new technologies on renewable energy" [MOP3]. This point was also re-emphasized by ECN3 who noted that "the area of capacity building is very important," and that a lot could be achieved "if there is … engineering ability to design, to fabricate, to manufacture within the country."

Training – both for the government personnel and the recipients of the proposed renewable energy powered rural electrification schemes – was highlighted as an important factor in developing human capacity and further promoting the awareness and acceptance of renewable energy technology for rural electrification in Nigeria. As an off shoot of human capacity development, training was perceived by some of the participants as a means of acquiring new knowledge, while some others saw it as a means of refreshing prior knowledge.

In general, the responses, with regards to training, clearly conveyed the magnitude to which the participants held the concept of training. For instance, one of the participants, REA2, strongly reiterated the importance of training, stating "… there must be training and re-training of our engineers," while another participant, REC2, concluded by stating "training is very important." Training was also seen as a means of keeping up with the ever evolving level of development in the area of renewable energy and electrification. MOP3 advised that "… we have to get, you know well trained so that we have the knowledge of the new technologies on renewable energy." This was a view echoed by ECN1, who indicated that "through advocacy, training – that is capacity building, people will be familiar with it [renewable energy]."

Stating his position on human capacity building from the perspective of personnel being able to carry out maintenance, ECN2 indicated that training is important "because most of the equipment we install out there, maintenance is a problem … To send people to go and maintain is a problem. So we need to train people that can maintain these equipment." Likewise, MOP5 noted that "what we need, is to train people, develop capacity in the operation and running of such plants and little little maintenance which it will require."

Human capacity development, as implied by ECN3, is one thing that the Nigerian Government is not taking for granted. He pointed out that there are several training centers around the nation. In his response, he drew attention to the existing

government research centers stating: “They must have told you about the existence of the four centers[8] – the energy research centers that are saddled with the responsibility of conducting research and training of personnel in those areas.”

Hinting at technological transfer which could be facilitated by adequate human capacity development, ECN3 remarked that the energy bureaucrats are now kicking against turnkey projects in a bid to encourage the development of local capacity. “We discourage it. Even if you are going to invite somebody from outside to build the project within the country, to install a project, let there be substantial participation by Nigerians … you must be aware of the local content laws.” [ECN3]

Other participants implied that technological transfer would serve Nigeria well in the quest for knowledge of relevant renewable energy technological systems. As indicated by REC1, “basically the problem for us to get it right, we might have to go back and start producing solar panels in Nigeria. That is the key.” This, he claims, is possible if Nigeria follows what Iran did with light emitting diode (LED) technology. REC2 posed a hypothetical question: “How do we solve these problems?” and, according to him, “put the right peg in the right hole.” entailed getting those that are qualified to do the job and seeking knowledge from other countries. This line of reasoning was also shared by REA2 who remarked, saying “I believe that stakeholders should be able to take time to understudy how effective this option of power has been … How it has been done in other countries and how it can be adapted in Nigeria.”

4.3.2.2 Government Incentives

A majority of the participants (13 of 17) saw government participation by way of provision of incentives as another viable means of promoting the use of renewable energy in the rural electrification sector in Nigeria. The responses from the participants all favored an active and conscious government involvement through the provision of incentives for renewable energy to really gain ground in a fossil fuel dominated economy like Nigeria.

[8] Several Federal Government sponsored energy development institutes with varied mandates currently exist across the different geo-political zones of the country (see Appendix K).

This role of Government was deemed vital by most of the participants in this category, mainly on the basis of cost reduction and ease of operation activities due to the high capital cost associated with renewable energy technologies' deployment. This was reflected in the following comments:

> You know renewable energy technologies are expensive. There is need for subsidy, especially for people to be encouraged to adopt this kind of technology especially in the procurement of the solar panels so this subsidy is key, because of the expensive nature of renewable energy technologies. [MOP7]
>
> Some people in the urban area, no matter the cost can still pay, but in the rural areas, cost is a very serious limitation, so unless we continue to subsidize for the rural people, they will not be able to adopt all these renewable energy technologies. [ECN3]
>
> Also the government providing subsidies to interested consumers … by so doing it will promote renewable energy. [ECN1]
>
> Government is supposed to encourage rural electrification and fund it Government has moved into subsidized ehh giving subsidies. Though it [government incentives] may be coming late but it's there in the policy. [NERC2]
>
> Will mean that there will be need for a level of subsidy because if we talk about giving power from renewable energy, it's more expensive than the power in the urban area from large hydro and large fossil fuel plants. [NERC1]

Incentives by the Government aimed at reducing the high cost of the deployment of renewable energy technologies, according to the participants, could also be in the form of waivers, elimination of taxes and security of investment as illustrated in the comments by NERC1 and NERC2 below:

> If you are bringing in machines and you are here to manufacture solar panels in the country, you will have no import duty for example. [NERC1]
>
> Government can come in and subsidize the manufacture also removal of import taxes, waivers, and importation tariffs. [NERC2]

Further to the above, a more proactive role being played by the Government through its regulatory arm, according to NERC1, include the provision of relief and waivers to entities interested in using renewable energy for rural electrification projects as part of the commission's Bulk Purchase Regulation. Describing this practice, he indicated that "… we [NERC] will no longer issue licenses on the face of applications. The hurdle is lowered for renewable energy as consideration is given to proposals involving renewable energy sources."

NERC1 further noted that the commission also believes in the provision by Government of a conducive atmosphere for the private sector in order for them to be fully invested in the concept of renewable energy. He explained that with the strategy that is being implemented, various incentives have been provided to help bring down the cost of accessing renewable energy by producers and as part of the incentives by the Government, "… renewable energy generators don't go through as much hurdles as the fossil fuel generators." [NERC1]

Other practices in place by the Government also include the institution of a Rural Electrification Fund (REF), which, according to NERC1, "is meant to provide the money for paying some of these upfront cost, in helping to bring down the cost of rural supply," and the feed-in tariff for renewables – solar, wind, biomass and small hydro – which is an incentive for those who generate power from these sources. Extending his argument of how incentives could also be used to promote a better quality of imported materials, remarking that to make sure of the quality there had to be some sort of incentive from the Government, he elaborated citing the removal of the 40% import duty from renewable energy (deep cycle) batteries formerly exercised on all batteries:

> There was a heavy policy of the government to scrap car battery importation because we manufacture car battery in Nigeria we have to encourage local

> industry, they put high import duty on imported battery. But there were no distinction between solar batteries and car batteries. So when they brought battery whatever battery, the customs say what are you carrying? – battery, 40% … we had to now work on creating special HS code, that is the customs' code, so they can give them [renewable energy battery importers] a separate tariff … Or say if you are going to manufacture solar panels here, we will give you so so tax free or some other incentives. These incentives will help to encourage companies. [NERC1]

Acknowledging that the role of investors in the pursuit of a successful renewable energy powered rural electrification programme was well appreciated by the Government, MOP7 noted "Nigeria is now trying to have all the requirements needed for investors to come in and invest." This he further emphasized was being achieved by "government provisions in terms of waivers in the importation of these renewable energy equipment like the turbines" and provision of "good security so that their investments will be protected."

Government intervention was seen in a very positive light by MOP6, who noted that "with the encouragement Government is giving, you find that most manufacturers are coming to build companies." He further indicated that with regards to the promotion of renewable energy technologies in Nigeria,

> The Government is encouraging the use of renewable energy and we are promoting it in Nigeria, and in actual fact that's why the Government … is looking at other sources of energy that will hasten the development of power system in Nigeria to reach the goal which we have set for us and the vision – the vision 2020 – of being one of the top 20 leading economies of the world.

This view was also shared by MOP1 who agreed that the role of Government in improving the status of renewable energy with policy tools is essential. Elaborating further, he stated:

> The Ministry has recently, as you are aware sold most of our fossil fuel power plants and the new focus of the Ministry is to develop our renewable resources which we understand clearly has to do with policies, has to do with support, incentives and so on.

Whilst admitting the existence of a plethora of incentives already in place by the Government for renewable energy technologies in Nigeria, just like the other participants, MOP5, however, noted that there was room for more to be done. He remarked "… I think we have enough incentives, though Government can still increase it because for now your solar PV and most of the components you bring in are duty free." He also wanted to see more Government action in the area of subsidies for the rural dwellers when it came to the electricity tariff. Adding that:

> The tariff structure for such an arrangement for the rural areas have to be subsidized … Government definitely will sort of subsidize, because most of the people in these rural areas and communities, their poverty level is a bit high so anything high tariff might not make the project sustainable. [MOP5]

Though government incentive was acknowledged by a majority of the participants as a means of reducing the burden of cost and promoting the widespread adoption of renewable energy technologies for rural electricity provision in Nigeria, it is interesting to note that of the 13 participants that mentioned government incentives, one of the participants (MOP3) indicated that currently there are no actual incentives in play as was suggested by the other participants. He asserted that while the use of the various incentives were mentioned in the policy document, "… actually, now there is no drawn line incentive per se." He concluded that "by the time it [the energy policy] is out, we will know what and what government will give as incentive to encourage or to reduce the cost of investment on renewable energy."

4.3.2.3 Funding

A majority of the participants (13 of 17) also reflected on the issue of funding and financing of renewable energy projects for rural electrification. Capital investment and cost of deploying renewable energy technologies for electricity,

especially in rural areas where the willingness and ability to pay for the utility has been found to be a key constraint, was a major concern highlighted by these participants. The issue of funding came up most times during the interviews as extensions of the responses on some other key concerns like government participation and incentives already mentioned in the sections above. MOP1, for instance, while extending his argument on the issues militating against renewable energy, elaborated that apart from having the right policy framework and exploring viable alternatives as well as sustainable energy options, "the issue of funding now also comes in."

Funding was highlighted as very vital for renewable energy to really pick-up in rural electrification in Nigeria. The following remarks underscored this expectation for a well-structured means of funding and financing of renewable energy projects in Nigeria:

> Funding of rural electrification projects is very expensive and although renewable energy has little or no maintenance cost but the onset cost is still high too. [REC3]
>
> Renewable energy assets are very expensive and the cost of borrowing money is very high. [REC2]
>
> Finance is always a constraint because you are limited to the resources available to you. [REA1]

Another reason why funding was of great significance, according to the participants, was the fact that for renewable energy powered rural electrification projects to be sustainable, there is need for a change in mindset, from donor or politically motivated projects to full private sector led pursuits. This will require the existence of a favorable business terrain and a higher likelihood of the investors to recoup their investment, as highlighted by REA2 who stated that "we should be able to look at the Nigerian economy [and ascertain] how there will be return on investment."

The significance of the involvement of private investors in the rural electricity sector in Nigeria notwithstanding, almost all of the rural electrification programmes in Nigeria are currently government funded, or "budget funded," as

pointed out by ECN3. In reality, getting funding or investment in the rural electrification sector is very difficult. “Those who would have loved to develop projects in such areas don’t want to, because … to recover their money is a challenge for them; because of the rural economy – they are poor people and they can’t afford it” [ECN3].

The general conclusion was that adequate funding would help in reducing the total cost of installation and ultimately the end tariff paid by customers. Funding and financing renewable energy projects is very important, as “you need funding to bridge the gap between the financing and the availability of consumables” [REC1]. This realization is not a revelation of sort, as a couple of the participants proffered, as shown in the following remarks, what they thought was the solution to the issue of funding and what is supposed to be done:

> That’s why the Rural Electrification Fund will be an option for funding such programmes. [NERC1]
>
> There is a way to fund it there is supposed to be a fund for electricity; the Electricity Assistance Fund, for people who cannot afford electricity. [NERC2]
>
> The only thing is that Government can provide money for pilot projects. Which they are doing in the street lighting projects in the “Operation Light up Nigeria. [ECN2]

In line with what appears to be a promising outlook in regards to the issue of funding in the renewable energy and rural electrification sectors, MOP1, attesting that “some funding mechanisms are being put in place here and there” highlighted further, the efforts currently being made by the Government to mitigate the problem of funding. He noted:

> We are also looking at funding. We just had this seminar on formation of renewable energy private equity fund for renewable energy development in Nigeria so this is what we are doing actually to drive the process of entry of renewables.

4.3.2.4 Political Will

The perception in regards to the issue of the low uptake of renewable energy technologies in rural electrification in Nigeria was one of high Government influence. A little above half of the participants (9 of 17) revealed that without political will there will be no meaningful uptake of renewable energy in rural electrification in Nigeria. Political will within the Nigerian context was portrayed as very important. Things get done if those in power wants it done, and as one participant put it, "I understand that most of the things we do, we give reasons why we are doing it. Basically the thing that makes things work in Nigeria is that government wants to do it" [MOP2]. Political will, as implied in the following responses, is a catalyst that will greatly facilitate the acceptance of renewable energy powered rural electricity in Nigeria:

> Once the political will is there, the policy is there, definitely everything will drive itself. [MOP5]
>
> The key factor. The way we do things in Nigeria or the way Nigeria operates; this is more like a personal opinion, it is not the issue of cost per se. it is the issue of the will. If government wants it, it is as good as done. You understand me? [MOP2]
>
> Actually in Nigeria, there are so many factors that could influence our power generation – the first one is political. We cannot run away from that one. The political will to actually use renewable energy has not been there. [ECN2]

The significance of political will was also highlighted by ECN3, who, while suggesting ways of getting the private sector to step in and help finance rural renewable energy powered electricity projects, concluded gloomily that without political will "it's going to be difficult really because all these multi-nationals will complain that they are already paying too much in the system. It's going to be difficult but if the Government will have the political will, they can have their way."

A couple of the participants, in their responses, also implied that the little progress being witnessed in the sector had a lot to do with political will – projects get carried out when those in authority deem it necessary. For instance:

> Our projects all depends on the federal budget. Mostly our projects are constituency projects. So unless there is a need from members or the Government, or from members of the National Assembly for those projects, we are usually handicapped. [REA1]
>
> Like the street lights, these are constituency projects. The members of the national assembly decided to take these projects to the Energy Commission to handle it for them. [ECN1]

It was then suggested by REA2, who concluded that going by the understanding that political will was of utmost importance in promoting the widespread adoption of renewable energy powered rural electrification in Nigeria, "government should also be determined in their policy and seeing to the implementation."

4.3.2.5 Better Coordination

More than half of the participants (9 of 17) raised the issue of better coordination of renewable energy powered rural electrification programmes and the activities of the various agencies involved. As there are so many agencies involved within the Nigerian renewable energy and rural electrification sector, coordination is deemed imperative by these participants. Their concerns were that the superfluous number of agencies have led to the problems of wastage, redundancies and overlap of duties and activities. As one of the participants put it:

> There has to be a deliberate policy between the research institutes and the Government implementing body not bodies. You see Energy Commission trying to do solar; Environment trying to do solar; Housing trying to do solar and Ministry of Power trying and you know this is dissipating the energy of Government and the attention of Government at actually arriving at what this ehh how to develop this product [renewable energy technologies]. [REA2]

With too many agencies gunning for limited resources, poor coordination can also exacerbate the issue of inadequate funding, as indicated by ECN3 in his remark that:

> At the end of the day we don't get money for that from the budget office, so we get far less than what is budgeted … so what is approved, appropriated and what is released will be far less than what is required.

Other participants acknowledged that the lack of coordination was an important obstacle to the growth of renewable energy powered rural electrification. In MOP5's view, without coordination there will not be any meaningful progress as the different units will not be working together, and "since there's a disconnect between the institution and the people, definitely, we are always coming back to square one." REA1 also conveyed this view when he highlighted that: " then area of coordination too. I think if you have a lot of different agencies doing the same thing with no coordination per se it's a huge challenge."

The importance of coordination was accentuated by ECN1 who indicated that this helped facilitate buy-in as well as the carrying along of all stakeholders. Drawing from a personal experience, he stated:

> You see during the formulation of the policy, you draw stake holders – both from the government and from the industry, from the academia, from international organizations who are stake holders in the field of energy all of them were all involved. From the industry, captains of industries in the field were all involved in the policy formulation. So they were carried along.

ECN2 however, did not see the numerous number of agencies as a problem; according to him, having them all work together was what was important. Implying that in as much as there was an understanding or cooperation between agencies, different agencies with specialized duties could handle different aspect of a given programme, he stated:

> If you want them to be handled under renewable energy or you want the Standard Organization of Nigeria (SON), me I don't have any problem. My only problem is that Standard Organization of Nigeria should work with the energy sector to set the standard.

Throwing more light on how agencies can work together and achieve better coordination, NERC1 explained how his agency has been working with other agencies. He remarked that:

> We also deal with other agencies that are also doing related work for example some of the things we do are also in line with what SON does. For example we regulate electricity but most of the equipment that are brought to the country like transformers, electric meters are things SON regulates in terms of standard.

Along the same premise; that the involvement of several ministries and agencies in renewable energy activities in Nigeria called for better coordination, MOP3 further noted that this need has actually brought about some positive work as it has led to the decision that:

> At the Ministry of Power, to collaborate with all sister agencies and ministries in the government to come together and now work together, and Ministry of Power [being] the focal point to drive the renewable energy potential in the country or the renewable energy activities. [MOP3]

Attesting to the pivotal position of the Ministry of Power within the Nigerian energy field, MOP3 further elaborated on the coordination of the various agencies while stressing the role policy will play. He stated "… also one other thing, when this policy comes, there will be collaboration between the MDAs [Ministries, Departments and Agencies] so that at least the Ministry of Power will coordinate properly to know who is doing what."

MOP2, while noting the wastage and duplication the lack of coordination among government agencies has caused and the associated cost of uncoordinated activities, indicated that the Government was not unaware of this problem, hence the creation of the inter-ministerial committee on renewable energy chaired by the Ministry of Power. He further elaborated, citing the reason why the inter-ministerial committee on renewable energy was constituted, stating:

> Why the committee came up was that we noticed that some development projects were going on provided by all these groups and they were going on in an uncoordinated manner, and we wanted to like bring them together so that we won't be wasting government resources in doing what other people have already done.

For better coordination, MOP2 concluded that instituting an integrated planning system would provide a very favorable outcome free of waste, repetitions and redundancies.

> If the agencies are working together, there will be this kind of planning that will integrate all the agencies together … a kind of coordination to know what the other person is doing. I think the best thing is to have a central planning system. That the planning will be central. That will be the only thing that will make them work together. Planning, integrated planning.

4.3.2.6 Commitment of the Local Communities

A number of the participants (8 of 17) talked about the commitment of rural communities towards renewable energy powered electrification projects in their domain. Emphasizing the importance of carrying the communities along in project implementation, REC1 stated that:

> You see, you have to adopt the concept of community participation for social development, for development. That is a very good concept. If you adopt it, you go to a community you want to install solar street light or solar PV, you take the community electrician, carpenter, welder, the artisans and you teach them how to install and maintain. Then you will have sustainable development in that area. We call it community participation for sustainable development.

The commitment of the rural communities to the idea of using renewable energy sources locally available for the provision of electric power for them is seen as a means of expediting rural electrification in Nigeria. This, according

to REA2, however, is based on the communities first realizing and recognizing that they want electricity, and also having access to the suitable energy sources. According to him:

> There is a paradigm shift from ehhh we believe that when the communities themselves demand for this electricity, and if it is renewable or grid option, it's going to be a self-participatory they will have that willingness to be able to participate with the agency in ensuring that these product is sustained, it's realization, it's sustained and maintained and they will also be willing at the end of it all to pay for the services. [REA2]

A commitment by the communities will also help sustain projects instituted solely on political grounds. This is because the recipients would not see such projects as "political gimmicks" [REA2]. Commitment would bring about a uniformity in acceptance and discourage vandalism. As REA2 further indicated, that sense of ownership of "we want this" will lead to the communities taking better care of the equipment and project.

NERC1 expressed a similar view regarding ownership when he stated:

> So in the village they will know that this is ours, they will protect it because they have their own interest in it. They know that if it goes off, we alone are the ones using it, so if it goes off we will be constrained. So they will protect it. Since it is community based project, they will also see that they have a stake in it and therefore protect it.

A sense of ownership by the communities was further emphasized by ECN3. Recalling an experience from a project instituted by the Energy Commission, he highlighted the importance of handing over such projects to a specific person in the community. "You don't just install it and nobody takes ownership. But if somebody takes ownership, then they can … if there is any repairs to be done they can take it up" [ECN3]. However, a couple of the participants pointed out that obtaining commitment or buy-in by the communities for rural electrification projects,

irrespective of how well meaning it is, is not easy to come by in rural Nigeria. This negative view is illustrated in the following comments by REC3 and ECN1 respectively:

> Yes. You know Nigeria … Easterners we are very hostile people. Sorry to use that word. You know rural electrification is something that rural people see [the contractors] as people that are gold diggers. They see the contractors as the government proper. They don't see us as people that have good intentions. So they came all out to exploit us. They came out to exploit us. They were demanding for things that are not relevant not considering the fact that we are bringing development to their place. [REC3]
>
> The feedback we get from them is that some of the beneficiaries, the communities, some of the communities will want to share the money with them; some of them are not very friendly – they think that it is a bonanza ... at times part with little money so they will be part of the project and guard the project even after the installation. But that is just very minimal. On the whole, many of the communities welcome the projects. [ECN1]

4.4 Finding 3: Internal Physiognomies of Renewable Energy

When it comes to discussions about renewable energy programmes especially for power generation, there are intrinsic factors that are specific to the concept. This section presents such factors which were highlighted in the literature, as well as by the participants. Here, the responses that portrayed the participants' perspectives on specific internal characteristics or physiognomies of renewable energy that are thought to greatly impact its adoption for rural electric power generation in Nigeria, as well as other parts of the world, are highlighted.

Some of the physiognomies of renewable energy stressed by the participants as factors that could influence renewable energy adoption include cost effectiveness, abundant supply, appropriate technology, domestic source of energy and clean energy. Appendix O presents a detailed breakdown of the data summary table of the responses that make up the themes under this finding.

4.4.1 Cost Effectiveness

A majority of the participants (13 of 17) provided responses that brought up the issue of the cost of electrification. Most of these responses were presented by the participants from two main perspectives: cost effectiveness of renewable energy projects on the long run when compared to the conventional electric supply strategy, which was viewed as an advantage; and capital cost of installation and deployment, which was mostly seen as a hindrance. In general, their responses as shown by the following remarks reinforced an already established conception about renewable energy powered rural electrification – there is a high level of cost involved in implementing renewable energy projects. This is underscored by the following statements:

> Then the high initial capital cost compared to the grid system the initial capital cost for renewable energy are usually several times higher than the grid. [REA2]
>
> Because if we talk about giving power from renewable energy, it's more expensive than the power in the urban area from large hydro and large fossil fuel plants So it's not just easy to say okay because they have 10kW load in a village of 1000 houses let's give them solar. If you give them solar, the cost of putting solar there is high. They can't afford it. [MOP4]
>
> Then another factor is capital cost. Capital cost is another factor, which we have to because of the high capital cost diffusion is difficult. [ECN2]
>
> The last one is that the cost of renewable energy still remain it is not competitive yet here in Nigeria. [NERC1]

However, while acknowledging the concerns already established by the other participants with regards to cost, REC1 indicated that among the main factors that will favorably influence the uptake of renewable energy for rural electrification was the long term savings in cost due to little maintenance. According to him, "you see renewable energy is a very cost effective mode of energy because the initial cost of construction is at implementation but after time it reduces." Also based on a life-cycle

point of view, a couple of the other participants, pointed out the benefit of cost effectiveness as indicated by the following statements:

> When you look at the life cycle cost – we try to tell the investors, we try to tell the consumers – when you look at the life cycle cost, you find out that once you install your solar installation, the running cost is little or nothing. You don't buy the fuel because the sun is there, the wind is there. When you compare it with the procurement of a gen set, where you have to carry out maintenance, you buy fuel, you find out that over about 5 years, the cost (of solar) becomes very attractive because of the life cycle cost. [ECN1]
>
> The long term effects based on the cost benefit analysis is such that though it may have an initial capital, but we don't have to buy fuel, we don't have to buy this and we don't have to buy that. So when you look at that overall … Whereas the renewable energy the initial cost might be a bit high but the maintenance cost and the running cost is much cheaper. In actual fact, you don't even have to run it, you don't even have to spend much in maintaining it and the life expectancy is also better off. [MOP6]
>
> So the market is big and the good thing about renewable though the technology might be expensive as in the initial cost, the running cost is almost zero and the maintenance is little unlike our conventional way of generating electricity. [MOP5]

Echoing an earlier remark by some of the other participants, REC1 implied that cost effectiveness of renewable energy projects would also be enjoyed if production is carried out locally. He stated:

> So if you start producing these panels, at least you've taking down a very high cost of the renewable energy on the solar side. The wind turbines, we can start constructing turbines with the wind mills here, or the propellers or whatever and you will reduce the cost.

This position was also supported by some other participants: ECN1 indicated that cost, which has been one of the major constraints, is being reduced every day due to technological advancement. He commented that “R&D is fast coming up ... So it is hoped that in no long future the price will no longer be a challenge to investors in the field of renewable energy.” MOP6, who reiterating that “the cost is a bit on the high side when compared with the fossil fuel” also emphasized the cost benefits that could be derived from the use of renewable energy technologies as a result of advancement in technology, stating that:

> The technology is evolving so that as time goes by, it will now be competing with the use of the fossil fuel and that now will inform the way the Government will look at it to encourage the use of renewable energy.

On a similar note, technological development was highlighted by ECN3 as a means of reducing the cost of renewable energy when he stated that:

> In the rural areas, cost is a very serious limitation If we can work on these areas, and with time, with the developments that are going on in the renewable energy sector, the price will be going down, renewable energy devices will be going down. So it will become adopted affordable.

MOP7’s concern was more with the present rather than the future. As he pictured it, the issue was taking care of the immediate cost of implementing renewable energy powered rural electrification projects and shielding the rural recipients from exorbitant tariffs as a result of these cost.

> To my own opinion, a problem they may encounter is tariff from the payment for energy consumed by the villagers because you are talking about renewable energy in the rural areas, because people living in the rural areas, they can’t have enough money to pay for the tariff, and you know renewable energy is a technology that is expensive.

Other arguments in support of renewable energy based on benefits, in spite of the large cost associated with its deployment, were offered by a couple more of the participants. Expanding on his increasing awareness discussion, MOP4 spoke about enlightening the powers that be, as to how cost effective renewable energy was, compared to say grid extension. According to him, "… we have to enlighten – give them awareness of cost effectiveness. Let's say cost effectiveness" as this was another way renewable energy adoption could be promoted.

NERC1, on the other hand, citing the large cost involved in carrying out grid extension, aptly surmised that "with renewable energy there will be savings." Elaborating with an example of extending the grid to a village that was carried out recently, he stated:

> So when you go 35km you know how much poles and how much wires, you need to put on the line and when you get there you find that the whole town the whole town is not up to a kilometer square. So you can imagine how many houses are there. So if you take power to that village, they cannot pay what will cover the cost of taking power to them, even in 20 years.

However, not all the participants agreed with the notion of the cost effectiveness of adopting renewable energy for rural electric power generation. It is not surprising that this contrasting position was expressed by MOP2 who has been noted to strongly favor the continual use of fossil fuel for power generation. Remarking that the major concern of Government is not to only look at how cost effective renewable energy is, but to see if the choice of energy could serve the purpose, he further concluded that:

> Government on the other side is looking at affordability because the issue is that how much of the energy are you going to have from the renewable to match in terms of cost So the basic thing for me, people may want to be more scientific to say okay we are looking at cost, we are looking at availability we are looking at – they usually tell you about the cost when they want to be scientific about it.

4.4.2 Appropriate Technology

Appropriate technology, as the name implies, connotes having a given technology that is best suited for harnessing energy from the given energy source. During the course of the interviews and discussions, more than half (10 of 17) of the participants made mention of appropriate technology as an intrinsic factor that could boost the large scale adoption of renewable energy for rural electrification in Nigeria. The key task, as indicated by some of the participants in this category, is the realization that rural electrification would mostly be built around renewable energy based on the reasoning that it was what was best suited for the rural areas.

NERC1 buttressed this point when he stated "… So you find that the potential of serving those places and considering them as electrified without worrying to take power to them is very high with renewable energy technologies." In his view, the goal is to "supply them appropriate power and voltage level from renewable energy … and help to make their economy better, and give them what we call the capacity to pay, which they usually don't have."

Appropriate technology suited for a given renewable energy source was also emphasized by a couple of the participants. As described by ECN1 "it is a technology that you can confine in a place. It is ehhh, it fits into appropriate technology which you can put in a location and it will serve that location." Illustrating how appropriate technology relates to renewable energy sources, REA2 remarked that:

> Mark you, this country Nigeria is very large. In the core north, where you have sunny days for almost about 14 hours in a day, you may say this area, we will concentrate on solar, and in the central part and the eastern part of the country where there are very high hills, like Plateau State and Taraba State, where you have very high hills above sea level, you can adopt either wind or hybrid of wind and solar. [REA2]

Highlighting the appropriateness of solar power for rural electrification, MOP6 alluding to the fact that a large portion of the Nigerian population dwell in the rural areas without access to electricity, further indicated that "… the deployment of renewable energy will readily give access to them because you don't have to wait for

long lines to be drawn to them." The use of the right technology, as implied by MOP2, could lead to achieving rural development much faster. This was further indicated when he reiterated his concern regarding the cost of electricity provision, stating: "Like I said before it should be renewable because if you are looking at rural electricity development for now, based on the cost it's most likely renewable."

Considerations regarding the load and the type of technology to cater to such load is also another area where appropriate technology was emphasized as significant in planning for electricity generation. REC1, citing a simple example of why renewable energy technology is most appropriate for rural electrification due to their compact nature, illustrated this in his comment that "for renewable energy to effectively give you 10 MW, 50 MW you need an area of excess of 30 hectares. So land, availability of land too is vital." To him, the compact nature of renewable energy technologies makes them well suited for power provision at the rural level since they almost always require a very small footprint.

NERC2 emphasized that the availability of an energy source also determines the type of technology that will be most cost effective and meaningful. In his view, in areas where biomass was in abundance, for instance, waste-to-power could be used. "Like with large agricultural projects, the rice shafts, the wheat remnants can be used … though they are used usually to feed animals but we can generate electricity with it." The appropriateness of certain technologies for power generation was also highlighted by some of the participants. MOP5 highlighted that "definitely the sun radiation in Nigeria is okay for solar. Which means solar PV or solar thermal or maybe concentrated solar could be used in any part of the country." REC2 was of the view that segmenting the power supply would create a platform for appropriate technology aimed at harnessing the energy from the different renewable energy sources to flourish. According to him,

> Segmentation is imperative With segmentation, you now begin to think – how do I get a generation source: is it through the water, should I build a dam? Okay my area does not really have a good source of water, okay I can go on solar.

4.4.3 Abundant Supply

Another intrinsic factor mentioned by a number of the participants (8 of 17) was that of the abundant supply of renewable energy sources in Nigeria. While there is an abundance of renewable energy sources in the country, their exploitation for electricity generation has been minimal. The seemingly none existent utilization of the abundant renewable energy sources in Nigeria for electric power generation was implied by MOP2 to be as a result of the dearth of technological know-how and the affordability of said technologies in the country. He stated:

> When they look at it on the surface it looks the resources seems to be available especially with consideration to the solar and then the biomass. The resources seem to be available but people wouldn't understand whether the technology is affordable ... We have these resources. Biomass is there, we have enough solar there, we have so much water.

As the responses from the participants showed, the availability and abundance of renewable energy sources in Nigeria was not in question. MOP6 highlighted that renewable energy is "nature given … which makes it more available than the other form of energy – the fossil fuel." Likewise, REC1, while also highlighting the natural aspect of renewable energy, further emphasized the limitless nature of renewable energy, stating that "once you are alive, the air is there free, the sunlight is there free … animal – cow dungs – you create biogas, you can do biodiesel and so on and so forth."

The low level of rural electrification in the face of so many sources of renewable energy was puzzling to most of the participants. In MOP5's perspective, "we have a lot of rivers and streams in the country." Pointing out that this is "the second most viable option apart from solar," he further emphasized that most villages or rural areas had numerous water sources well suited for power generation.

Comments from some of the other participants also reinforced the notion of a lack of electric power supply in the midst of an abundance of renewable energy sources. While ECN3 and MOP7 respectively accentuated that "we have a lot of potentials for solar," and "you know in Nigeria we have a lot of renewable energy

resources. We have solar, wind, and the biomass," NERC2 saw no reason why a renewable energy source like solar was not being largely used in Nigeria for rural electrification. He pointed out that: "Solar insolation, ehhh almost eight hours of sunshine … so with eight hours of solar, you are good to go. You can do a lot of rural electrification – distributed."

The very low level of rural electrification decried by the other participants was seen by NERC1 as an avenue to actually explore the use of renewable energy to meet this need. Enumerating the wide array of renewable energy sources available in Nigeria, he suggested that "this is an opportunity for renewable energy in that, one, renewable energy is available almost everywhere in the country." He further highlighted that, other than solar, "virtually both wind, biomass and small hydro potentials are also available in many areas in the country," which could be used for rural electrification purposes.

4.4.4 Domestic Source of Energy

Within the context of this study, domestic source of energy was taken to mean the in-situ generation or supply of energy, which is one of the specific characteristics of renewable energy. A few of the participants (5 of 17) mentioned this attribute as being relevant to ensuring the large scale use of renewable energy in rural electrification in Nigeria. This characteristic of renewable energy sources to generate energy that can be converted to electric power and used at the point of generation was highlighted by MOP2 as a cost saving benefit that puts renewable energy powered electricity generation at an advantage when compared to a fossil fueled decentralized form of power provision like in the use of diesel generators. Citing an example using the proposed power project in Mabinla, Plateau State, he added:

> You know places like the Mabinla Plateau where we are thinking of a large power project. In such places you won't be thinking of first taking diesel there. Taking diesel there is expensive. It can make the cost high, but we can have solar there which will be very cost effective.

Highlighting that the use of renewable energy in-situ for other purposes was not new to the rural populations who, for instance, were already used to converting biomass for energy, MOP5 noted that extending same practice to power generation should be a seamless experience. This notion was underscored by his remark that:

> When we are looking at the rural areas, most of Nigeria except for the Northern part falls within the rain forest. They have a lot of wood or you can call it biomass, they have a lot of wood and that's also one of the resource I will say maybe the rural dwellers are really tapping.

Another major advantage of the domestic source of energy attribute of renewable energy was presented by two other participants. For MOP6, by harnessing the local energy source for power generation, "you don't have to wait for transformers to come … you put your solar panel on top of your roof and then you can generate electricity by yourself." ECN1's case for the use of power locally generated was in the elimination of grid extension programmes. He remarked that "as you have observed the national grid does not extend to these remote areas. Renewable energy technology is modular, compact and is extendable. It does not need all these elegant structures for transmission."

4.4.5 Clean Energy

Although only a handful of the participants (3 of 17) brought up the clean energy characteristics of renewable energy during the course of the interviews, this theme was retained as the points that were made were deemed noteworthy to the study. The relatively low number of responses that produced this theme did not come as a surprise as it was perceived that the issue of pollution and clean energy is not really seen as a big deal within the Nigerian energy quarters.

Arguing that when it came to electricity, the first thing is to find a way of making it available by whatever means – be it fossil or renewable. MOP2 emphasized that in his view, "when you are going for something, you first go for … necessity. You don't first go for luxury." He posited that at the moment, renewable energy was perceived as a luxury and that any case being made for the promotion of renewable

energy as an energy source over fossil fuel for electric power production should not be based on its clean energy characteristics, but on the fact that it can produce the required result which is to generate power.

While MOP2 leaned more towards getting power with little concern of whether it is from a clean source or not, MOP6 saw the danger in the continual use of fossil fuel and highlighted the need for cleaner alternative sources. He remarked that:

> Well, ahhh as we are also aware that using fossil fuel requires some burning and burning the fossil fuel produces some emissions of greenhouse gases – the Carbon dioxide, Nitrogen and all these go into the atmosphere turning to a cleaner alternative shouldn't be a bad thing.

He further highlighted the advantage of renewable energy when it came to the reduction in air pollution, stating: "In the case where in this country where we generate electricity virtually in all our homes, the use of renewable energy becomes more cost effective and less polluting … like noise or even air pollution will be reduced." Likewise, ECN1, with a more global perspective, hinted that Nigeria as an oil producing member of the global community has to be bothered about contributing its own quota to the use of clean energy. Highlighting the possibilities of being ostracized and/or penalized, he pointed out these implications saying:

> You depend on generating electricity from your oil. What if now there is a decision that is taken, law passed about emission: that any country emitting this amount of CO2 will pay this amount, you've heard about the Kyoto protocol you see it … countries that emit this amount of CO2 will be paying this. You've heard about the CDM – clean development mechanism – a particular amount is attached to it.

4.5 Finding 4: External Physiognomies of Renewable Energy

As already pointed out in Section 2.10.1, understanding certain specific characteristics of renewable energy, whether internal or external features, will best

create a means of explaining how they influence the adoption of renewable energy for rural electric power generation in a fossil fuel rich country. Some of the characteristics highlighted by the participants, which in this study were classified under external physiognomies, include perceived value of renewable energy, energy policy and frameworks, topographical considerations, environmental/climate change mitigation requirements, energy security, energy politics, and catalyst for stimulating rural development. Appendix P depicts a detailed breakdown of the data summary table of the responses relating to this finding.

Following is a presentation of some of the narratives from which the themes this section is based on have emerged.

4.5.1 Perceived Value of Renewable Energy

The perceived value attached to renewable energy as an energy source suited for electricity generation, especially in the rural areas, was highlighted by more than half of the participants (10 of 17) as one of the factors that could influence the uptake of renewable energy in powering rural electrification projects in Nigeria. Value in this sense signifies how vital renewable energy is seen in the scheme of things, and that it becomes indispensable as an energy option. This was reflected in the statement by REA2 when he remarked that it "is the belief that this [renewable energy] could really substitute as an option."

The value of renewable energy is seen by some of the participants in its capacity as a resource that can plug the shortcomings of the fossil fueled electricity grid in Nigeria. Advocating a distributed system of power generation, NERC2 emphasized the immense value that comes with renewable energy, highlighting that when the hurdles of grid extension are taken into consideration, electricity provision becomes "possible using distributed energy resources," which are made possible easily with renewable energy sources. Elaborating further on the value of renewable energy, NERC2 emphasized that:

> The best option for government when you are talking rural electrification is distributed, and for the distributed, the most reliable and sustainable is solar in fact the best you can do for rural electrification is distributed energy resources.

From the responses posed by NERC1, it was implied that people are now gradually keying into the idea of renewable energy powered programmes. Emphasizing this perceived value, and referring to a well-known concept of renewable energy, he stated that:

> Everybody have now known that small is also beautiful – if you can put small small pieces together, you make a big one … they say little drops make the ocean. So if we can generate even in kilowatts. Kilowatt sizes of power in places, then we can amalgamate them to become, in terms of access to power, total people that are served will go to megawatt sizes.

The value of renewable energy as perceived by NERC1 was further underscored by the following remark:

> So these are some of the things renewable energy can do if we let it go along that line of having it service those appropriate routes in the rural areas ... So if the objective is to give them power at the appropriate economics and there for service purposes, then you will be thinking of renewable energy.

In a similar line of reasoning, the perceived value of renewable energy by REC1 is apparent in the way he positioned renewable energy. The importance of renewable energy, as highlighted by REC1, is such that it contributes to both energy security and rapid development as illustrated in the remark below:

> You see the concept of renewable energy, because of the cost, this is cheap that if Government take it to the rural sector, it will ease up power supply to the industrial sector from the fossil fuel. I mean you can have 20 communities that you power with renewable energy, and you give them maybe 2 MW, 2MW, round. You see that 40 MW that you are taking out will power an industrial sector to get rapid development.

MOP4, who stated that renewable energy was "becoming more of a thing in Nigeria now" as people were now seeing its value, also pointed out the usefulness of renewable energy systems in reducing the demands on the grid when he stated that "if they can provide renewable energy, i.e. off-grid, we call it off-grid. So if they can provide for them there, so depending on this at least the conventional will be for industry and other things."

Renewable energy was also perceived as valuable by MOP2 who clarified that while strongly backing fossil-fueled generation of electricity, "there are some places where renewable energy have comparative advantage … In such areas there is no need saying we should go on fossil fuel." A notion inadvertently shared by almost all of the ten participants was that the value of renewable energy becomes more apparent when it is sought as an alternative due to constraints on the original choice (fossil fuel). This notion is accentuated by the following comments:

> Once a resource is scarce definitely you look for alternatives – cheap, reliable and sustainable alternatives. But for now, since we have abundance of fossil fuel, it's an uphill task telling people to go clean or use renewable energy. [MOP5]
>
> So that in itself is driving or has helped in driving the process of deploying renewable, because rural areas as you know would be difficult to extend grid therefore you have the economic competitiveness of renewables coming in ... our focus has always been to bridge supply-demand gap. So what is our focus is to get people to have electricity no matter how. And to that extent, we are using renewables as a means of adding power where they are a better option. [MOP1]

4.5.2 Energy Policy and Frameworks

A key feature of what initially guided the design of this study was the assumption that the issue of a seemingly lack of interest in renewable energy powered rural electrification in Nigeria had to do with policy. More than half of the participants (10 of 17) highlighted energy policy and framework in their responses as a platform from which the issue of promoting renewable energy powered rural electrification is to be addressed.

Energy policy and framework, in general, is seen as very important, considering that policy – the position of the Government – no matter how mediocre can greatly affect any given issue in a country. This position of the Nigerian Government on renewable energy powered electricity, or its energy policy presently, as already pointed out by MOP2 in Section 4.3.1.1, is that of the nation's attention being focused on fossil fuel and not renewable energy.

NERC1, who emphasized how the present situation in Nigeria is a reflection of the effect policy can have on an issue like the promotion of renewable energy for rural electrification projects, pointed out that what was stipulated is what is subsequently being experienced. According to him, "… they put a cap, since the government doesn't want to have too much renewable energy in the mix so as not to make it too expensive."

Enumerating the efforts so far employed by the Government to drive renewable energy in Nigeria, MOP1 on several occasions during the interview, drew attention to the importance of having the right policy framework. On one instance, he remarked: "so I can say that the two fundamental issues, are (1) knowing that there are alternatives that are viable and sustainable, and (2) having to establish the right policy frameworks." Elaborating further, he then stated "Primarily the three things I can contemplate from our own experience are the awareness issues, the policy and frameworks issues, and funding issues."

Policy was also presented as foremost in the plan of action in achieving a renewable energy powered rural electrification programme in Nigeria. According to MOP1, in line with this dispensation of further driving renewable energy adoption in the country, "currently we are developing a number of policies." This line of action, according to him, has culminated in the finalization of "the first dedicated policy for renewable energy and energy efficiency … a dedicated renewable energy and energy efficiency policy which has come up with a number of drivers."

REA1, while acknowledging that the lack of a proper policy framework is a huge hindrance to the promotion of renewable energy in Nigeria, nonetheless accentuated the direction the Government is taking in remedying the situation. He stated that: "I think the challenges mainly is in the area of policy ... there are strategies. I think there are plans to have certain percentage of our energy by 2020 to

be renewable." This positive direction being taken by the Government to help drive the uptake of renewable energy via the use of policy, was also emphasized by MOP3 who gave an account of the process they have undergone so far when he commented that:

> So that's what gave us the drive to go to that extent and now by the time all the presentations are made to the respective agencies, now the final will be taken to the Presidency and then they will now forward it to the National Assembly to legislate an Act that will establish a renewable energy policy in the country … So any investor who is coming, now knows where to go and what to do concerning investment in renewable energy.

Highlighting the benefits the use of policy would render to the process of furthering the acceptance of renewable energy in the electrification arena, for instance in better coordination of agencies, MOP3 further indicated that:

> The policy is going to be flexible so that any MDA that identifies what is relevant to her, will use, will drag from that policy and implement, then the Ministry of Power will be a kind of supervisory ministry, being the Ministry of Power [and be able] to know what activity on renewable energy on power generation is going on ... So we have a target by year 2015, this is what share of renewable energy is going to be in the energy mix, by the year 2025, 2030 like that. We have these in the policy. So I think by the time the policy is out, it will really launch the country to a greater height.

Just like MOP7, who noted that "very soon our national energy, renewable energy policies will be signed by the Federal Executive Council," most of the other participants, as shown in the following statements, also shared the optimism that policy was an important channel through which the uptake of renewable energy, most especially for rural electrification on a larger scale, could be achieved faster.

> For example we just recently had a draft policy on renewable energy which we hope when it's signed into law or when it is approved, it becomes a document that everybody in the country will look at to encourage and also it will also encourage the investors to come and build power plants using renewable energy because the Government too will try to do a lot to encourage investors and to encourage the use of such ... So with the policy now, it's easier now to now create awareness among the consumers to to to use alternative energy. [MOP6]
>
> The policy paper will state clearly the direction of Government ... For now what we have is a draft and hopefully before the end of the year, we should have a signed policy ... So it's a huge market and there's a lot of potential and I believe from the policy, everybody will clearly know that this is where the government is going. [MOP5]
>
> The other thing is that the policy document will help those interested investors to study what we intend to offer and they also know what they can offer. So there could be long, I mean short, medium and long term agreements that will be able to now start off. [REA2]

NERC1 further highlighted the achievements that have so far been attained by the use of policy in the promotion of renewable energy powered rural electrification in Nigeria. He asserted that:

> So that is where the issue of Rural Electrification Fund (REF) comes up and the EPSR Act of 2005 provided for what they call the Rural Electrification Fund. Rural Electrification Fund which will be operated by the Rural Electrification Agency (REA), which was formed by the same Act. The Act is the one that established NERC, and established REA that is the Rural Electrification Agency and also the REF.

However, concluding on the importance of policy as a stance the Government needs to take, he further indicated that "once you don't have that policy in place, you are not going to encourage the use of renewable energy." According to him,

> One of the ways which we need to do that, [that is encourage renewable energy development for electrification purposes] first of all is to create a national programme target; that says we want to … But there has to be that policy decision – give incentives, ensure quality, promote renewable energy.

4.5.3 Topographical Considerations

One major issue that proponents of grid extension face in their debate on implementing rural electrification via the extension of the national grid is considerations regarding the topography of the country and the region the grid is intended to be extended to. A number of the participants (8 of 17) raised the issue of topography as a notable disadvantage to the rural electrification strategy of grid extension in Nigeria. Among other concerns outlined below, it was clearly implied in most of the responses that the large expanse of land to be covered almost always makes the idea of extending the grid come off as a very expensive endeavor.

Highlighting the sustainability of rural electrification projects, REA2 called for getting the suitability of a given electrification strategy right, by say, considering renewable energy powered decentralized projects where it is prohibitive to extend the grid. In this light, he remarked:

> Then you look at the suitability, the option that will be good for them. If they are in very far and remote areas where bringing the grid will require excessive amount of money, then you opt for the renewable energy, the off grid or central grid and you tell them, look, if you want this to be sustainable, for each household, this is what you have to pay.

The view shared by MOP5 was based on the reasoning that with all alternatives considered, if the economic viability of grid extension is seen as unlikely, then the idea of a decentralized system now creates an opening for renewable energy project deployment. In his perspective:

> It’s not lucrative or commercially worthy for any investor to spend hundreds of millions to run the network to those rural areas where he is sure he can’t get

> his money in the next 50 – 100 years because of their low level of income, and that opens a window for developing renewable energy in an off-grid manner.

The issue of topography was also highlighted by NERC2, though from a different angle. He highlighted that a fossil fueled decentralized electrification strategy by way of diesel powered generators had been tried in Nigeria, but "then with the issue of the transportation of the fuel – Mind you the fuel is now being imported" and due to the problem of rugged terrain, and long distance which added to the cost, the projects were abandoned. Another problem militating against grid extension, according to NERC2, is the distance between communities. Citing the nature of communities in Eastern Nigeria, he further pointed out that:

> One, it is difficult to connect villages, especially in the East - they are dispersed and two, for you to have connection to each community, every family is a community, so they are dispersed and though we may have sizable number of communities, but the distance between them is much.

The concerns expressed by NERC1, with regards to topographical considerations, had to do with the associated cost and security of power lines. In his view:

> Some of the villages are also in places that they are far from the national grid, that taking power to them is expensive, two, there is no security of the lines, because when you have five to twenty kilometers in the bush to get to a village, the next village then who will secure the line, along the line.

So according to NERC1, with these concerns in mind, "rural electrification will mostly be based on renewable energy because that is what's more appropriate for those areas." Reiterating this affirmation, he concluded:

> I will justify why we need to use renewable energy for rural electrification and why we need to also think about appropriateness of not taking or bothering

about fossil fuel in those areas but to adopt renewable energy for those areas because it's more appropriate and it saves you from having to take the power from the urban area across those wide area of land.

REA1's position, as indicated by his response, was that "what we look at basically is … we do grid extension but in areas where it is very expensive or it is not emm advisable to go for grid extension, we go for standalone (renewable energy technology) per se." This was in line with the points made by both MOP4 as underscored by his remark that "so we have to consider the land mass of Nigeria too. So both, we need both [strategies]", and MOP2, who stated emphatically that: "… while we aggressively pursue the fossil fuel aspect of it, renewable energy will be considered where it has comparative advantages. Especially in the rural areas that have very difficult terrain to access."

4.5.4 Environmental/Climate Change Mitigation Requirements

Global environmental requirements was also highlighted by a number (7 of 17) of the participants as an issue to be considered while agitating for the uptake of renewable energy in rural electrification projects in a fossil fuel rich country like Nigeria. As affirmed by these participants, globally, the trend is towards more use of renewable energy, if not for anything, but for environmental reasons. ECN1 emphasized the issue of environmental concerns. Highlighting the ills of the continual use of fossil fuel, he stated that "whether we like it or not, the world is tending towards renewable energy, sustainable development. Today we talk of climate change and it is with us and it's causing a lot of havoc."

The increasing drift towards the application of renewable energy technologies as an alternative to fossil fuel and large hydro, which bring about adverse impacts on the environment, was also highlighted by two other participants as shown in the following comments:

Now when you look at the challenges in the world with the global warming and all these challenges we are having as a result of the global

> warming; sea tide rise and all those things, the whole world now is advancing, championing or campaigning to go for renewable energy globally. [MOP3]
>
> You know the effect of all these is that; as the scientist will say, it will make a hole in the atmosphere and therefore the whole world is getting warmer and the consequent effect is that we now have more flood and more planet change effect. We mentioned of GHG gases [Green House Gases] which tend to make the earth warmer, and therefore the tendency is now to look for alternatives ... If we don't want the earth to get hotter and to produce such uninhabitable place for human beings. So that's why it becomes necessary that we look for other alternative energy to mitigate against the effect of climate change, and the use of renewable energy comes readily to mind. [MOP6]

Noticeably, two of the participants did not quite see the environmental requirement as enough reason to actually go all out for renewable energy within the Nigerian energy context. MOP1, while acknowledging that though the environment is seen as an issue in regards to the continuous exploration of fossil fuels, indicated that, while "we are fully aware that these things have enormous negative impact. We are also very conscious of the fact that we have not even started in terms of spoiling the environment." The need for more attention to be focused on renewable energy for rural electrification in Nigeria is not to be influenced by environmental issues, according to MOP2. Nigeria should promote the use of renewable energy for the real reason that we need electricity from it and not primarily because of the environment. He elaborated further stating:

> If I want to take the real, popular stand I will say that we should go on renewable energy because we want a cleaner planet, this and this and this. But for me it doesn't make sense What are we actually promoting in Nigeria? We are looking at the environment. How much pollution is Nigeria contributing today to the entire global environment, you understand? Very little; and yet we don't have this energy.

Environmental requirements by way of carbon footprint reduction could be very effective according to ECN2 if it can be used as a controlling tool. He explained that one way to encourage the penetration of renewable energy technologies in rural electrification in Nigeria is by promoting the reduction of the carbon footprint of other industries in the country. According to him, this would require the implementation of regulations which will come in form of:

> May be a law, you say okay 1% of fossil fuel should go to renewables. Alright? If you are going to burn carbon, then you are penalized the amount of carbon you burn, the money, the tax, carbon tax should go to renewable energy.

4.5.5 Energy Security

In their responses to the issue of how renewable energy can be adequately promoted, some of the participants (6 of 17) commented on the issue of the development of renewable energy serving as security for or as a means of prolonging the life span of the existing conventional energy source in Nigeria. Their remarks bordered on a symbiotic relationship between fossil fuel and renewable energy sources already implied in most of their earlier comments. To the participants, the conservation of fossil fuel and the energy that can be obtained from it is one key factor that should work in favor of a large scale development of renewable energy for electricity production in a fossil fuel rich country like Nigeria.

Emphasizing the distinct characteristics of fossil fuel being exhaustible and renewable energy being inexhaustible, MOP3 indicated that it would be advisable to start considering developing the inexhaustible energy source in preparation for the inevitable expiration of the exhaustible one. He elaborated that:

> Nigeria being a developing country now, even though we have the abundance of crude, but since it's exhaustible and the drive of the modern technology now is to go for renewable, the government is seen now focusing on harnessing the renewable energy potentials in the country to at least conserve the fossil fuel.

Energy security was viewed by two of the participants, more from the perspective of conserving the generated electric power, by generating and utilizing the electric power via ways that make more economic sense. REA2, as implied in his comment that: "… If you do that you will even reduce what you need from the grid," indicated that by employing renewable energy in the rural areas, the country could lessen the load on the national grid.

Following REA2's point of view, NERC1 also figured that a strategy that entails having the national grid supply the urban areas, while the renewable energy powered decentralized generators are used for rural supply, would go a long way to remove transmission losses and eliminate the cost of grid extension from the equation. According to him:

> Since we have a country that have most masses in the country living outside the urban areas, so these people outside the urban areas, some of them are places that the power demands are not much and are in range of kilowatts. So such people you can supply them and solve their own problems with renewable energy and forget about that. That is as part of the problem being solved and conserving the other energy for the people in the urban areas.

MOP1 highlighted that the long term implications of the continuous use of fossil fuel was a troubling concern for the Government. Elaborating, he stated that "the government is very conscious of the fact that fossil fuel is an exhaustible source and therefore if you have an alternative, it's always better for you." He further indicated that efforts were already being made to integrate both strategies, and pointed out saying: "We recognize the infinite nature of renewables if you were to develop them despite their challenges. So we are also looking at the energy mix and energy security. We are looking from that perspective as a second priority probably."

Highlighting the current energy situation in Nigeria, and how this was going to adversely affect the cost of petroleum products on which the national grid depends, ECN3 reckoned that developing renewable energy was not supposed to be subject to debate, as from all indications, the level of uncertainty with regards to the fossil fuel industry was too high. According to him,

> So if Government will like to weigh the action on the investment in the oil sector, even right now you find that with the petroleum industry bill in the National Assembly, the oil companies are no longer investing as they should, they are no longer prospecting, drilling for oil because they feel that … they are not sure what the fiscal regime will come out to be, that is the taxes and all the charges they will have to pay, they don't know how it will affect their investment.

The concept of developing renewable energy as a means of guaranteeing energy security was not isolated from the other factors. Most of the arguments for developing renewable energy based on energy security were also connected to points raised about other attributes aimed at the promotion of renewable energy for rural electrification purposes. This inter-linkage can be seen in such a response like: "… for the mitigation of climate change, the use of this form of energy [renewable] which is naturally available in abundance may also help to, to prolong the usage of the fossil fuel." [MOP6]

Citing experiences from countries with similar conditions like Nigeria, that are rich in both fossil fuel and renewable energy sources, MOP6 further explained how such countries are integrating renewable energy sources into their energy mix, both as a means of conserving the fossil fuel and for environmental reasons. He stated:

> That's why you find countries not only in Nigeria that have fossil fuel like in the Middle East countries; they are also going into renewable energy because the tendency is to prolong the length of time that this fossil fuel will be available and as well as mitigate against the effect of climate change.

4.5.6 Energy Politics

A few of the participants (5 of 17) pointed out that one salient issue which is very relevant to the debate of how to promote renewable energy in general, and in a developing country like Nigeria in particular, was the politics involved in choosing what type of energy source to develop and how to develop it for electricity generation. As shown by the responses, energy politics could be a favorable factor or an

inhibiting factor depending on the end of the spectrum from which the argument is made.

With regards to energy politics, the concern expressed by ECN1 was that irrespective of the abundant supply of fossil fuel in the country, Nigeria should be concerned about international requirements and the pressure that comes with such requirements. According to him, "we should bother about developing our renewable energy sources, because Nigeria is not isolated from the rest of the world." ECN1 further explained that the fact that Nigeria had fossil fuel was not enough to say they should only depend on it. He indicated that the country should diversify its energy sources to guard against the pressures of international energy politics, stating "If America decides today that they will not buy our oil and other countries of the world say no more oil – what will you be doing with your oil? We will not be doing anything with our oil."

Implying that a major factor to be considered by the Government in the quest for a higher uptake in renewable energy was not to offend the multinational companies that have already invested heavily in the conventional fossil fuel sources, ECN3 pointed out that the continual provision of a favorable environment for fossil fuel development might work against the development of renewable energy. This, he said, was one way energy politics could come into play and adversely affect renewable energy development. ECN3 further highlighted that there are already concerns about the state of affairs of the fossil fuel industry. Coupled with the fact that most of the companies are now moving to other countries with new oil fields and more favorable conditions, his concern was that "some of them right now they are very skeptical and they are no longer investing so much into drilling and exploration of new oil fields." So as this is where the nation's revenue comes from, there is every tendency that the politics will mostly be in favor of fossil fuel than renewable energy.

The understanding, according to ECN3, was that in order not to lose the players in the fossil fuel arena to other countries by taking actions that would seem favorable to renewable energy development but seemingly detrimental to fossil fuel, the "Government would weigh that action before taking it … I have not done the analysis so deeply but I know that government will think twice before they do it because oil is what generates most revenue for Nigeria." MOP3, reemphasizing that

energy politics also comes into play in the form of pressure from international organizations, cited the call for sustainable energy development made by the United Nations secretary General Ban Ki Moon, who, according to him, advocates for "sustainable energy for all, and he wanted that sustainable energy for all to be driven by renewable energy." Such appeal could greatly influence government action in favor of renewable energy and initiate a new way of thinking, as suggested by the following response by MOP1:

> Yes, recently, when I say recently I mean in the last five years or so, the focus has been shifting, there is this paradigm shift towards other sources, particularly renewables ... there is a lot of awareness about these issues especially at global and regional levels, and now coming to national levels.

4.5.7 Catalyst for Stimulating Rural Development

Renewable energy as a catalyst for rural development was also highlighted by a few of the participants (4 of 17) as another important factor for promoting its use as an energy source for rural electrification. Although the general understanding was that the relationship between development – specifically rural development – and electricity is somewhat ambiguous, with many arguing that the existence of electricity does not really bring about rural development. However, responses from the participants that related renewable energy powered rural electrification with rural development were of the view that renewable energy powered electricity could and has actually catalyzed some form of development in rural Nigeria.

This was accentuated by such remarks like "… you know electricity brings rapid growth and then the economy and then there might even be a geometric progression" by REA2, and the following statement by ECN2, who, in describing the achievements made possible by the constituency projects, expressed how this had contributed to the development of the recipient communities, when he stated that:

> Overall in the whole country, because we are lucky to get a breakthrough, through the national assembly which now took what is called a constituency project and we are still having those constituency projects which we have used to extend development to those communities.

Relating renewable energy powered electricity to rural development was also portrayed by NERC1. Highlighting the benefits of electricity, he stated: "… for electricity as you know, it will help to also boost the economy of the rural areas and therefore make them to be able to even pay the bills." Explaining further, he stated that by providing electricity to both the rural and urban areas, "development will also be growing along the same pace." He indicated that, as a catalyst for development, the presence of electricity in the rural areas also could facilitate simultaneous growth in both the rural and urban areas of the country.

The way renewable energy powered rural electrification could catalyze rural development was further illustrated by NERC1. Citing the changes that could occur economically due to extended economic hours as a result of providing say solar powered lighting to a rural village, he reckoned that:

> If you're going to make light there, put solar panels there and batteries there that can run for three, four hours, the market can stay open till eleven o'clock. That means you are extending the hours of business. The barber's salon can now operate longer, the one who is selling medicine can stay longer in the shop … So these are things that can happen to improve the economy of our rural area once you put solar there.

Apart from the notion of renewable energy powered rural electrification bringing about rural development, the idea that enabling rural development could indirectly catalyze the promotion of renewable energy powered rural electrification was suggested by one of the participants. Rural development, as implied by MOP2 in the following comment, can drive renewable energy:

> So honestly I'm thinking of what should be able to encourage these people to go for renewable energy or what should drive them. Just like you said – rural development … So I think the way to develop the nation should be what should actually encourage us.

This line of reasoning by MOP2 could be said to be based on the understanding that a well-orchestrated development programme could rely on available renewable energy sources for the generation of electricity locally, hence promoting its use on a larger scale.

4.6 Finding 5: Country Specific Factors Related to Renewable Energy and Rural Electrification

During the course of the interviews, it became apparent that certain issues relating to the renewable energy powered rural electricity discourse were specific to Nigeria and needed to be addressed within the local context. It was important to categorize these issues separately due to the level of attention being paid to addressing them in the country. On a global level, these issues might appear trivial or taken as given because they ought to be in place. However, as this study has already pointed out in Chapter 2, several things taken for granted in other nations with similar endowments are not common place in Nigeria.

So in order to get the complete picture of why things are the way they are, it is important we also address or present how things really are. It is believed that an understanding of these factors – deficient electricity industry, inadequate or nonexistent renewable energy policy, underutilization of excess resources, lack of continuity in Government programmes, antiquated process and endemic corruption - will further help position this study within the context in which it is presented. A detailed breakdown of the data summary table for this finding is presented in Appendix Q.

4.6.1 Deficient Electricity Industry

For a country with so many natural energy sources well suited for electricity production, it comes as a shock to many observers that the end products of these energy sources are very scarce in Nigeria. The electric power industry in Nigeria, as indicated by more than half of the participants (9 of 17), is overburdened and runs at a large deficit. The available supply is inadequate to cater to the nation in its entirety. According to MOP6, “the reason is this – in the country now we don’t have enough

power to go round. With the population of over 170 million, what we can boast of is only 4000 MW, and that's from the Government source." The situation was further emphasized by MOP1 along the same lines, remarking that:

> As you know we have just under 10,000MW of installed capacity out of which less than half is working and we are a country of close to 170 million people. So if you check per capita electricity consumption it's extremely one of the poorest in the world.

Acknowledging the implications of having a deficient electric power sector and hinting on what is already being done to remedy the situation, MOP1 decried the discrepancy existing within the power sector, and how unfortunate it is that Nigeria is among the least electrified nations in the world. The deficient electric power industry, as it is, has not only adversely impacted the urban, but the rural electricity sector as well. Though this happens to be a general problem, in reality, its effect is felt stronger by the rural sector who it seems will always play second fiddle in electric power supply.

Most of the responses by the participants further substantiates this notion. They implied that, in effect, power has to be sufficiently provided first for the urban dwellers before it could get to the rural areas. NERC1, in his response, suggestive of the willingness and ability of the consumer to pay which is higher for urban dwellers than for rural dwellers because of their economic status, puts it all in context: "… the power available is not enough for the people in the urban areas who are paying the bills."

The deficient electric power sector in Nigeria has further fueled the need for electricity. Highlighted by the participants from different perspectives, the situation has impacted different facets of the Nigerian life. ECN2 attributed the deficiency in the Nigerian electricity industry to neglect. The issue, according to him, was that "for about 25 years in this country there was no new power station built. So when you are now talking of renewable it's also a problem because even for normal conventional power stations there was none." He further indicated that while the population and economy was growing, the power sector had remained stagnant, creating a perfect environment to incubate over the years the present situation.

In agreement with ECN2, the shortcomings in the electric power industry, according to NERC2, has now created a domino effect in such a manner that the lack of the fossil-fueled electricity has also slowed down any meaningful progress in the renewable energy sector. Explaining how this is all tied together, he surmised that "… unfortunately if you are encouraging companies to come and set up manufacturing of PVs, we don't have the electricity to power the manufacturing."

Further emphasizing the dilemma faced by the country due to its deficient electric power industry, NERC2 pointed out how security and employment has also been affected, stating:

> Yes we are in a fix. So we have to fix one in order to get the other one right. So we need to fix the electricity, so that the place will be conducive for people to invest. The security challenges in Nigeria are based on lack of electricity, that's my own belief, because there is no electricity. No production so people are redundant. They don't have work.

MOP2 was resounding in his response regarding the need for adequate electricity supply in Nigeria irrespective of the source. Venturing some recommendations, he stressed this need for electricity, stating: "If I were to honestly recommend, one, we need energy. That is the number one thing that Nigeria needs. We need this energy, which we don't have adequately." The issue, he further indicated, was the provision of electric power which could partly be solved by reviving the deficient infrastructure.

The inadequate supply of electricity in Nigeria as a result of the deficient electric power sector has, however, given room for more interest in renewable energy powered electricity generation in Nigeria in general, and more particularly in rural electrification. Those in the urban areas are now tending towards solar home systems as back up for their power supply, and the rural dwellers are looking at such solar systems as their primary source of power, especially for lighting. As indicated by REA1:

> If you've gone around Abuja for example, you will see people out of condition or what I say it is, because of the epileptic supply of power, you see roof tops on their own, having solar, you see people having inverters in their houses, all those things. Even in the villages now.

Since the need for electricity services by Nigerians far outweighs the available supply which currently is being serviced by a fossil fueled grid, ECN1 emphasized that there was no reason to exclude renewable energy powered electricity to support what is already on ground. According to him, taking the general situation into consideration "Nigerians and Nigeria is prepared to adopt renewable energy power because we need electricity in the country."

4.6.2 Nonexistent Renewable Energy Policy

Considering the effect Government action would have on the promotion of renewable energy sources with regards to the existence of an effective renewable energy policy, a number of the participants (8 of 17) highlighted that a major constraint faced by proponents of renewable energy powered rural electrification in Nigeria is the absence of a policy specific to renewable energy. The absence of a renewable energy policy in Nigeria was one of the first assertions made by ECN1 in contributing to this study when he stated: "The constraint is that till date, there is no renewable energy law, policy has been formulated but it still remains a draft." He further indicated that:

> For renewable energy to have impact in the nation there must be a policy which has to be passed into law compelling the investors, all stakeholders to work according to the policy; but such type of policy is yet to be approved by the Federal Executive Council.

The issue of the lack of a renewable energy policy in Nigeria was further emphasized by two other participants. MOP5 emphasized this point when he remarked that: "Like one of the major challenges is having a policy on renewable energy and energy efficiency," while MOP3 pictured the constraints from an investor-

deterrent stand point when he stated that: “Now Government of Nigeria, we don’t have policies on renewable energy. That is what is actually hindering investors. When they come, they ask ‘what is the policy on the ground on renewable energy?’”

With renewable energy gradually gaining more recognition within the corridors of power in Nigeria, MOP6 pointed out that the Government is now leaning more towards seriously incorporating it into the energy mix. Addressing the benefits associated with the use of renewable energy, he noted: “so we’re trying ... the Government’s policy is highlighting this and once the policy is approved, it becomes a document that we can now take to the consumers to encourage them.”

Though the increased interest in renewable energy powered electricity projects have come as a welcomed development, however with various agencies getting on board with individual programmes, this has brought about the problem of coordination as already explained in Section 4.3.2.5. One of the solutions to the problem of coordinating the various agencies, as this finding has already shown, calls for an active energy policy. An active renewable energy policy was portrayed by MOP2 as vital to solving the problem of coordination in order to minimize wastage and duplication. According to him, the existence of such a policy “will have all these stake holders involved … on the same page.”

ECN2, highlighting the proceedings that led to the existence of the current energy “master plan that will enable us to overcome this power generation problem,” noted that Nigeria has never cultivated the will to adopt the use of renewable energy. He explained that due to the nation’s reliance on the abundance of fossil fuel for a very long time, until under President Obasanjo’s administration in 2005, “there was no energy policy on how to use renewable energy.” In his view, “it is that policy [the National Energy Policy 2005] that actually spelled out the policy direction of the energy sector in the country ... and that included diversification, alright?”

A part of the diversification of the energy portfolio is the consideration of renewables, which, according to ECN2, is one of the things the Obasanjo administration wanted in the policy. This role played by policy and administrative power in influencing issues as they affect renewable energy was further acknowledged by ECN2 when he remarked: “So that was why I said that it is more or less a problem of policy and political will.” According to him, the National Energy

Policy serves as a tangible instrument with which the Government gets involved, and through which the way is paved for the energy master plan.

MOP1, emphasizing the dominance of fossil fuel in the Nigerian polity, highlighted that "you find as a result of that, there are no existing policies and frameworks for the entry of renewables for instance." In his view, "in all the other policies, that is the Energy Policy of 2005 and Electric Power Policy, mention has been made of renewables, use of renewables in some sense but there are no details." This has greatly affected the level of attention the nation has given to renewable energy programmes. Considering the current state of affairs, one can figure, as implied by MOP1 that even with the present level of attention that renewable energy has been attracting, the policy and the Government's position on renewable energy is still not that concrete. As he puts it, "having been in the system for quite a long time now, I can authoritatively say that it has never been our government's policy to shift away completely from fossil fuel to renewable energy."

MOP7 acknowledged the preparedness and readiness on the part of Government to get renewable energy powered rural electrification off the ground. In his account, there is already good policy on the ground waiting to be implemented. He indicated that as part of this effort, the requirements for investors are already being put in place, and that with both the national energy as well as renewable energy policies already prepared, from all indications "there's good policy on ground, there is from my own understanding, the Government is preparing to receive investors."

4.6.3 Underutilization of Excess Resources

With respect to country specific issues that could affect the propagation of renewable energy powered rural electrification, some of the participants (6 of 17) highlighted the fact that Nigeria has not really taken advantage of the abundant natural renewable energy sources in the country as one of these issues. It is obvious that the energy sector was more accustomed to programmes that promoted the use of fossil fuels and large dams for hydro power production than renewable energy sources.

Utilization of renewable energy sources, as highlighted by REA2, is actually very low. According to him, based on the statistics, "the development of renewable

energy or the utilization of renewable energy in rural electrification is less than 0.5%". This figure could not be further from the reality on the ground. For instance, there are several communities with large sources of running water suitable for electric power production that are living without electricity services in Nigeria. According to MOP2, the hydro resources available in Nigeria are not being harnessed for the proper purpose. He argued that "the resources should be used for energy generation" and not just water supply and irrigation purposes. Highlighting the country's poor institutional structure, he was of the view that an agency like the Ministry of Water Resources should be more involved in energy production. "… but if we look at it, they should handle more of energy issues than the water supply … they are building dams but the dams are built for water control. You understand?"

Elaborating further on how the strategy of only harnessing hydro power for irrigation purposes in Nigeria is a typical example of underutilization of resources, MOP2 decried this as a waste of resources, stating:

> Without tapping the energy that is there. So why would you use so much money and you are making a solid structure, you understand? And you end up using just a little part of it. You have them for ehhh you have water for irrigation but the irrigation wouldn't compensate for how much money you have used in building that dam, but that is what we usually do. You build a dam, you wouldn't have any power component on it. You build a dam, a very big dam that you would have harnessed so much energy from it for electricity but they'll just leave it for irrigation and the irrigation is for pepper and tomatoes which will take like 100 years to compensate for the cost [laughter].

Another participant, NERC1, also pointed out how the nation's use of its dams only for irrigation purposes has not helped in promoting micro hydro technology for electricity production in Nigeria. His conclusion on how this has and will continue to hamper the development of renewable energy for electricity production with regards to micro hydro was that in reality, the focus is not on electricity production using those dams, "… even in small dams we build, and those dams were built mostly for irrigation purposes. They were not meant for power generation."

ECN3 was more sympathetic to the situation, emphasizing that at the moment, power generation will continue to come from fossil-fueled generation. He saw the situation more as a case of using what is available for the meantime until you can develop the preferable. On the other hand, ECN2 wondered why renewable energy sources are being shunned for fossil fuel. He pointed out that even "our refineries are not functioning," and since this has also led to scarcity of fossil fuel products, people have adapted to alternative energy sources. He then questioned: "… people are using other things. So can they use renewable energy? I think you understand? Can they use renewable energy?"

NERC2 approached the question from a decentralized electrification point of view. His notion was utilizing the available resources properly for decentralized electricity production. Emphasizing how misdirected strategies could hurt the growth of a good programme, he stated:

> Unfortunately in Nigeria we run away from diesel I remember during the second republic, most of the rural electrification in the country were distributed energy resources using diesel but the politicians were of the opinion that it's better to connect to the grid.

4.6.4 Lack of Continuity in Government Programmes

A smooth transition and continuity of Government programmes was deemed beneficial to sustaining renewable energy in a fossil fuel dominate country like Nigeria by a few of the participants (5 of 17). REA1 saw a lack of continuity as a major hindrance to the uptake of renewable energy technology in Nigeria. He stressed that "another challenge was in the area of continuity on the part of Government policies and programmes." ECN2 also attributed one of the barriers to the uptake of renewable energy for rural electrification in Nigeria to the discontinuity of government programmes based on political leanings. He stated "So that's why me I always call it political, because the government that comes in might not be interested in the project of the other one. So the challenges, the barriers have always been political one."

To MOP5, the issue of a lack of continuity was deeply engrained in the nature of the nation's institutions. He emphasized that:

> If we have a strong institution and there's continuity, from the pilot projects that were done in the seventies and eighties, by now we should have started building ours based on the man power and capacity that have been developed.

Likewise, MOP2 saw the institutional arrangement in Nigeria as a major cause of the lack of continuity of Government policies and programmes. According to him, things are supposed to move seamlessly "on a general level that is irrespective of the government that is in power" but this seems not to be the case. He stressed that discontinuity was very common in Nigeria – with new Government there's always a change of agencies responsible for various development activities. Citing the Energy Commission as an example of an agency that has been moved around several ministries, he stated:

> These things keep on changing. Initially they were under the Ministry of Power; which makes it very easy for them to drive the energy sector especially as it relates to electricity. Now they have moved from here like the earth is moving around – like the eclipse.

From a slightly different perspective, MOP1 indicated that the issue of continuity is not supposed to be much of an obstacle, in as much as there is a well-informed human capacity in the bureaucracy. He credited the lack of continuity and consistency in Government programmes mostly to poor human capacity development and lack of awareness on the part of those within the bureaucracy, as well as to budget in general. Observing that "those kind of issues about non-consistency of those government programmes exist probably for budget or for other reasons."

MOP1 further highlighted that other than those at the helm of affairs (i.e. political appointees), all the technical people, for instance, work and retire in the Ministry, indicating that there should be a reasonable level of continuity considering that the managers of the day-to-day affairs are more or less always there in the

agencies. He further pointed out that it is "quite normal to expect that when you have changes in government the high level policy could as well be affected in some ways." He, however, indicated that to a large extent the bureaucracy remains, and if they are well equipped and have adequate knowledge about the implementation of these technologies there will always be continuity. He concluded that continuity could be guaranteed with an enabled work force "because a typical civil servant stays." To him, the issue had more to do with having quality people who knew what they were doing, and who could do the job right, irrespective of the changes in the country's political leadership as the bureaucrats are still the same people that are on the ground.

4.6.5 Antiquated Process

A few of the participants (5 of 17) pointed out that the use of an antiquated and ineffective process of generating and delivering power is another concern specific to Nigeria's issue of low electricity coverage in general. The conception was that by sticking to the antiquated grid system, the nation has failed to develop other forms of electric power generation like a renewable energy backed decentralized system that could conveniently serve rural electrification purposes.

As emphasized by NERC2, the Government has opted for grid extension at the detriment of decentralized systems which could also have been powered by renewable energy sources. The discontinuity of the diesel powered decentralized system brought with it a lot of problems which, to date, have not been addressed. He indicated that when the decentralized programmes were abandoned, "… all the rural electrification eh eh diesel generating stations were connected to the grid. So that added so much burden on the grid."

ECN3 stressed that the present strategy for rural electrification programmes in Nigeria also is not adequate. This strategy, he implied, is based on an outdated process that relies on a central system. It has stagnated the rural electrification process because infrastructure was being set up to deliver a nonexistent power. Highlighting this as an important error, he stated: "So when they have money they will just go to one village, erect distribution lines and power lines but there is no supply. That, becomes a problem." Similarly pointing out the shortcomings in relying on a central system, REC2 called for a more up-to-date system of breaking up or segmenting the generation to replace what is currently being used. According to him:

> There are many ways we can generate electricity. So many ways. We can segment our power source. Segmentation of power sources - that is generation. And when you segment it in many numbers, you will make sure that each of those numbers are very effective and you will have constant supply.

The problem of electric supply, as hinted by NERC1, is aggravated by the nature of the power sector. He explained that the nature of the electric power sector in Nigeria is such that all the power plants are situated at "the southern periphery of the country because that is where the fuel resource are and those are where you also have the load centers." The present situation, he elaborated, was such that "even the control center, the National Control Center is in Oshogbo which is in the South-West while the gas plants are mostly in the South-South areas and only the hydro power plants are in the North like in Niger state." [NERC1]

While a decentralized system that could easily by supported by renewable energy sources would have served the country better, the centralized system which has failed in meeting the electricity needs of the people has strongly gained roots. The implication is that power has to go to the North of Nigeria, for example, from the control center in Oshogbo in the West. This problem of the use of an antiquated process, according to NERC1, is not limited to power generation and supply only. It also extends to the grid network itself. He remarked that:

> We also have the problem that the grid network is radial type, it's not ring so you don't have several routes of getting to a place. So if there is a severance of one line, then any other person at the other end has no electricity access. Well if it were ring, you have it that if you can't go this way, you go the other way.

4.6.6 Endemic Corruption

The source of some of the problems facing Nigeria's quest for a renewable energy powered rural electrification programme was also traced by a few of the participants (4 of 17) to the pervasive corruption in the country in general, and energy establishment in particular. Emphasizing the issue of poor institutions in Nigeria,

which is reflected in the wide spread corruption, NERC2 noted that the endemic corruption has subsequently reinforced the misplacement of priorities in the electricity industry. He stated:

> The worst part that is eating Nigeria is this corruption. We have enough to do all those things but there is corruption in the whole thing. So we can't deny it our people are not able to provide energy because of corruption. Nobody is going to do it.

Corruption, as MOP3 put it, has also given room for substandard and low quality renewable energy technologies to enter into the market, and this has further tainted the people's perception of the capabilities of these technologies. He highlighted this as a major challenge: "So you see this issue of these unqualified personnel that are involved in the market and also the issue of fake materials also is a very big challenge." REC2 was very pessimistic about the situation due to his perception of how corrupt the system is. As a contractor, he highlighted how frustrating it could be to get the job done when those monitoring and managing the government aspect are not trustworthy. He concluded, saying: "Yeah in this society that we are, in our Nigerian context, I'm very sorry I want to use a very bad word, we are dubious."

A more enthusiastic response was provided by REA2, who acknowledged that other than eradicating corruption, the development of renewable energy technologies entails lots of sacrifice and effort. His optimism can be deduced from his remark that the development of renewable energy is "quite a sophisticated thing that requires very serious study and determination, and where corruption is eliminated, then I believe we will be able to go a long way."

4.7 Recap of the Emerged Findings

The themes that formed the categories on which the findings of this study are based were presented in this chapter. The data gathered from the individual discussions and interviews show the perception and understanding of the respondents

as they tried to throw some light on the issues they felt were responsible for the seemingly lack of uptake of renewable energy in rural electrification programmes in a fossil fuel rich country like Nigeria.

The primary finding points out areas that need attention for renewable energy to be accepted as a viable energy source for rural electrification projects in Nigeria. An overwhelming majority of the respondents felt that such factors like conscious government participation, increased awareness, serious advocacy, improved bureaucratic involvement, and efforts to overcome liabilities of newness are vital to the process of entrenching and subsequently institutionalizing the use of renewable energy in rural electrification projects in a fossil fuel rich economy like Nigeria.

The perceptual factors which formed the basis of the second finding of this study show that the respondents were in congruence with most of the literature, as both the inhibiting and facilitating factors they mentioned are in line with what is highlighted in previous studies. The findings show that the respondents were also able to articulate the relevance of these factors to the context of the study and interview questions. The general argument was that for a sustainable renewable energy programme to be obtainable in Nigeria, efforts have to be made to strengthen the perceived facilitators while diminishing the inhibitors, especially in the minds of the Government, policymakers and energy bureaucrats.

The third and fourth findings illuminate the physiognomies of renewable energy that generally affect its acceptance and application as an energy source for electricity purposes. These findings look at the internal and external characteristics of renewable energy that could affect its deployment in any part of the world. Country specific factors emerged as the fifth finding. They represent those factors that are specific to Nigeria – factors that could affect the deployment of renewable energy for rural electrification in Nigeria.

The responses show that the participants were aware of what most of the issues are. They were able to cite instances that buttressed their responses and, while it was obvious what their stance were regarding the use of renewable energy in Nigeria, each participant was able to clarify his position and made convincing arguments for taking such a stand.

The next chapter presents a discussion and interpretation of the above findings and how they tie into the literature, and this study's research questions.

CHAPTER 5

INTERPRETATION OF FINDINGS

5.1 Research Synopsis

The purpose of this study was to explore, from the perspective of a selection of key government officials responsible for the implementation of the Nigerian Energy Policy, the seemingly lack of use of the abundant renewable energy resources in Nigeria for rural electrification projects and the effect the availability and abundance of fossil fuel has had on the use of renewable energy for rural electrification in the country. The intent was that a better understanding of the perceptions of the bureaucrats and administrators tasked with the management of energy as it affects the electricity sector in Nigeria would throw more light into the workings of the nation's electric power sector and provide better insight into the process of establishing renewable energy as a suitable option for rural electric power generation in an oil rich nation like Nigeria.

The qualitative data collected were obtained by a naturalistic process of inquiry through in-depth interviews of 17 participants made up of bureaucrats and administrators within selected federal energy and electric power agencies in Nigeria. Using the framework from the Literature Review in Chapter 2 as a guide, data obtained via the semi-structured interviews were coded, analyzed and organized into theme based categories which were directly aligned to the study's research questions.

This qualitatively study explored through the narratives of the various participants, issues affecting the uptake of renewable energy sources for rural electrification and development projects in Nigeria, based on the following research questions:

1) How has being a fossil fuel-rich country affected the large scale adoption of renewable energy technology for rural electrification and development projects?

2) How can policy makers be encouraged to support the use of renewable energy technologies in promoting rural development in Nigeria?

3) How do the bureaucrats tasked with the responsibility of providing electricity for rural communities in Nigeria view renewable energy technologies in Nigeria?

4) What are the dynamics involved in accepting an alternate form of energy for rural electrification projects in a fossil fuel rich country like Nigeria?

5) How has the interaction between having an abundance of fossil fuel and renewable energy sources in Nigeria affected the choice of including modern renewable energy sources and technologies in the electrification mix?

This chapter is a presentation of the interpretation and discussion of the research findings presented in Chapter 4. The discussion in this chapter covers the analysis of the themes that made up the findings in the previous chapter, and how the relevant theories and prior research are tied to this study, as well as compares and contrasts issues raised in the literature review.

As an extension of the previous chapter in which the findings of this study were presented by organizing the data from the in-depth interviews into categories to produce a readable narrative as suggested by Bloomberg and Volpe (2012), this chapter fulfills the purpose of providing interpretive insights into the findings. Dealing mainly with the analysis of the findings, this chapter attempts to reconstruct a more holistic understanding of the chunks and pieces of data split apart and separated in the previous chapter.

5.2 Analysis, Interpretation and Synthesis of the Findings

The analysis of the data gathered as presented in Chapter 4 saw the emergence of 35 themes (presented earlier in Section 4.1.3) which were synthesized into five key categories that made up the findings of this study. Social scientists, as indicated by Boeije (2009, p. 149), "are often puzzled as to what can be considered to be the outcomes of a qualitative research project." These outcomes or findings which "can consist of descriptions that are more or less theoretical as well as interpretive explanations of the research subject … always include interpretation of the empirical data" (Boeije, 2009, p. 94) which is a function of how strong the researcher's skills are.

Interpretation of someone's words or actions, as shown by Boeije (2009), requires the explanation of what the researcher thinks it means and how he or she thinks it should be understood. It is "the databased and integrated discoveries, judgments, or pronouncements researchers have offered about the events or experiences under investigation" (Sandelowski & Barroso, 2002, p. 214). Findings on which interpretations are based are arrived at in qualitative research by way of the researcher's interpretation of the processed data. So in keeping with maintaining the expected quality and standards of a qualitative study, effort was made in this research to eliminate the mistakes advised against by Boeije (2009).

Data was clearly seen and represented as what they are – empirical material on which scientific findings are based. The research process acknowledged that data required interpretation, enabled discoveries and made the drawing of conclusions and inferences possible. The analysis and interpretation of the data which led to the findings were also clearly separated from the findings and an exhaustive exploration of the data was carried out to guard against under-analysis.

The framework of the research was rooted in the data and not forced on it, as it emanated from the data. To help eliminate the issue of over-generalization, this study made no attempt to draw any inferences about the entire study based merely on a selection of cases within the sample. The following is a discussion of the categories and emergent themes along with a presentation of how they relate to previous findings from the literatures.

5.3 Categories and Emergent Themes

The analysis, interpretation and synthesis of the data from the interviews produced themes that were grouped together into three main categories of analysis based on how well they addressed the elements of the research questions. This was in line with Fereday and Muir-Cochrane (2006, p. 4) supposition of thematic analysis being "a form of pattern recognition within the data, where emerging themes become the categories for analysis."

The theme based analytic categories helped make sense of the factors that could affect the concept of renewable energy powered rural electrification in a fossil

fuel rich country. The resulting thematic categories were structured to also address aspects of the framework of the study in an effort to tie and align the findings to the research question.

5.3.1 Thematic Analytic Category 1: Legitimizing Factors of Renewable Energy Powered Rural Electrification in Nigeria

This category of analysis spoke to Finding 1 of this study – factors for entrenching renewable energy for rural electrification. It showed that, for renewable energy to stand out as a viable option for power generation in a fossil fuel rich country like Nigeria, it needed a high level of legitimacy to help overcome institutional barriers that could pose as obstacles both in the near term and in the long run. It was observed that an overwhelming majority of the participants were of the stance that for renewable energy to be accepted, legitimacy will depend on the concept of a renewable energy powered rural electrification programme in Nigeria overcoming several misconceptions while building on already proven strengths of the concept.

Legitimizing and institutionalizing a renewable energy powered rural electrification programme in a country like Nigeria, with a seemingly more accessible and dominant alternative, entailed several factors. These factors as shown by the literature include the involvement of the administrators and policy makers, ability to make renewable energy more attractive, advocacy, awareness, and a conscious participation of actors (e.g. government, stakeholders etc.) (Akpan, Isihak, & Udoakah, 2013; Bergek, Hekkert, & Jacobsson, 2008; Bergek, Jacobsson, & Sandén, 2008).

The above notion was affirmed by almost all of the participants. Just as the literature suggested, the responses from the participants showed that legitimizing renewable energy as a viable option for rural electrification projects in a fossil fuel rich economy like Nigeria required conscious government participation, increased awareness, serious advocacy, improved bureaucratic involvement, and efforts to overcome liabilities of newness.

5.3.1.1 Analysis of Themes in Thematic Analytic Category 1

Category 1 consists of five key themes which mostly reflect the participants' perspectives on how renewable energy and its associate technologies could be legitimized for rural electrification projects in Nigeria. These themes which were initially obtained from the Literature Review, also emerged from the responses from the interviewees. They were highlighted as the core of any effort aimed at achieving renewable energy powered rural electrification in Nigeria. Figure 5.1 shows the distribution of the responses from which the themes in this category were obtained.

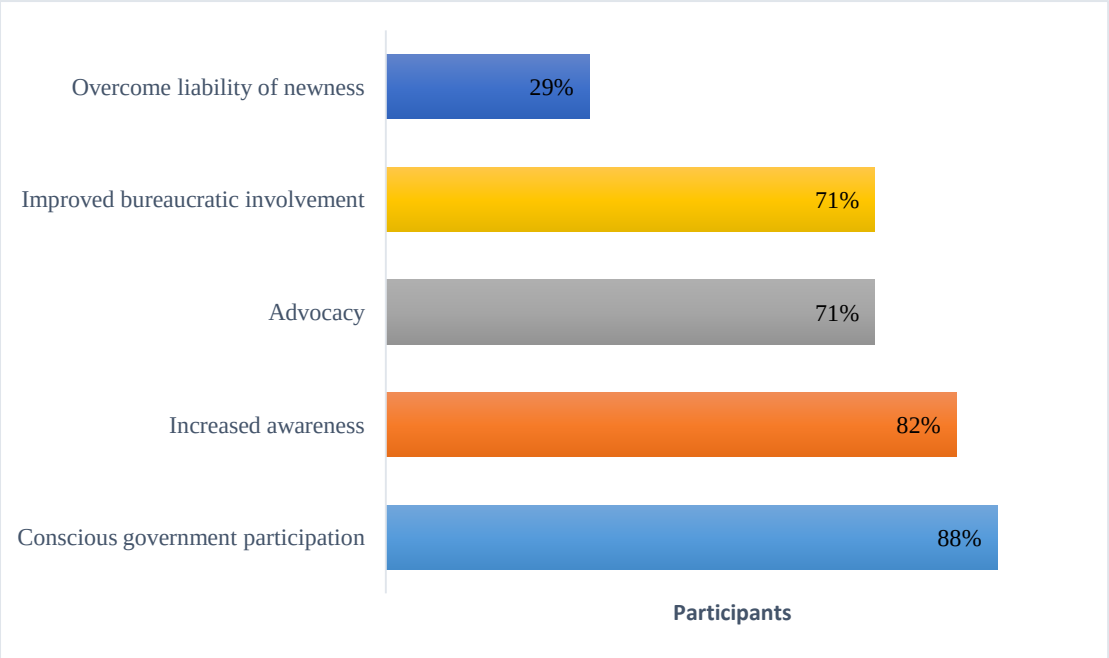

Figure 5.1 Factors for Entrenching Renewable Energy for Rural Electrification

1) Conscious Government Participation

The literature on legitimacy and institutionalization, as suggested by Bergek, Jacobsson and Sandén (2008), established the need for conscious participation from the Government, as this is required to be able to fulfill such government responsibilities as regulative alignment, market regulations, tax policies and the direction of science and technology policy. With government

participation, it is easier to establish renewable energy powered programmes as Government can easily exercise their powers by creating enabling institutions with mandates to promote the programmes (Agboola, 2011; Bugaje, 2006).

The above notion is consistent with the perception of almost all of the participants, who saw the onus of building the foundation for a viable renewable energy powered rural electrification programme in Nigeria as primarily that of the Government. As one participant put it, for you to actually develop renewable energy powered rural electrification, "… government has to shoulder the bills." [NERC2]

In a similar manner, the participants' positions on conscious government participation also concurs with the argument by Mostert (2002, p. 63) that examples of substantial progress in rural electrification from around the world show that rural electrification was achieved mainly based on such developing nations having "a determined political objective for achieving it" and "a specialized institution given the mandate to achieve it."

The participants' perception of how crucial government involvement was, also reinforced the proposition by Akinbami (2001, p. 178) that:

The development, application and diffusion of renewable energy systems especially for decentralized electricity generation and supply into the Nigerian economy require adequate institutional support and strengthening.

Conscious government participation, as the responses showed, consolidated the participants' expectation of success which is highly dependent on the Nigerian Government being fully involved or invested in the idea of actually using renewable energy for rural electrification.

2) Increasing Awareness

The analysis also showed that the participants all saw the awareness of the long term economic and environmental benefits of renewable energy sources and technologies in Nigeria, both at the public and the bureaucratic levels, as being generally low. An improvement of the awareness level was deemed by most of the participants as paramount to the successful adoption of a concept like renewable energy powered rural electrification in a fossil fuel rich state.

This theme aligns with the proposition in the Renewable Energy Master Plan 2005 that "public awareness and promotion will be critical elements of the drive to expand the market for renewable energy" (Energy Commission of Nigeria, 2005b, p. 10). Awareness of the potentials of renewable energy as it has been found, can be more widely disseminated by integrating renewable energy into government programmes like rural electrification, rural development, poverty alleviation, and social welfare programs. This strategy, as Flavin and Aeck (2005) showed, could help advance the effectiveness of such programmes in many cases.

Similar to the findings by Akinbami (2001), the responses suggested that due to lack of awareness, there were really no immediate incentives to motivate the people to influence the Government to begin to take more decisive actions in enhancing the development, application, dissemination and diffusion of renewable energy resources and technologies in the national energy market. While this was seen as a pitiable situation, most of the participants proposed that increasing awareness, would be one way of enabling a wider uptake of renewable energy in power generation in Nigeria especially for rural electrification.

Increasing awareness was specifically seen by one of the participants (MOP2) as one way of streamlining the numerous and conflicting information about renewable energy that has somewhat stifled its acceptance among Nigerian energy bureaucrats. This view of increasing awareness, as echoed by the participants, resonated with the findings by Chineke and Ezike (2010, p. 682) that "the need to increase awareness within governments of the benefits of a renewable energy strategy will serve as momentum-drivers" for the propagation of renewable energy technologies.

3) Advocacy

Advocacy as expressed by a majority of the participants was very relevant in achieving a sustainable renewable energy powered rural electrification programme. The responses implied that a very strong coalition of advocates especially among the stakeholders was needed to better position renewable energy alongside the already established fossil fuel. This followed along the lines of the argument that "for a new technology to gain ground, technology-specific

coalitions need to be formed ... to advance the perception that a particular technology, e.g. solar cells or gas turbines, answers wider policy concerns" (Jacobsson & Lauber, 2006, p. 259).

The participants' position on advocacy was accentuated by the realization, as pointed out by Suurs (2009, p. 98), that "the emergence of a new technology often leads to resistance from established actors. In order for an innovation system to develop, actors need to raise a political lobby that counteracts this inertia, and supports the new technology." Taking this into consideration, their supposition supported the conclusion by Van Leeuwen and Ruff (2014) that to achieve the desired targets and impacts of universal energy access, such a process requires a well-organized, structured, branded, and sustained advocacy.

The participants' views on advocacy with respect to renewable energy powered rural electrification also resonates with the one shared by Mostert (2002, p. 63), "that rural electrification needed strong political and institutional champions to succeed." It is believed that the intensity that comes from such champions or advocates could pressure or influence policy makers to fix ambitious but realistic quantitative targets for rural electrification and create appropriate institutional launch pads for achieving it.

4) Improved Bureaucratic Involvement

The argument for improved bureaucratic involvement simply called for more and better participation of the administrators in the process of implementation. Bureaucrats and administrators have been described to wield enormous influence and power in the final implementation of government decisions. Their role within the implementation agencies in shaping the actual policy outcome was acknowledged by Lipsky (2010) who emphasized that the everyday problem-solving strategies of "street-level bureaucrats" is part of what makes up implementation.

While acknowledging the importance of energy bureaucrats and their role in facilitating a wider uptake of renewable energy in Nigeria, the responses from the participants showed that the Nigerian energy bureaucrats currently operated under too many restrictions. This sentiment was noted in the response of one of the participants who pointed out that: "… usually in Government, there should be

the technocrats who should now propose or recommend but that's the reverse in Nigeria actually ... here the technocrats try to fit into the government decision" [MOP2]. This however should not be the case as energy and expert bureaucrats have been shown to occupy a prominent role which they can use to influence policy decisions by virtue of their position (Uba, 2010).

The responses underscored the fact that energy bureaucrats and administrators in Nigeria were yet to take control of the importance of their position to start influencing the Government, especially on renewable energy matters. These government executives tasked with seeing to the development of electricity in Nigeria should come to the realization that they occupy a very influential and powerful position. Their responsibilities, as indicated by Gruber (1987), go beyond the proverbial paper pushing, as decisions they make significantly affect the way Government serves or regulates its citizens.

As the analysis shows, the constraints within which bureaucrats perceive themselves to be operating within can be loosened if these bureaucrats are provided with better information and capacity development. Then they will have more confidence and would not see themselves as usurpers, because being that they are bureaucrats and administrators, the power they wield was deliberately given to them by elected officers (Gruber, 1987). They should, therefore, take the initiative to lead the drive for more use of renewable energy in electric power generation in Nigeria.

5) Overcome Liability of Newness

Legitimacy, as portrayed in institutional theory by Stinchcombe (1965), is a fundamental resource that organizations deploy in their efforts to lessen the negative impact of the liabilities of newness in an industry, market, organizational field, or economic sector. This implies that overcoming the liabilities of newness of renewable energy technology for rural electrification is essential to strengthening its acceptance as a viable energy source.

Similar to Pfeffer and Salancik (1978), and Weber (1978), the participants acknowledged legitimacy as a basis for survival and growth, and "a precondition for the continuous flow of resources and the sustained support of organizational constituents" (Turcan, Marinova, & Rana, 2012, p. 426). Though only a few of the participants reflected on the novelty of renewable energy as an issue, the

magnitude of their responses highlighted the fact that overcoming the liability of newness of renewable energy would really enhance its legitimacy in a fossil fuel dominant environment.

5.3.2 Thematic Analytic Category 2: Perceptual Factors that Could Influence the Deployment of Renewable Energy

As already highlighted in Section 4.3, perceptual factors, which were those factors perceived by the participants as factors that could affect the uptake of renewable energy, were classified into two sub-categories. These categories were those perceived by the participants to be inhibitors and facilitators of the widespread adoption of renewable energy for rural electrification projects in a fossil fuel rich country like Nigeria respectively.

5.3.2.1 Analysis of Themes in Thematic Analytic Category 2 – Inhibitors

From the analysis, it could be discerned that most of the participants acknowledged that addressing inhibitors is fundamental to achieving the goal of a renewable energy powered rural electrification programme in Nigeria. According to Mutingi (2013, p. 176), "technology inhibitors, particularly in the renewable energy sector, often seek to increase the number of opponents to renewable energy innovation. In so doing, they hold back the spread of innovation, or even try to stop its diffusion." The finding aligned with the deduction by Mutingi (2013, p. 191) that "technology inhibitors and their likely negative influence should always be considered when analyzing RET (renewable energy technology) management problems."

Figure 5.2 depicts the distribution of the responses from which the themes in this category were synthesized.

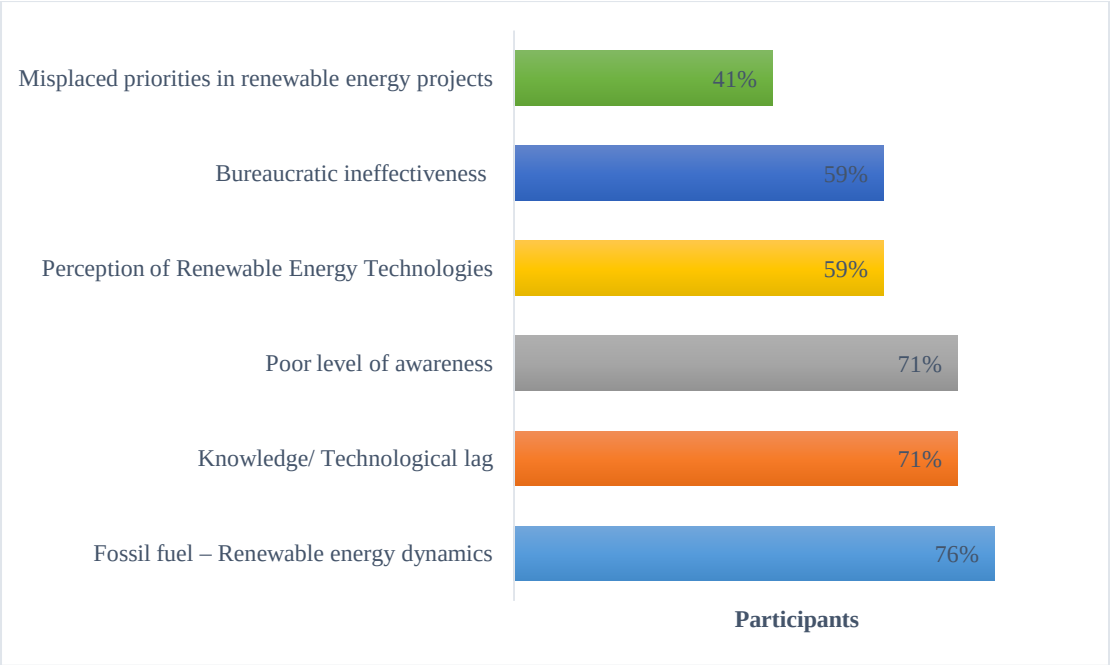

Figure 5.2 Perceptual Factors – Inhibitors

1) Fossil Fuel–Renewable Energy Dynamics

The lukewarm attitude towards renewable energy in most instances, have been attributed to the impression of the existence of an abundant and unlimited supply of fossil fuels by Nigerians (Akinbami, 2001). While the existence of fossil fuel could be seen as a disadvantage to the development of renewable energy, most of the participants did not totally portray the dynamics between fossil fuel and renewable energy in Nigeria as completely adverse in nature. Interestingly, though most of their comments reflected the general notion of fossil fuel unfavorably impacting the development of renewable energy for rural electrification in Nigeria, almost half of the 13 participants who commented on this relationship highlighted the existence of abundant fossil fuel in Nigeria as a plus. They say it as an opportunity for further development of renewable energy. To them, renewable energy could also be developed alongside fossil fuel exploration to the benefit of the nation.

A response that epitomized this notion was that expressed by one of the participants who, commenting on current efforts to see to the coexistence of both fossil and renewable energy sources in the Nigerian energy mix, stated:

> We are putting all of them together as much as possible. In fact where we can make renewables work, we are doing it we are trying to make sure it works and where other options too can work we are also trying to make them work. [MOP1]

Though it is inherently implied that an abundance of fossil fuel basically indicates policies and activities that are biased towards its development at the expense of other energy sources, this finding, however, shows, based on the perception of the participants that this does not necessarily need to be the case. It was their position that, while the reality encourages this stereotype, in essence diversification is also in the best interest of fossil fuel development.

2) Knowledge/Technological Lag

Although, as indicated by the Department of Trade and Industry, 2003 cited in Moula, Maula, Hamdy, Fang, Jung, and Lahdelma (2013, p. 91), it has been assumed by some studies that "negative perceptions towards renewable energy are caused by the lack of knowledge and public understanding, there is limited evidence that more informed individuals are accepting renewable energy technologies." A lack of knowledge and technological know-how has been presented as a barrier to the diffusion of renewable energy technologies (Painuly, 2001; Roehrkasten, 2015). Analysis of the findings shows that the participants' perception in this study, points at a lack of knowledge and technological know-how as an important problem.

This study found that participants perceived the level of knowledge and technological understanding in regards to renewable energy technology development in Nigeria as very low. As lamented by one of the participants, "we don't have local facility to produce them renewable energy technologies" [NERC1]. The findings also confirms that knowledge and technology wise, Nigeria is actually behind other countries. This observation could as well be one of the reasons why renewable energy uptake has been practically very low in Nigeria, as the effect of a lack of knowledge and technological know-how has been shown by various studies (for instance, Doukas, Karakosta, & Psarras, 2009; Luken & Van Rompaey, 2008; Painuly, 2001; Worrell, Van Berkel, Fengqi, Menke, Schaeffer &

Williams, 2001) to be a major barrier to the successful diffusion of renewable energy technologies.

The notion of technological lag being a major barrier to the uptake of renewable energy in Nigeria as presented by the participants corresponds with findings by Ravindranath and Balachandra (2009) who, like Painuly (2001) found, barriers associated with knowledge and technology not only limited access to the international technology market but also limited capacity to assess, adopt, adapt and absorb technological options. Other than the issue of not having the means to procure the needed technology, the findings also align with those by Roehrkasten (2015, p. 151) who argued that "developing countries often do not have the expertise to produce renewable energy technologies nor the means to buy, maintain and repair the necessary equipment."

While the participants acknowledged that Nigeria was a developing country lacking the means to produce, maintain or repair, there was, however, the understanding that these could be achieved through training and human capacity development. As shown by this finding, overcoming the issue of knowledge and technological lag is very important for renewable energy to gain a strong standing in the Nigerian energy sphere. To this effect, most of the participants recommended the acquisition of this knowledge by way of technology transfer agreements or outright purchase of these technologies and creating a forum for understanding the workings by engaging in reverse engineering where and if possible.

3) Poor Level of Awareness

The findings show that the participants agreed that the level of awareness of renewable energy technologies and the practicality of using renewable energy sources for power generation was not at the level it was expected to be. The portrayal of the low level of awareness of renewable energy technology in Nigeria by the participants as a barrier is in agreement with several other similar studies; for instance, Muntasser, Bara, Quadri, El-Tarabelsi, and La-Azebi (2000) who highlighted the lack of awareness as one of the barriers facing the uptake of photovoltaics in developing countries, and Haanyika (2008) who highlighted the lack of awareness among the constraints to the application of alternative technologies.

As a barrier to the adoption of renewable energy, the lack of awareness of renewable energy technologies extends across a wide spectrum from the Government through the bureaucrats to the rural beneficiaries of the technologies. A lack of awareness exacerbates the problem of access to updated and reliable information on the technologies and their associated costs and benefits (Economic and Social Commission for Asia and the Pacific, 2008). Lacking this important information is seen as a constraint to the promotion of renewable energy development as most times it leads to the use of substandard materials and equipment. As one of the participants noted: "… they don't know the difference, and they will say that this thing is bad. So these are some of the challenges I have seen." [MOP4]

Similar to Dada (2014), the participants did not only see the lack of awareness as a barrier in itself, but were mindful of its ability to generate other forms of barriers like contributing to the reluctance of those tasked with implementing renewable energy powered rural electrification programmes in accepting new technologies. Another implication of the lack of awareness as acknowledged by some of the participants was the fact that it could lead to the Government overlooking the advantages of renewable energy as they continue to concentrate on fossil fuel development which they are more conversant with. This subsequently has led to the nation missing out on the benefits that renewable energy development could have afforded Nigeria, especially with regards to rural electrification.

4) Perception of Renewable Energy Technology

It could be discerned from the responses that the perception of the bureaucrats and Nigerians towards renewable energy technologies at the moment was not favorable. As should be expected, this constituted a hindrance to its rural electrification efforts. The perception of renewable energy technologies have been found to be important in explaining the public's acceptance of an energy technology (Visschers & Siegrist, 2014). If the understanding that negative ideas about the characteristics of renewable energy are expected to serve as disincentives, while positive ideas could serve as incentives for adopting renewable energy applications (Eshchanov, Plaat, & Stultjes, 2011), then this finding holds true to the literature based on what is being experienced presently in Nigeria.

The participants emphasized that the unfavorable way renewable energy technologies are perceived in Nigeria has been compounded by various factors. On one hand, the presence of low quality imported equipment [MOP3] and issues of reliability of available technology [MOP7] have tarnished the impression people have of renewable energy technologies. While on the other hand, having the wrong perception as indicated by one of the participants [NERC2] has also led to unmet expectations imposed on renewable energy technologies – further discrediting them.

However, while acknowledging the issue of perception as a problem, some of the participants had a positive outlook. NERC1 advanced that confidence in renewable energy could be cultivated with improvement in quality of the renewable energy technologies allowed into the market. Another participant was of the view that the people's perception of renewable energy technologies is actually improving noting that the realization of the benefits of renewable energy is an understanding that people are beginning to have.

5) Bureaucratic Ineffectiveness

Bureaucratic ineffectiveness was another notion expressed as a major concern by the participants. The analysis shows that most of the participants indicated this issue as an offshoot of the perceived weak institutional structure in the country. The situation, as explained by most of the participants, was that presently, the institutions in the country are very weak and as such incapable of sustaining a renewable energy powered rural electrification programme. As asserted by some of the participants, this poor institutional structure has led to wastage in both financial resources and effort.

The participants' perception of bureaucratic ineffectiveness being of immense concern, especially as it affects almost all the aspects of implementation, supports the argument by Mohammed, Mustafa, Bashir and Mokhtar (2013) that bureaucratic ineffectiveness was among the key challenges to renewable energy development in Nigeria. Due to the vital position occupied by the bureaucrats, an ineffective bureaucracy was seen as highly detrimental by most of the participants. As one of the participants observed, it inherently weakens the institution and consequently creates room for lapses and oversight by government personnel.

6) Misplaced Priorities in Renewable Energy Projects

Misplaced priorities in renewable energy projects in Nigeria was the least factor perceived by the participants as an inhibitor. This was highlighted by a number of the participants as a barrier to the widespread uptake of renewable energy powered rural electrification in Nigeria. Expressed in varied degrees was the perception of a clear misdirection of focus by the authorities in regards to renewable energy powered electrification projects in the country. A shown by the interview data, projects being classified as renewable energy powered rural electrification projects are limited in scope; for instance the ubiquitous solar powered street lights in most communities. The motivation behind most projects are also misplaced as they are politically initiated, therefore making such projects unsustainable. As affirmed by one of the participants, most rural electrification projects being executed were constituency projects commissioned mostly for "political aggrandizement."

Another issue that has complicated the prioritization of renewable energy powered rural electrification projects, is that of confusing grid extension for rural electrification. One of the participants pointed out that, in reality, efforts geared towards rural electrification in Nigeria were not to be considered rural electrification in and of itself as they were nothing but grid extension practices disguised as rural electrification projects. An understanding of what rural electrification is, according to the participants, would help to a large extent in the prioritization process of renewable energy powered electricity projects. Better prioritization was deemed essential to overcome this problem in order to enable full implementation of renewable energy powered projects.

5.3.2.2 Analysis of Themes in Thematic Analytic Category 2 – Facilitators

As indicated in Section 4.3.2, facilitators were established as factors perceived and portrayed by the participants as being beneficial to the adoption of a renewable energy powered rural electrification programme in Nigeria. Sustaining these factors, as the findings show, is essential for the entrenchment of the use of renewable energy for rural electrification in the country. Human capacity development, government incentives, funding, political will, better coordination, and commitment of the local communities were the key factors portrayed by the

participants as facilitators of a renewable energy powered rural electrification programme in Nigeria. Figure 5.3 shows the distribution of the responses from which the themes in this category were obtained.

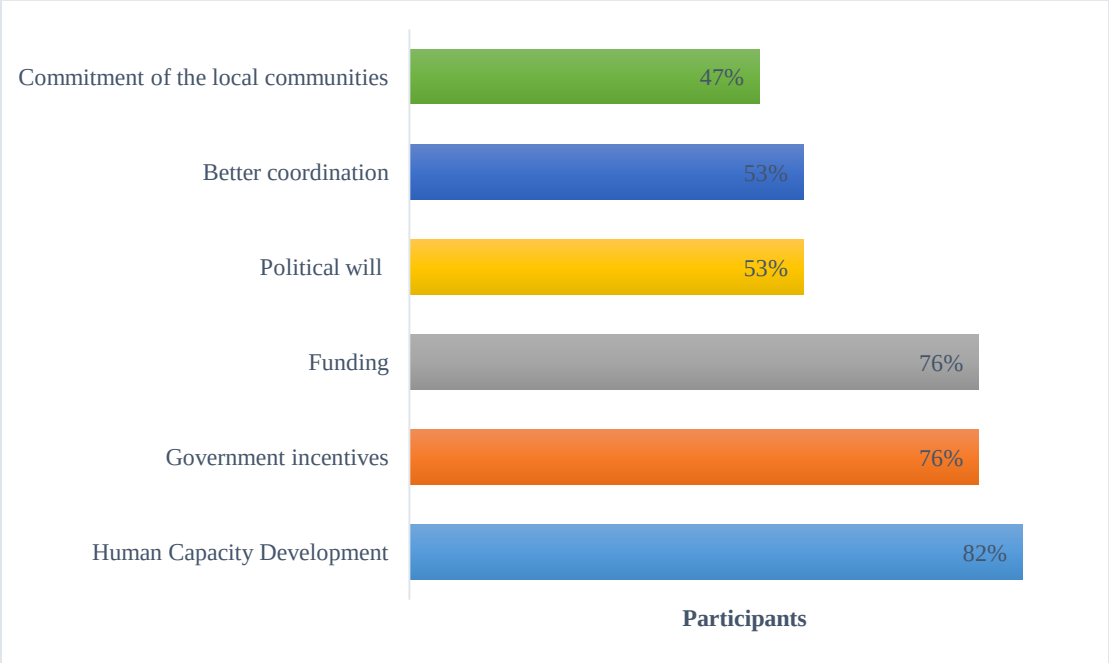

Figure 5.3 Perceptual Factors - Facilitators

1) Human Capacity Development

The findings support the need for capacity building to properly integrate any efforts being made by the Government to boost renewable energy powered rural electrification in Nigeria. A large proportion of the participants acknowledged the importance of developing human capacity in the area of relevant technological systems. Building high analytical competence [REA2], local technical know-how [MOP1, MOP2, NERC1], as well as training [ECN1, MOP3, REC2], are seen as vital by the participants to instituting renewable energy powered rural electrification in Nigeria.

The need for capacity building to install and maintain renewable energy technologies was one way of boosting the nations' interest in renewable energy technology for power generation (Chineke & Ezike, 2010).

Analysis shows that this finding resonated with those from prior studies. For instance, Agboola (2011) who recommended that for there to be any form of power generation reform in Nigeria, the need in manpower, research and electricity conservation awareness had to be met, and Van Leeuwen and Ruff (2014, p. 373) who found that "to achieve significant increases in energy supply operations and delivery, there would need to be a corresponding growth of a trained and educated workforce."

Similar to Van Leeuwen and Ruff (2014, p. 373), the findings shows that in order to "help support needed systemic change and to ensure that suitably qualified local capacity exists to provide appropriate installation and maintenance services on an on-going basis", incorporation of renewable energy and rural electrification studies into the national university curriculum is a perfect means of bringing about human capacity development. The arguments by the respondents that made up this particular finding were closely related to those connected to the issues of a lack of knowledge of appropriate renewable energy technologies by officials tasked with the job of seeing to the implementation of renewable energy powered electrification programs in Nigeria. As implied by the responses, the general drift was that human capacity in the form of knowledge of appropriate renewable energy technologies and high analytical competence on the part of the officials is connected to the means of alleviating most of the hurdles that a renewable energy powered rural electricity program could face.

2) Government Incentives

Government incentives was portrayed by the participants as a very viable means of promoting the use of renewable energy in the rural electrification sector in Nigeria. It was deemed vital by most of the participants mainly on the basis of cost reduction and easing of operations due to the high capital cost associated with renewable energy technologies deployment. Similar to findings by Ajayi and Ajayi (2013) regarding the relevance of economic and fiscal incentives to the development of renewable energy, this finding highlights the provision of subsidies [MOP7, ECN3, ECN1], waivers, elimination of taxes and security of investment [NERC2, NERC1] as incentives that could help propagate the use of renewable energy for rural electrification in Nigeria.

3) Funding

Funding of capital investment and deployment of renewable energy technologies for electricity generation was acknowledged by the participants as critical for renewable energy powered rural electrification in Nigeria. Adequate funding, it was noted, would help in reducing the total cost of installation and ultimately the end tariff by customers [ECN3 and REC1]. This finding is in consonance with the argument that overcoming the issue of funding was essential to giving renewable energy in Nigeria the required impetus (Bugaje, 2006).

The issue of adequately funding renewable energy projects as emphasized by this finding also corresponds with the recommendation by Muhammad (2012, p. 8) that there was the "need to establish a renewable energy funding machinery agency that [would] fund and finance renewable energy projects in Nigeria" at the different levels of Government. This will be an agency funded specifically for energy research and development, and charged with the responsibilities of renewable energy programmes.

4) Political Will

The analysis shows that the participants acknowledged the relevance of political will in ensuring the uptake of renewable energy in rural electrification in Nigeria. The "political zeal to implement desirable energy options" (Nnaji, 2010, p. 35) has been highlighted to be a major limitation to the propagation of renewable energy development in Nigeria due in large part to political interest. Although political will and other actions by Government that help in reforms in energy are often difficult to ensure (Asia Development Bank, 2009), it has been found just as this finding has indicated, that "given political will and transparent energy policies, renewable energy technologies can be disseminated to the people of Africa" (Chineke & Ezike, 2010, p. 683).

5) Better Coordination

In Nigeria, the fact that so many agencies are involved with renewable energy development raises concerns for coordination among these agencies. The analysis shows that most of the participants saw the superfluous number of agencies as avenues through which resources have been drained; hence, perpetrating the problem of wastage, redundancies, and overlap of duties and activities. The notion of better coordination as portrayed by the participants was to

organize renewable energy powered rural electrification initiatives with other infrastructure development efforts to provide a broad set of complimentary infrastructure (Kirubi, Jacobson, Kammen, & Mills, 2009).

This finding shows that coordination is required to help streamline the budget [ECN3], encourage synergy and promote buy-in of stakeholders [MOP5, ECN1]. Although the consensus was more towards a leaner arrangement with a couple of implementing bodies, one of the participants (ECN2) however did not see the numerous number of agencies as a problem as implied by the others; what was important, according to him, was having them all work together.

6) Commitment of the Local Communities

The importance of having the buy-in of recipient communities as a means of building confidence in renewable energy powered electricity projects was emphasized by the participants. The commitment of the local communities was perceived as a facilitator as it ensures community participation and sustainability of development projects. The involvement of the communities, as described by the participants, is a sure means of expediting rural electrification in Nigeria. This is because carrying the communities along ensured their willingness and cooperation.

As this finding shows, commitment of the community can be shown by way of active participation which provides the added benefit of fostering responsibility and a sense of ownership which the literature indicated are essential for the sustainability of such projects (Bhattacharyya & Ohiare, 2012; Green, 2004). Though the notion of commitment of the local communities was portrayed as vital to the development of renewable energy in Nigeria, it was, however, noted by two of the participants that obtaining commitment or buy-in of the communities in rural electrification projects, irrespective of how well-meaning it is, is not that easy to come by in rural Nigeria.

5.3.3 Thematic Analytic Category 3: Characteristics of Renewable Energy that could Affect its Adoption

As already stated in Section 4.4, there are certain intrinsic factors or characteristics particular to the concept of renewable energy. For analysis purposes, three of the findings from this study – internal physiognomies of renewable energy, external physiognomies of renewable energy, and country specific factors related to

renewable energy and rural electrification – were grouped under this thematic analytic category which reflects those characteristics of renewable energy that could impact its acceptance as a viable energy source for rural electrification in Nigeria.

5.3.3.1 Analysis of Themes in Thematic Analytic Category 3 – Internal Physiognomies of Renewable Energy

This category is made up of five themes that represent such characteristics of renewable energy as cost-effectiveness, abundant supply, appropriate technology, domestic source of energy and clean energy. These features of renewable energy, in more ways than one, were perceived to greatly impact the adoption of renewable energy for rural electric power generation. They represent the common characteristics of renewable energy which most often influences its adoption as an electric power source in general. The distribution of the responses from which the themes in this category were synthesized are shown in Figure 5.4

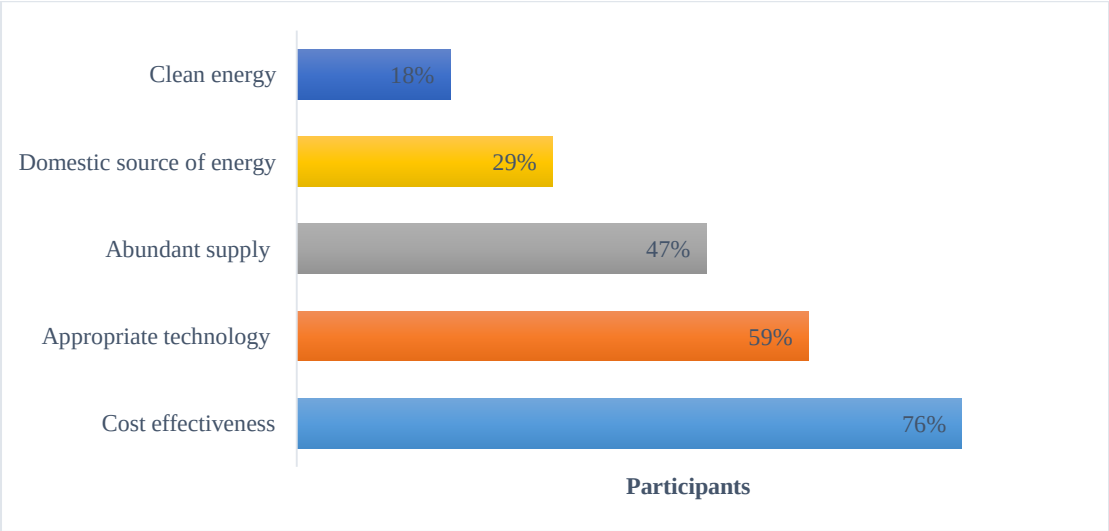

Figure 5.4 Internal Physiognomies that could Affect Renewable Energy Deployment

1) Cost-Effectiveness

From the analysis, the dominant characteristic of renewable energy that could influence the deployment of renewable energy technologies in Nigeria is cost effectiveness of the deployment of renewable energy projects. The discourse on renewable energy powered rural electrification is filled with issues relating one way or the other to cost (Afa, 2013; Agbemabiese, Nkomo, & Sokona, 2012; Ajayi & Ajayi, 2013). While acknowledging the onset capital cost of renewable

energy technologies deployment, the cost-effectiveness of renewable energy projects compared to the conventional means of electricity supply on the long run was emphasized by a majority of the participants.

Several reasons have been provided as to why renewable sources of energy are becoming increasingly more cost-effective and thus competitive with conventional modes of electric power generation and supply (Chaurey, Ranganathan & Mohanty, 2004). The arguments by those participants who mentioned cost-effectiveness are all in line with the literature. Apart from one participant (MOP2) who noted that the major concern of Government is not only to look at how cost effective renewable energy was, but to see if the choice of renewable energy could serve the purpose of provision of electricity, these participants highlighted the attractiveness of renewable energy projects based on such factors as life-cycle cost analysis [ECN1, MOP6], cost saving by eliminating grid extension [NERC1] and the requirement of very little maintenance [REC1].

2) Appropriate Technology

Although the interest among several actors is indifferent, it's been argued that appropriate renewable energy technologies could contribute to expansion of off-grid rural electrification (Ahlborg & Hammar, 2012). The appropriate technology characteristics of renewable energy was seen by the participants who commented on this subject, as a big factor in promoting its large scale adoption. Most of these participants made the case that rural electrification will mostly be built around renewable energy, based on the reasoning that it is what is best suited for rural electrification.

The general consensus was that with renewable energy comes appropriate technology in rural electricity provision. Appropriate renewable energy technologies connote a degree of flexibility that ensures that the right technology is deployed in the right circumstance. This, according to the participants, is what renewable energy affords a proper decentralized rural electrification strategy. As concluded by most of the participants (ECN1, REA2, MOP6, MOP2), appropriateness of any selected technology is a major selling point for proving that renewable energy could do the job of powering rural electrification in Nigeria.

3) Abundant Supply

It is generally understood that where there is an abundance of a given energy source, exploration of such an energy source tends to be the primary objective. However, as revealed by some of the responses, this seem to not be the case in Nigeria, especially with regards to the use of renewable energy for rural electrification. A number of the participants acknowledged that Nigeria seemed to buck the trend and has consciously overlooked the development of its abundant renewable resources.

Sharing a similar perspective as Akinbami (2001) who highlighted that the abundant energy resources – both conventional and renewable – available in Nigeria provides the country with immense capacity to develop an effective national energy plan, a number of the participants (MOP6, REC1, MOP5, ECN3, MOP7) noted that this variety and abundant supply of renewable energy sources is ample motivation for considering their application in power generation in rural communities. However, one of the participant was of a contrary stance; opposing the notion of abundant resource as a driver for the wide propagation of renewable energy projects, the participant argued that other factors other than abundance had more to do with having a renewable energy powered rural electrification programme in Nigeria.

4) Domestic Supply of Energy

The idea of renewable energy filling the bill of being a domestic source of energy was highlighted as having a very powerful appeal. This characteristic of renewable energy sources to generate energy that can be converted to electric power and used almost at the point of generation was pointed out by the participants to be advantageous in several ways. It provided cost saving benefits [MOP2], expedited electrification operations [MOP6] and eliminated irrelevant infrastructure for transmission [ECN1]. As shown by this finding, being an energy source local to the area of deployment reinforces other advantages of renewable energy as a source of power such as cost reduction and employment generation.

5) Clean Energy

The clean energy characteristics of renewable energy sources was another strong appeal of renewable energy highlighted by the participants. The

importance of renewable energy as a clean source of energy cannot be over emphasized. As found by Pao, Li, and Hsin-Chia (2014, p. 933), "with the increasing importance of sustainable development, clean energy sources (e.g., nuclear and renewable) have become the major components in the energy matrix." However, what the analysis shows is that in reality, the clean energy attribute of renewable energy is not really a strong argument for deploying renewable energy technologies in Nigeria.

Although some points were made in line with developing renewable energy for rural electrification as a way of counteracting the adverse effects of the use of fossil fuel locally [MOP6] and also as part of the nation's contribution to offsetting emissions globally [ECN1], the real issue that resonates with developing renewable energy for electric power generation, especially in the rural market, is more of it being an adequate rather than a clean source of power. As emphasized by one of the participants, due to the shortage of electric power in general, the nation's concern should be more on obtaining electric power irrespective of whether it is from a clean source or not.

5.3.3.2 Analysis of Themes in Thematic Analytic Category 3 – External Physiognomies of Renewable Energy

In this section, the external characteristics of renewable energy that could affect its choice as a source of electricity in rural electrification projects are discussed. These characteristics which have been classified as external, based on the reasoning that they impact the idea of using renewable energy from the outside rather than being an inherent attribute of renewable energy per se, include perceived value of renewable energy, energy policy and frameworks, topographical considerations, environmental/climate change mitigation requirements, energy security, energy politics, and catalyst for stimulating rural development. Figure 5.5 shows the distribution of the responses from which the themes that made up this category were obtained.

The seven themes grouped under this category represent the general external characteristics of renewable energy which could influence its adoption as an electric power source. These external features of renewable energy are tangible features attributed to renewable energy and its associate technologies that come about as a result of the impact caused by renewable energy adoption or influences that could result from other sources other than renewable energy.

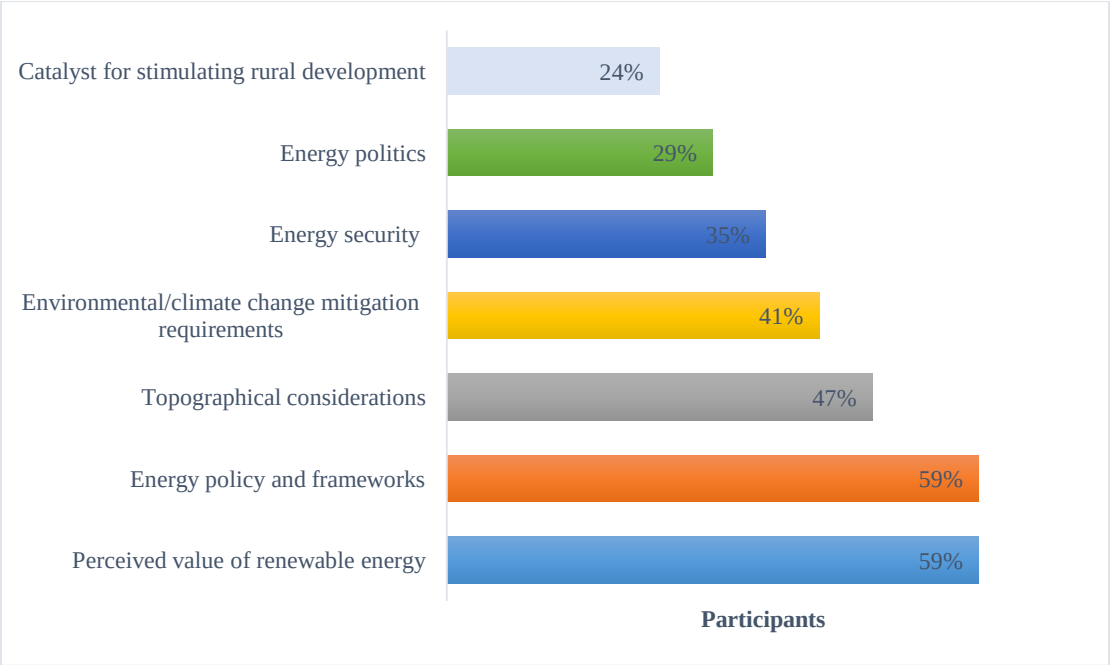

Figure 5.5 External Physiognomies that could Affect Renewable Energy Deployment

1) Perceived Value of Renewable Energy

The perceived value of renewable energy entails how important renewable energy was viewed as an energy source for electricity generation. It was highlighted as one of the factors that could influence the uptake of renewable energy in powering rural electrification projects in Nigeria. People are now looking to renewable energy and it is becoming more valuable with the realization that conventional approaches to energy access are approaching their limits (Agbemabiese, Nkomo, & Sokona, 2012).

Analysis shows that the participants were aware of the realization of the importance and benefits of renewable energy being expressed by Nigerians. They pointed out that people are now keying into the idea of renewable energy [NERC1], considering it as supplemental to the fossil fuel powered grid [MOP1], as well as in off-grid and distributed generation [MOP4, NERC2].

2) Energy Policy and Frameworks

Energy policy and frameworks was stressed as a very important factor in promoting renewable energy powered rural electrification by the

participants. Though there exist numerous policy statements (Ajayi and Ajayi, 2013), Nigeria really lacks a comprehensive national energy policy; A "policy that will help the country to develop an integrated sustainable energy strategy … and disseminate renewable energy technologies" (Akinbami, 2001, pp. 177-178).

In line with existing data, the findings show, as concluded by Efurumibe, Asiegbu, and Onuu (2014, p. 75), that in Nigeria, "substantial flow of resources and policy attention is on the fossil fuel sector." This, as noted by some of the participants, has made it quite difficult for renewable energy to gain much ground. The responses emphasized that for renewable energy powered rural electrification to gain roots, the right policy framework is needed [MOP1, REA1, NERC1] as it would help with increasing awareness [MOP6] and defining the Government's direction on the application of renewable energy technologies [MOP5]. This finding substantiates Akinbami (2001, p. 178) who argued that among several positives, a comprehensive policy could "also act as a catalyst in the drive for transfer and acquisition of appropriate technologies adopted to suit local conditions and environment."

3) Topographical Considerations

Topographical considerations were highlighted by a number of the participants as a barrier to the rural electrification strategy of grid extension in Nigeria, and by extension, indirectly an advantage of the concept of renewable energy powered rural electrification. Renewable energy sources have been suggested to be the best alternative to reduce the energy poverty of rural areas where grid extension through difficult terrains are prohibitive (Borhanazad, Mekhilef, Saidur, & Boroumandjazi, 2013). This finding shows that this was a view strongly supported by the participants. Getting the strategy right according to them was paramount. It dictated the choice of a renewable energy backed strategy from the view point of cost savings [REA2, MOP5], as well as the elimination of the problem of securing extension lines from theft and vandalism [NERC1].

4) Environmental/Climate Change Mitigation Requirements

Though environmental requirements has not been a strong influence on the debate for renewable energy adoption in Nigeria as it has been in most Organisation for Economic Co-operation and Development (OECD) countries, the view that climate change concerns are increasingly becoming a compelling driver

for sustainable energy (World Bank, 2004) was reinforced by some of the participants. This finding shows that global warming [MOP3] and greenhouse gases [MOP6] were seen as reasons for more interest in renewable energy sources and why Nigeria should be part of it.

One of the participants (ECN2) figured that environmental regulations in the form of requirements for carbon footprint reduction could be useful in leveraging support for renewable energy development from the fossil fuel sector. This is expected to provide a win-win situation for the nation. The point is to use resources from fossil fuel for renewable energy development as a means of offsetting the damages inflicted by fossil fuel exploration in the country.

5) Energy Security

Energy security was implied by the participants as an attractive way of portraying renewable energy development in order to make it less threatening to advocates of fossil fuel and large hydro. They emphasized that the development of renewable energy could serve as security for or as a means of prolonging the other energy resources like fossil fuels in Nigeria. This is in line with the belief that energy security entails diversifying the energy portfolio to include more renewable energy as diversification contributes to the economic and energy security of a nation (Flavin & Aeck, 2005).

The finding indicates that, developing renewable energy alongside the existing fossil fuel resource, not only guarantees reliability but also helps maintain uninterrupted supply and conservation of the fossil fuel resource [MOP3, MOP6, REA2, NERC1]. It maintains the same views as Aliyu, Ramli and Saleh (2013, p. 366) who found that "a diversified energy supply mix, [would] ensure greater energy security for Nigeria."

6) Energy Politics

As the literature shows, energy politics is of great relevance as it affects the dynamics involved in choosing what type of energy source to develop, and how to develop such energy source for electricity generation. Energy and politics are intrinsically linked (Shaffer, 2011) and politics has been shown to be an important part of "determining the goals of electrification policies" (Cecelski & Glatt, 1982, p. 7).

Energy politics in terms of global governance, as indicated by the literature, can help promote renewable energy by committing governments and

other policy actors to increase the use of renewable energy within their spheres of influence. It can also "facilitate free trade of renewable energy technologies and services, transfer finance and technological know-how and advise governments and other policy actors on how to promote renewables in an effective way" (Roehrkasten, 2015, pp. 20-21).

Politics associated with energy, as it seems and as implied by the participants, could be a favorable or an inhibiting factor for renewable energy. It plays a role in dealing with pressure from international organizations [ECN1 and MOP3], as well as in government interactions with players in the energy sector locally [ECN3]. Having a healthy balance is, therefore, of the essence in order for renewable energy to be considered in a society like Nigeria.

7) Catalyst for Stimulating Rural Development

Renewable energy as a catalyst for rural development was another important factor viewed by the participants as reason for promoting its use as an energy source for rural electrification. Though the provision of energy alone cannot guarantee rural development (Economic and Social Commission for Asia and the Pacific, 2008), its availability has proven to be a catalyst for economic and social transformation (Bugaje, 2006; Goldemberg, 2000). This finding, in accord with findings in the literature, shows that the little experience Nigeria has of renewable energy powered rural electrification indicates that renewable energy powered rural electrification could [REA2, NERC1] and have actually brought about some form of development in rural Nigeria as have been seen with some of the constituency projects [ECN2].

Interestingly, it was also found that contrary to the position held by most of the respondents on the relationship between renewable energy and rural development, one of the participants (MOP2) pictured the relationship from a different perspective. According to him, proper rural development would catalyze the use of renewable energy rather than the other way round as was presented by the others. From his perspective, a well-orchestrated rural development programme will entail the use of the available renewable energy sources for the generation of electricity locally, hence promoting its use on a larger scale.

5.3.3.3 Analysis of Themes in Thematic Analytic Category 3 – Country Specific Factors Related to Renewable Energy and Rural Electrification

An underlying cause of power outages in Nigeria has been traced to several issues, among which are the electricity demand deficit of about 7,500 MW which exists as a result of the country's low generation capacity of an average of 3,600 MW (Aderibigbe, 2010; Oluwole, Samuel, Festus, & Olatunji, 2012). Data show that most of Nigeria's electricity (about 72.9%) is generated from fossil fuel, with hydropower accounting for the balance (World Bank, 2011). Despite large reserves and production of oil and gas and significant hydroelectric power potentials, total output is significantly lower than current demand. Nigeria as described in a nutshell by Eleri (2002a, p. 177) "is paradoxically energy starved."

As can be seen, the above analysis paints a very gloomy picture specific to the local context. From a global perspective, issues like deficient electricity industry, nonexistent renewable energy policy, underutilization of excess resources, lack of continuity in government programmes, antiquated process and endemic corruption might appear trivial, but several things taken for granted in other nations with similar endowments are not common place in Nigeria. Figure 5.6 shows the distribution of the responses from which the themes that made up this category were obtained.

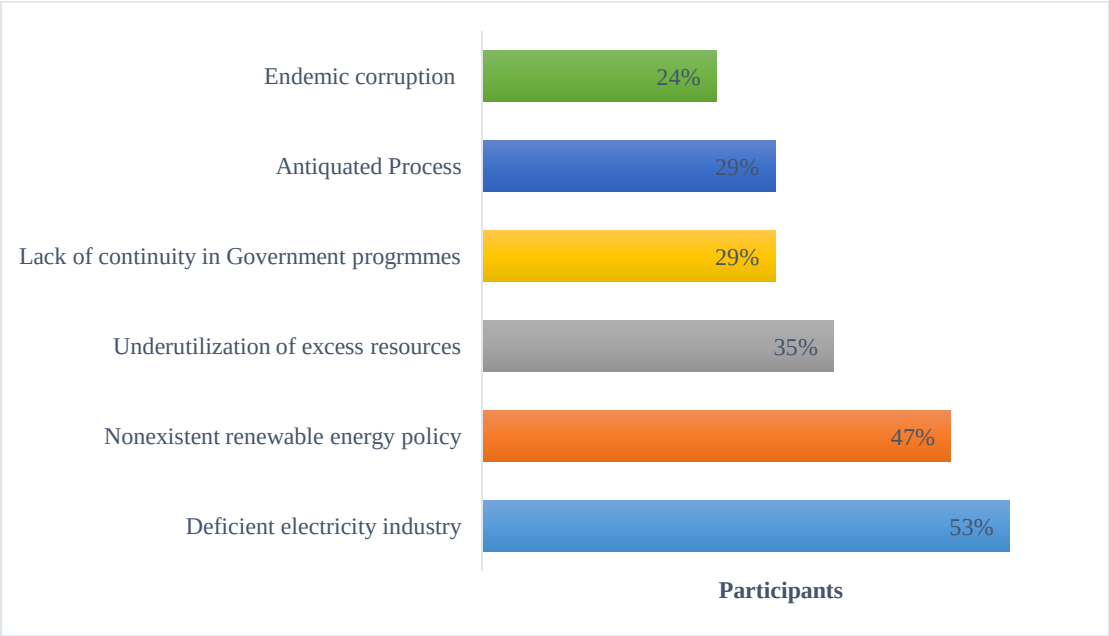

Figure 5.6 Country Specific Factors that could Affect Renewable Energy Deployment

1) Deficient Electricity Industry

Nigerians practically live in a society plagued with a deficient electricity industry. Current power generation data shows that the available supply is inadequate to meet the nation's demand (Vincent & Yusuf, 2014). The deficient electricity industry has not only adversely impacted the urban, but the rural electricity sector as well, with the rural areas bearing the worst of it. With respect to the deficient electric power sector in Nigeria, this finding shows that efforts to rectify it will conversely prove beneficial to renewable energy. As indicated by some of the responses, the misfortune of a deficient electric power industry in the country, should create some room for considering renewable energy technologies and more interest in renewable energy powered decentralized electricity generation in Nigeria in general, and particularly in rural electrification [REA1, ECN1].

2) Nonexistent Renewable Energy Policy

A nonexistent renewable energy policy, as noted by the participants, has been one of the banes of renewable energy uptake in Nigeria. It has been shown that a lack of policy can exacerbate inefficiencies in an energy programme (Asia Development Bank, 2009) and the nonexistence of an actual renewable energy policy in Nigeria is evident of this. The absence of a policy specific to renewable energy was underscored as a major constraint facing renewable energy development in Nigeria by this finding.

According to the participants, it has deterred interested investors [MOP5], made coordination more difficult [MOP2] and has further solidified the dominance of fossil fuel [MOP1]. Having a renewable energy policy as indicated by this finding could help smoothen the way for more activities and interest in renewable energy development [ECN2, MOP7]. A renewable energy policy will also help shift focus from fossil fuel to renewable energy development in the country.

3) Underutilization of Excess Resources

This finding shows that the underutilization of the excess resources in Nigeria is a major problem. Nigeria's electricity sector is more in line with programmes that promoted the use of fossil fuels and large dams for hydro power production than renewable energy sources (Ajayi & Ajayi, 2013; Shaaban & Petinrin, 2014). As decried by one of the participants, even with the abundant

renewable energy sources, its development and utilization for electric power generation in rural electrification is less than 0.5%.

This finding also shows that Nigeria has underutilized its renewable energy resources in the area of hydro resources. Hydro resources suitable for small and micro electric power generation available in Nigeria are not being harnessed properly according to some of the participants. They are mostly being used for irrigation and water supply. A way to develop Nigeria's renewable energy resources, as indicated by these participants, is to consciously refocus the adopted strategies that require the use of these resources. This is because proper utilization of these resources is what could help propel electric power generation (Ubi, Effiom, Okon, & Oduneka, 2012).

4) Lack of Continuity in Government Programmes

A major challenge to the uptake of renewable energy technology in rural electrification and development projects in Nigeria highlighted by some of the participants is the lack of continuity in Government programmes. Although not primarily specific to Nigeria alone, this is a major issue in most African countries (Agboola, 2011). In Nigeria, however, as pointed out by some of the participants, continuity on the part of Government policies and programmes tend to die with the administration that instituted them.

The issue of the lack of continuity of government programmes highlighted by some of the participants are mainly as a result of political leanings [ECN2], weak institutional structure [MOP5, MOP2], and poor human capacity development [MOP1]. Lack of continuity has led to most meaningful projects getting truncated as soon as there is a new administration, creating a vicious cycle of always starting afresh, repeating stages that have already been covered and wastage of financial resources and effort. This finding shows, similar to the recommendations in the literature, that these issues could be mitigated "with political will, commitment and continuity rather than unpredictability of rural development programmes and agencies" (Ocheni & Nwankwo, 2012, p. 55).

5) Antiquated Process

The use of an antiquated process of power generation and delivery as found here, has not helped with the problem of low electricity coverage in

Nigeria. Similar to findings by Vincent and Yusuf (2014) who claimed that Nigeria's poor energy situation results from the national grid network which is burdened with inefficient power plants, deteriorated long transmission and distribution lines, and obsolete infrastructure, analysis shows the view of the participants that an overhaul of this antiquated strategy is required as this will give room for the country to explore other avenues like the use of renewable energy.

The conception by the participants was that by sticking to the current antiquated grid system, the nation has failed to develop other forms of electric power generation like a renewable energy backed decentralized system that could have conveniently served rural electrification purposes [NERC2, ECN3, REC1] and helped with the development of the vast array of renewable energy resources available.

6) Endemic Corruption

This finding shows that the source of some of the problems facing renewable energy powered rural electrification in Nigeria could be traced to the endemic corruption in the country in general, and energy establishment in particular. Corruption, seen as a ubiquitous practice that has ravaged every sector of the economy, including the power sector, is attributed to be a symptom of poor institutions in Nigeria (Vincent & Yusuf, 2014).

According to the participants, corruption has posed numerous challenges for renewable energy. It has given room for substandard and low quality renewable energy technologies to enter the market, thus diminishing the credibility of renewable energy technologies [MOP3]. Its eradication from the electric power and energy industry was proposed as one key means of fostering renewable energy development for electricity generation in Nigeria. This finding is in line with the recommendation by Iwayemi (2008, p. 20) that:

> The elimination of the electricity curse and emergence of the required strong investment response are contingent on (among other things) radical reform in the sector embodying changes to improve and strengthen the industry governance structure to enhance accountability and minimize corruption.

5.4 Summary of the Findings

The findings from this study in the most part confirm existing qualitative information about factors that could influence the uptake of renewable energy and its associate technologies for rural electrification and development in a fossil fuel rich country like Nigeria. Similar to how technological innovations systems are sustained (Bergek, Jacobsson, & Sandén, 2008), the adoption of renewable energy for sustainable development, as indicated by the participants, is often facilitated based on the strengthening of the enabling elements and weakening of the inhibiting ones found in this study.

Based on the outcome of the analysis, it can be inferred that the participants agreed with the idea of Nigeria expanding its rural electrification programme to include the use of the abundant renewable energy resources. With the problems the electric power industry is facing at the moment, a decentralized electric power generation strategy specially targeted at meeting rural demand creates an opening for renewable energy development and deployment. The findings further showed that the importance of energy bureaucrats in policy programme realization cannot be overemphasized. Policy, as indicated by Kelly (2005, p. 869), "is implemented by bureaucrats and governmental agencies, and their actions can diverge greatly from the initial intent of legislators." Their action or inaction can cause bureaucratic bottlenecks and delays which could hamper policy programme realization (Energy Commission of Nigeria, 2005a).

Developing the human capacity of the bureaucrats and officials in the energy sector, as indicated several times during the course of the interviews, was one factor which will not only help build a strong advocacy base, but also increase awareness of the value of renewable energy. It could further help promote its credibility as a viable energy source for rural electricity applications in Nigeria. Likewise, a committed interest from the Government was seen as the fulcrum on which all the factors were anchored. In sum, it was found that without a conscious government commitment, all other resources for the propagation of a renewable energy powered rural electrification programme in a fossil fuel rich country like Nigeria cannot be accessed.

5.5 Discussion of this Study's Research Questions

Relating the findings of this study to the research question entails the alignment of the emergent themes with the research questions. Synthesis of these themes shows that the issues relating to each of the research questions are addressed in part by most of the themes directly, and in some areas by a combination of two or more themes.

5.5.1 How has being a Fossil Fuel-rich Country Affected the Large Scale Adoption of Renewable Energy Technology for Rural Electrification and Development Projects?

The general assumption was that being a fossil fuel-rich country has greatly affected interest in the use of the abundant renewable energy resources for electric power generation in Nigeria. Fossil fuel has had a considerable amount of influence on several aspects of electricity development in the country, ranging from policy to the perception and the way of thinking about electricity generation of the average Nigerian (Ajayi & Ajayi, 2013; Akinbami, 2001). When Nigerians think of electricity, what comes to mind is basically fossil fueled/large hydro and not renewable energy based generation of power.

However, the findings show that the renewable energy–fossil fuel dynamics in Nigeria, or the relationship between the existence of both energy sources is not as clear cut as was assumed. While data from other studies and most of the responses confirmed the initial assumption that the existence of fossil fuel has had an adverse effect on the use of renewable energy for electric power generation in Nigeria, data from this study shows that this notion is not as strong as was first presumed.

From the views of the participants and the documents reviewed, several arguments that emerged from this study supported the fact that the existence of fossil fuel in itself was not really the obstacle to renewable energy development in Nigeria. The issue was with the way the energy policy and electric power industry were set up, which has only fueled the perception that renewable energy in the presence of fossil fuels had no place in power generation in Nigeria.

The research finding – fossil fuel–renewable energy dynamics – throws some light on this research question. It exposed the fact that renewable energy development in Nigeria, especially for rural electrification need not be adversely affected by the existence of fossil fuel. This is because adopting a complementary strategy would benefit the nation more and help speed up the attainment of adequate electric power supply in Nigeria.

Improved bureaucratic involvement also relates to this question in that with a more active bureaucracy, gaps in the policy system could more easily be plugged and issues obstructing renewable energy development rectified. This could also help with a reorganization of the sector which would lead to better awareness, efficiency, effectiveness and reliability. It is believed that a strategy of co-existence of both energy sources, where renewable energy is applied at the rural front and the fossil fueled/large hydro powered grid dedicated to the urban areas, should be pursued.

5.5.2 How can Policy Makers be Encouraged to Support the Use of Renewable Energy Technologies in Promoting Rural Development in Nigeria?

A key concern the findings from this study accentuates is the gap between the energy bureaucrats and the Government or ruling body. As the findings show, the goals of the policy makers and those of the bureaucrats are almost always not aligned. Being that as technocrats with a reasonable level of stability who see a lot of policy makers come and go, the onus is on the energy bureaucrats to institute a sound working environment robust enough to accommodate the oscillation of programmes that come with the constant change of those in power.

Policy-makers often lack information on efficient renewable energy policies, industry requirements on research, and development and training. As indicated by Roehrkasten (2015, p. 151), “misinformation also prevails. Thus governments are not able to develop appropriate strategies to structurally reform their energy systems.” Therefore, energy bureaucrats should position themselves to be able to deliver high-level information regarding renewable energy and its value to rural electrification when advising policy makers on matters concerning the energy sector. Though it might be tough, they should be able to build a culture of sustainability; one of staying

the course of set programmes till they come to completion instead of always starting afresh or doing the same thing under a different moniker.

Misplaced priorities in renewable energy projects, as shown in the findings, is one key area in which renewable energy for rural electrification has been inhibited in Nigeria. A well informed bureaucracy will be better placed to highlight the relevance of a renewable energy powered project borne out of necessity and aimed at development rather than posturing. Furthermore, better awareness of the value of renewable energy as an environmental/climate change mitigation agent, as well as a catalyst for stimulating rural development, could go a long way to help policy makers realize the importance of renewable energy development in Nigeria.

Based on the findings from this study, it is believed that if policy makers are made to see the development of renewable energy as a means of securing fossil fuels and also as a bargaining chip in international energy politics, then the country can start making headway in achieving a larger propagation of renewable energy in rural electric power supply.

5.5.3 How do the Bureaucrats Tasked with the Responsibility of Providing Electricity for Rural Communities in Nigeria View Renewable Energy Technologies in Nigeria?

Although there were mixed feelings from the respondents as to how well a renewable energy powered rural electrification programme is received by those tasked with the responsibility of providing electricity for rural communities in Nigeria, taken all into account, it can be said that the idea of using renewable energy and its associate technologies for rural electricity supply is welcomed by a majority of the respondents. Most of the participants were of the view that consideration for renewable energy in rural electrification could become more favorable with better awareness, human capacity development of the bureaucrats, government incentives and a better appreciation of those factors and characteristics of renewable energy that could influence its development and deployment.

A reorientation of both the implementers and beneficiaries of renewable energy powered projects was strongly suggested as a means of breaking most of the barriers facing the adoption of renewable energy for rural electrification. Renewable

energy technologies, according to most of the respondents, is advancing on a daily basis. Their vision was that as the technology gets better, the efficacy of such renewable energy powered projects will increase and more people in Government will be converted.

Taking into consideration that the views shared by the respondents on how they and their colleagues feel towards renewable energy powered projects is highly subjective, it can be said that this study was able to highlight the bureaucrats' position that the use of renewable energy is a welcomed development for power supply in Nigeria. This is because, as inferred from the interactions during the course of the interviews and discussions, the respondents were able to draw several analogies from other countries in support of renewable energy powered electrification.

On the strength of how they presented these examples of how renewable energy has been incorporated into the energy programmes of those countries, it could be inferred that renewable energy is viewed in a positive light by the respondents, further indicating that the job of convincing the Nigerian energy bureaucrats to adopt renewable energy powered rural electrification strategies is not that daunting.

5.5.4 What are the Dynamics Involved in Accepting an Alternate Form of Energy for Rural Electrification Projects in a Fossil Fuel Rich Country Like Nigeria?

With regards to this research question, the findings indicate that when it comes to selecting energy options there always exists an element of politics. Politics, it has been found, is a huge part of determining the goals of electrification policies, and it is intrinsically linked to energy (Cecelski & Glatt, 1982; Shaffer, 2011). Energy politics, as an external physiognomy of renewable energy that could affect its adoption, addresses this research question. Understanding that energy politics is very relevant in that it distinctly affects the dynamics involved in choosing what type of energy source to develop, and how to develop such energy sources for electricity generation in a country could help influence how renewable energy for rural electrification is viewed in Nigeria.

The findings also show that other than energy politics and a total overhaul of the electric power industry in Nigeria to cover other forms of power generation which

also includes renewable energy, due to its seemingly rookie status in Nigeria, renewable energy needs very strong advocacy, as well as a high level of legitimation to help institutionalize its use in the energy sector for power generation. Though a fossil fuel powered electrification strategy has not been overtly successful in Nigeria, its use as the primary source of power generation cannot be disputed. So for the dynamics of energy selection in Nigeria to tilt towards renewable energy, legitimization, as found by this study, is a resource highly coveted.

Being that renewable energy for electricity generation, on the surface, is perceived as an "adversary" of the already established fossil fuels in most quarters in Nigeria, legitimizing renewable energy for electric power generation, especially for rural electrification purposes, is very essential for renewable energy to gain the required recognition. This is because with legitimacy, renewable energy will have access to the necessary support structure and resources to strengthen its propagation (Parsons, 1960; Turcan, Marinova, & Rana, 2012).

5.5.5 How has the Interaction between Having an Abundance of Fossil Fuel and Renewable Energy Sources in Nigeria Affected the Choice of Including Modern Renewable Energy Sources and Technologies in the Electrification Mix?

The findings show that the sustainability of a renewable energy powered rural electrification programme in Nigeria depends on many factors. Having an abundance and variety of energy sources should be viewed as an advantage and not a hindrance. Presently, the interaction between fossil fuel and renewable energy in Nigeria has been contentious. Having a preponderance of fossil fuel has dictated largely how much of renewable energy is involved in the energy mix. Although, as already pointed out in this section, a strategy combining both energy sources is more beneficial for Nigeria; the current situation has been unfavorable to renewable energy.

In order to alleviate the seemingly adverse impact of fossil fuel on renewable energy, it is believed that a strengthening of the enabling factors, and mitigation of the inhibitors in general, coupled with a rethinking of the present concept of rural electrification, is needed in Nigeria. Going by the analysis of the data gathered in this study, a sustainable renewable energy powered programme would require the

definition of rural electrification to go beyond grid extension. The objective should be the adoption of a more decentralized generation strategy which would be based on using locally available renewable energy sources for power generation. This in turn would better separate and define the areas of activity of fossil fuel and renewable energy in regards to electric power generation. Also, better access to government support in the form of active government participation will help reduce the bias towards fossil fuel, such that at the policy making level, more incentives can be channeled towards renewable energy development. Sustainability would also be ensured with a more effective bureaucracy that would get more involved with the programmes and their implementation.

Funding, as is found in this study, is not a big issue when it comes to renewable energy powered projects in Nigeria. The main issue is the proper channeling of these funds, prioritizing of the projects and seeing to it that standards are met and quality as well as reliability assured. If the above is properly orchestrated, it is believed that a renewable energy powered rural electrification programme in Nigeria could be sustained over a very long period.

5.6 Recap of the Process of Analysis

The interpretation of the findings from this study along with how they relate to the research questions were presented in this chapter. The themes which were analyzed under three main thematic analytic categories revealed that part of the challenges renewable energy development in Nigeria has been facing is the uphill battle of recognition, as it has to compete in the minds of the respective authorities with the traditional fossil fueled and large hydro power electricity generation strategy.

As noted by some of the participants, there seems to be no specific platform on which to push a sustainable renewable energy agenda due to such elements as lack of awareness and knowledge, weak human capacity, low interest and participation by the Government, and little or no advocacy. The factors found by this study to be of relevance to the research topic also tallied with findings from several other studies regarding renewable energy development, most especially in Nigeria.

The analysis shows that the factors presented in the findings are illustrative of how a sustainable renewable energy powered rural electrification programme can be achieved by taking into consideration and understanding such factors as facilitators and inhibitors of renewable energy development, external and internal characteristics of renewable energy and its associate technologies, as well as country specific factors, and balancing them against those that could help enhance the legitimacy of renewable energy in rural electrification.

5.7 Implications for Practice

From the foregoing and based on the research findings, if anything can be learnt from this research, it has to be that there are a lot of misconceptions about the concept of a renewable energy powered rural electrification strategy in Nigeria. While the hurdles faced by a renewable energy powered programme might easily be discounted as a consequence of the existence of an abundant supply of fossil fuel in Nigeria, in reality the existence of fossil fuel should not have any adverse effect on the propagation of renewable energy but rather be a boost to its development, as both resources can easily complement each other.

If the findings from this study are to contribute to practice, there has to first be a rethinking of the fossil fuel vs. renewable energy dialogue – a misconceived dialogue prevalent in the Nigerian energy and rural electricity sector. With respect to the context in which this study was carried out, it is believed that a government driven process backed by an active bureaucracy will be required for success. This would necessitate the existence of a champion – a focal point or constant between the always changing government administrators and the relatively constant energy bureaucrats.

The implication is that with the existence of a champion who has to be from among the bureaucracy, policies and programmes will have a better chance of running their course and reaching completion, and projects could be instituted with better coordination and effectiveness. A champion would propel advocacy for renewable energy powered rural electrification projects more easily and would have a higher likelihood of seeing to the success of such projects as he or she would be invested in such success by virtue of being a champion to the cause.

5.7.1 Recommendations for Implementers

Rural electrification project implementers are encouraged to reflect on the findings from this study and understand that renewable energy has a lot to offer in terms of cost savings, efficiency and reliability. Implementers should also understand that when it comes to sustainable rural development, a self-sufficient mentality in power generation avails those rural communities a sense of fulfilment of using what they own to generate the power they need.

5.7.2 Recommendations for Development Administrators

By reflecting on the findings of this study, development administrators can find that achieving renewable energy powered rural electrification in Nigeria is not as daunting as it has been presented to be. The findings of this study illuminates the fact that development administrators wield a lot of power in how electrification projects can and should be implemented. For instance, laying down requirements like having such projects powered by local renewable energy sources is one way administrators could affect more positive interest in the use of renewable energy in rural electrification in Nigeria.

5.7.3 Recommendations for Further Research Studies

This phenomenological study could be seen and regarded as the rudimentary work required to start a more focused and serious debate on the exploration of the vast array of renewable energy sources in Nigeria for rural electrification purposes. As such, it is suggested that this study spark new research topics aimed at exploring and extending some of the propositions in this study.

It could also be taken as the starting point of a quantitative investigation of one or more of the themes that emerged from this study, and further investigation could yield more interesting findings and results. It is also believed that conducting the same study with a different sample, for example one that consists of political appointees, could provide a different insight into how renewable energy could be better incorporated into the Nigeria energy system.

5.8 Researcher's Reflections

This study has demonstrated how a flexible research design creates an avenue for findings to be arrived at based on contributions from individuals with different perspectives. It has created a platform for participants to express their views on the efficacy of renewable energy in the Nigerian energy mix. Some of the respondents, while pointing out interesting reasons why fossil fuels should continue to play a central role even in decentralized generation, were, however, able to articulate that with the present state of affairs in the energy sector in Nigeria, this was not really feasible. It was obvious that taking into account the poor state of the energy sector in Nigeria, developing renewable energy becomes less challenging, even when it would have been easier to have the entire nation supplied with fossil fuel generated power due to its abundance.

The atmosphere in most of the interview sessions were almost always clouded with emotions both from the interviewer and the respondents. These emotions were elicited mainly from the understanding that a nation with so much resources would be engaged in this kind of debate – of lack of electricity in the country, and why the abundant resources are not being used for power generation. In situations where emotions crept into the interview, the train of the discussion sometimes drifted into less relevant areas. So the researcher was watchful that these occurrences were minimized to as low a level as was reasonably possible by always drawing the respondents' focus to the interview guide in front of them, and repeating the questions or rephrasing them so the respondents could address the specific questions.

5.9 Conclusion

The purpose of the research was to ascertain the issues affecting renewable energy uptake for rural electrification in a fossil fuel rich country like Nigeria. Though the respondents all shared a diverse range of perspectives regarding how well a renewable energy powered rural electrification programme could actually do in Nigeria, one commonality that resonated from the findings was the fact that there was

a distinct agreement that the Government and energy bureaucrats needed to be more involved.

It can also be concluded that for there to be a deviation from the status quo, and a break in the energy paradox that this fossil fuel and renewable energy rich country is experiencing, especially as it relates to electric power supply, there is a need to spell out a clear programme or strategy for electricity supply in the country. It is envisaged, for instance, that more attention could be paid to renewable energy if rural electrification is designated as being powered strictly through renewable energy.

In a bid to increase and further encourage the promotion of renewable energy in Nigeria, the Government needs to invigorate those mechanisms that have been established as advantageous to renewable energy development and propagation. Renewable energy and its associate technologies will become attractive within the rural electrification arena if such challenges as the absence of a legal framework to regulate the industry, clear rules, legislation, and roles and responsibilities of various agencies and stakeholders being clearly spelt out and enforced.

There is also a serious need for the emergence of a champion who would shepherd the process of tying together the rural electrification goals of the Government with the technical requirements needed to promote the use of renewable energy technologies for rural electrification in Nigeria. The necessity of a champion is not farfetched as it has been found that getting government programs to work requires astute management orchestrated by managers (champions) who are ready to go the entire mile, know exactly what results they want to produce and how they intend to produce them (Behn, 1994).

A champion in this case could mirror the likes of Charles M. Atkins, the Commissioner of the Department of Public Welfare in the State of Massachusetts between 1983 and 1988, who with the employment and training (ET CHOICES) programme, “managed to turn a mess of a department into a very efficient operation” (Behn, 1994, p. 8). Such a champion would be a serious advocate of renewable energy powered rural electrification, and promote its benefits in powering rural electrification in terms of cost savings and alleviation of rural conditions, amongst other advantages.

It is suggested that similar to the ET CHOICES programme in Massachusetts, a renewable energy powered rural electrification programme in a fossil fuel

dominated society like Nigeria requires a champion who is a manager from the bureaucratic ranks with a clear vision of what it entails and how things should be done. A manager who is a champion that will merge political will with interest, kick start a proper funding and financing mechanism, provide awareness across the board and demystify the relationship between the availability of fossil fuel and that of renewable energy.

If renewable energy powered projects are properly executed and can check all the boxes – efficiency, effective delivery, reliability and success – renewable energy and its associated technologies can then be seen in a different light and hence be better positioned as a viable option, as well as supplemental energy source to fossil fuels in electric power generation, especially in the rural areas in a fossil fuel dominated society like Nigeria.

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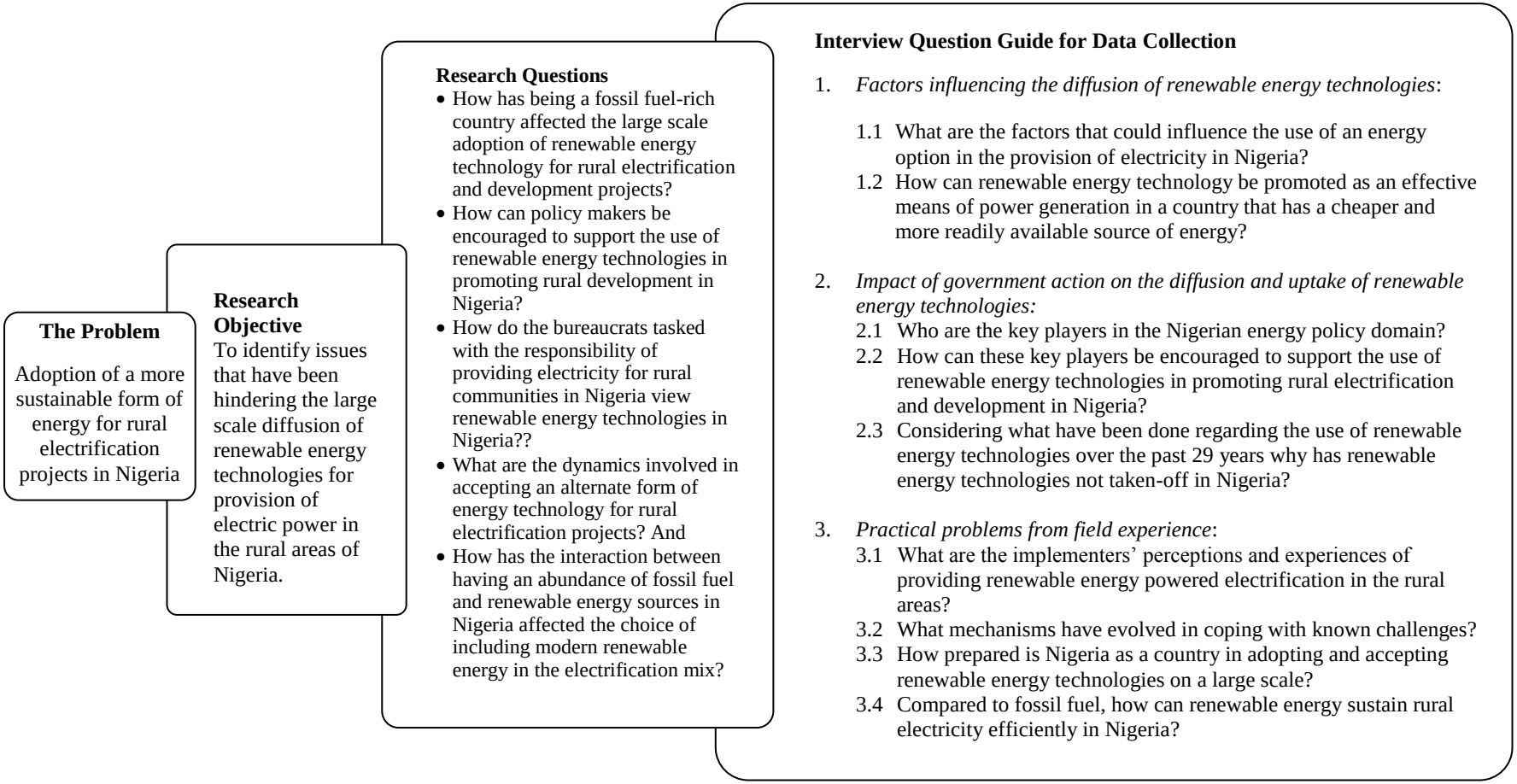
APPENDICES

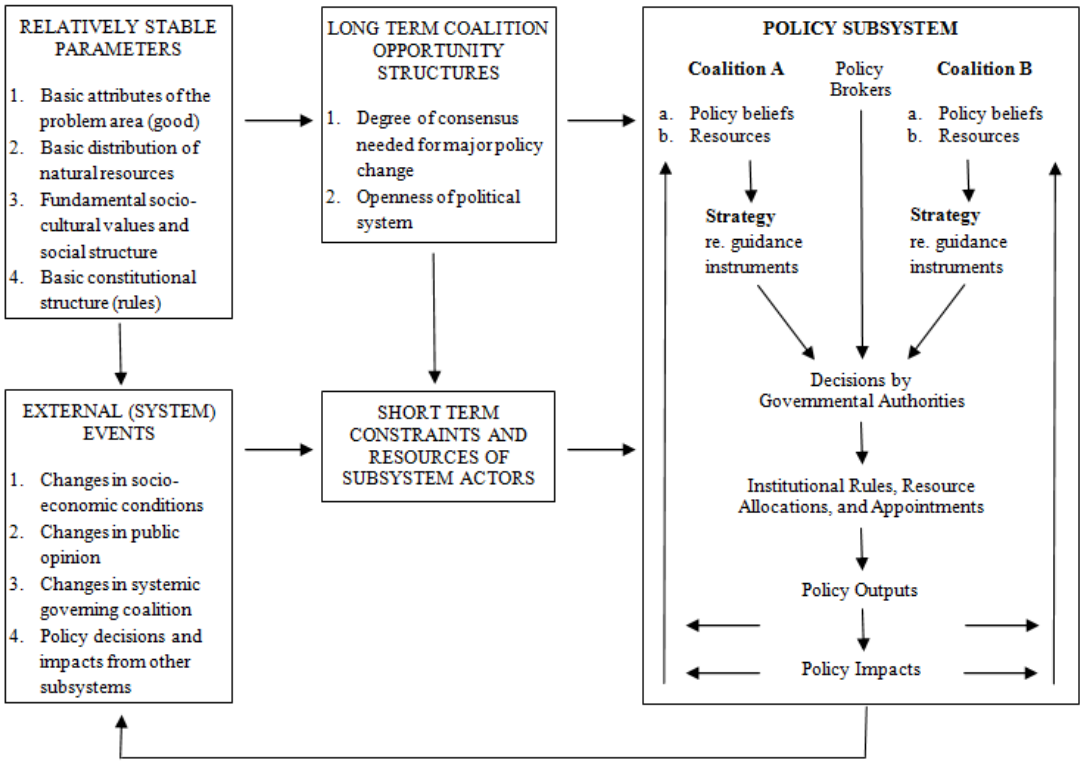
APPENDIX A

Framework for Data Collection



APPENDIX B

Advocacy Coalition Framework



Source: Sabatier & Weible, 2007, p. 202.

APPENDIX C

Interview Guide

Data Collection Sheet

Interview Session ……..… Participant: ……..….. Date/Time: …….

1. Factors influencing the diffusion of renewable energy technologies:
   1.1. What are the factors that could influence the use of an energy option in the provision of electricity in Nigeria?
   1.2. How can renewable energy technology be promoted as an effective means of power generation in a country that has a cheaper and more readily available source of energy?
2. Impact of government action on the diffusion and uptake of renewable energy technologies:
   2.1. Who are the key players in the Nigerian energy policy domain?
   2.2. How can these key players be encouraged to support the use of renewable energy technologies in promoting rural electrification and development in Nigeria?
   2.3. Considering what have been done regarding the use of renewable energy technologies over the past 34 years why has renewable energy technologies not taken-off in Nigeria?
3. Practical problems from field experience:
   3.1. What are the implementers' perceptions and experiences of providing renewable energy powered electrification in the rural areas?
   3.2. What mechanisms have evolved in coping with known challenges?
   3.3. How prepared is Nigeria as a country in adopting and accepting renewable energy technologies on a large scale?
   3.4. Compared to fossil fuel, how can renewable energy sustain rural electricity efficiently in Nigeria?

APPENDIX D

Summary of Government Agency Profiles

To obtain relevant information relating to the application of renewable energy for electrification purposes especially in the rural areas, several Federal Government Agencies were considered as viable sources of information. However on close scrutiny, it was discovered that most of these agencies were not really suited for this study as they were really duplicating the task of other better placed agencies.

In order to reduce the cost of the study, the data gathering operation was restricted to the following government agencies under the domain of the Ministry of Power whose mandates encompassed energy as it concerned electric power. These agencies include the Energy Commission of Nigeria (ECN), the Nigerian Electricity Regulatory Commission (NERC), Ministry of Power (MOP) and the Rural Electrification Agency (REA).

The other agencies like the Ministry of Environment, Ministry of Water Resources, Ministry of Agriculture and Rural Development, Ministry of Natural Resources do dabble in renewable energy projects but for the purpose of this study, I decided to go with the agencies that had a more concentrated focus on electric power generation as part of their mandate.

Following is a summary of the government agencies from which data for this research were obtained. The fifth source of data for this study was not an agency per se but a group of volunteers from Federal Government Contractors who were into rural electrification. They were categorized under Rural Electrification Contractors (REC) for sorting purposes and clarity.

Energy Commission of Nigeria (ECN)

The Commission was established by Act No. 62 of 1979, as amended by Act No.32 of 1988 and Act No. 19 of 1989, with the statutory mandate for the strategic planning and co-ordination of National Policies in the field of Energy in all its

ramifications (Energy Commission of Nigeria, 2013b). Part of this agency's responsibilities as an 'Energy Commission' within the Economic Community of West African States (ECOWAS) is the coordinating and supervision of all energy functions and activities in the country.

Along with the 11 functions specified in the commission's mandate especially the recommendations for the exploitation of new sources of energy, the ECN is also charged with the responsibility for the strategic planning and coordination of the nation's policies on energy in all its ramifications (Energy Commission of Nigeria, 2013b). By its mandate, the commission is empowered to carry out overall energy sector planning and policy implementation, promote the diversification of the energy resources through the development and optimal utilization of all, including the introduction of new and alternative energy resources like solar, wind, biomass and nuclear energy (Energy Commission of Nigeria, 2013b).

The ECN is the apex organ of government for energy policy formulation and coordination in Nigeria, and it is headed by a Director-General who also serves as the Chief Executive Officer. There are five Energy Research Centers under the Commission with specific technical and research roles, and six departments in the commission including the Renewable Energy Department that oversees energy technology assessment and dissemination, pilot projects in renewable energy, rural energy technology (including rural electricity) and other new energy technologies. Figure D.1 below shows the organizational structure of the ECN.

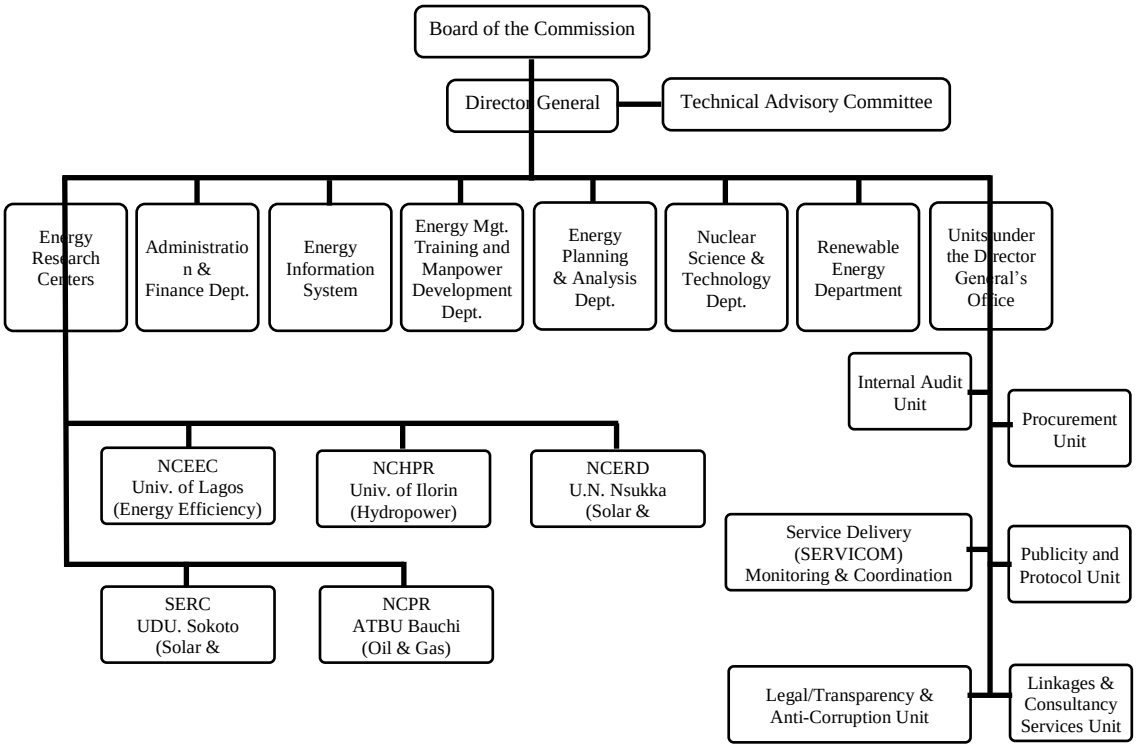


Figure D.1 Structure of the ECN

Source: Energy Commission of Nigeria, 2014.

Nigerian Electricity Regulatory Commission (NERC)

The Nigerian Electricity Regulatory Commission (NERC) is an independent regulatory agency which was inaugurated on 31st October 2005 under the auspices of the Electric Power Sector Reform Act 2005 (Nigerian Electricity Regulatory Commission, 2014b). The Commission is made up of seven divisions, each with its strategic role. This divisions include: The Office of the Chairman; the Engineering, Standards & Safety Division; the Finance & Management Services Division; the Government & Consumer Affairs Division; the Legal, Licensing & Enforcement Division; the Market, Competition & Rates Division; and the Renewable Energy, Research & Development Division (Nigerian Electricity Regulatory Commission, 2014a).

A key part of the functions of the Renewable Energy, Research and Development Division is helping the Commission drive its renewable energy programmes as well as providing the Commission with the required database and

policy instruments to carry out its various activities (Nigerian Electricity Regulatory Commission, 2014a). Under the leadership of a Chairman/Chief Executive Officer who oversees six other commissioners, the NERC is mandated with the responsibility of carrying out the monitoring and regulation of the electricity industry; issuing licenses to market participants, and ensuring compliance with market rules and operating guidelines (Nigerian Electricity Regulatory Commission, 2014b).

Ministry of Power (MOP)

The Federal Ministry of Power is the policy making arm of the Federal Government with the responsibility for the provision of power in the country (ECOWAS Centre for Renewable Energy and Energy Efficiency, 2015). The Ministry in discharging this mandate is guided by the provisions of the National Electric Power Policy (NEPP) of 2001, the Electric Power Sector Reform (EPSR) Act of 2005, and the Roadmap for Power Sector Reform of August 2010 (Ministry of Power, 2015a).

The Ministry's mission to provide the nation with adequate and reliable power supply by implementing generation, transmission and distribution projects in the sector and facilitating the emergence of a private sector led competitive and efficient electric power industry is envisaged to be a reality with the working together of its key departments and units. These departments and units which make up the Ministry of Power include: Renewable and Rural Power Access, Human Resources Management, Investment & Sector Development, Planning, Research & Statistics, Finance & Accounts, Procurement, General Services, Reforms Coordination & Service Improvement, Special Duties, Energy Resources Development, Distribution System, Transmission System, Legal Services, Internal Audit, Press & Media, Anti-Corruption & Transparency, and Gender.

Other than initiating and formulating broad policies and programmes on the development of the power sector (electricity) in general, the Ministry's responsibilities also include the initiation of concessions in the power sector of the economy, licensing of electric generating sets of 1MW capacity and below, conducting investigation on electrical accidents and ensuring safety in the electricity industry in Nigeria. The Ministry also conduct statutory tests and certification of electric poles (concrete, wooden, steel etc.) as well as other major electrical materials before they are used on the grid and networks in Nigeria (Ministry of Power, 2015b).

Other activities like implementing Renewable Energy programmes and initiatives in the development of solar, wind, biomass, small hydro etc., coordinating several activities of the power sector, handling policy matters relating to research and development in the power sector, promoting the development of hydro power plants through public private partnership (PPP), participating in bilateral and multilateral relations affecting the power sector as well as facilitating the overall coordination of the activities of the parastatals under its supervision, all fall under the purview of the Ministry of Power (Ministry of Power, 2015b).

Rural Electrification Agency (REA)

The Rural Electrification Agency is a Federal Government of Nigeria agency saddled with the responsibility of providing electricity to rural communities in Nigeria. It was established based on the provision of Section 88 of the Electric Power Sector Reform (EPSR) Act 2005 as part of the Federal Government of Nigeria's commitment to aggressive rural electrification. It is headed by a Managing Director/CEO who oversees the operation of five directorates: the Procurement, Projects, PR&D, Promotion and Fund Management directorates (Rural Electrification Agency, 2015b). As per the requirements of regional equity, it maintains a presence in the six geo-political zones (Econ One Research, 2006). Figure D.2 shows an overview of the structure of the agency.

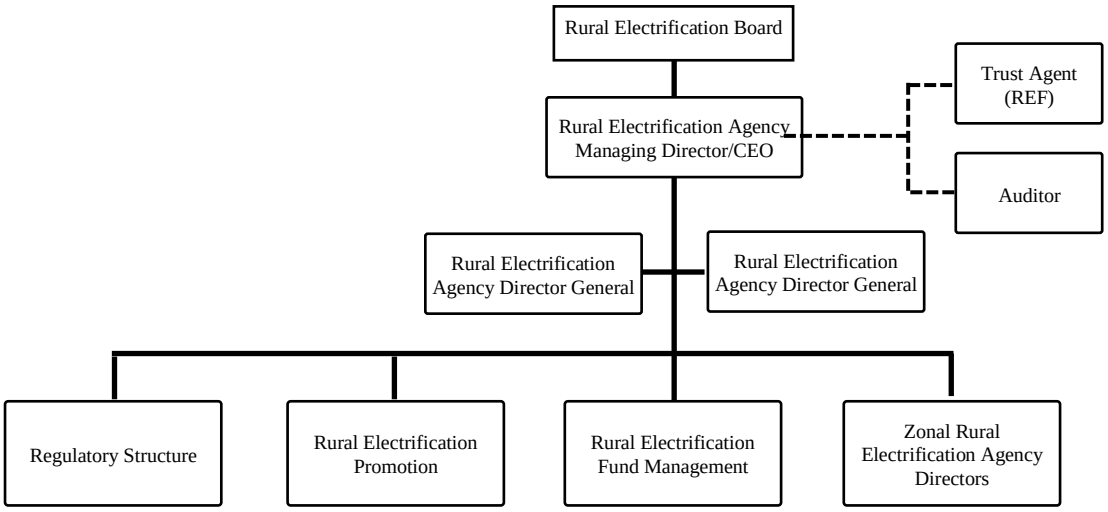


Figure D.2 General Overview of the Rural Electrification Agency

Source: Econ One Research, 2006.

Apart from facilitating the extension of electricity to rural and peri-urban dwellers, the agency also sees to the provision of steady and reliable power supply at economic rates for residential, commercial, industrial and social activities outside the urban areas of the country. It also encourages and promotes private sector participation in grid and off-grid rural development using the nation's abundant renewable energy sources while ensuring that Government Agencies, Co-operatives and Communities, participate adequately in enhancing electricity service delivery (Rural Electrification Agency, 2015a).

The Rural Electrification Agency is mandated to promote rural electrification in Nigeria, co-ordinate the rural electrification programmes in the country, and administer the Rural Electrification Fund (REF) to promote, support and provide rural electrification with focus on remote and inaccessible settlements from urban areas, settlements without access to basic infrastructural services, agrarian settlements that contribute to the local economy, and settlements with low socio-economic indicators (e.g. income, education & health) (Rural Electrification Agency, 2015a).

APPENDIX E

Letter of Introduction

11 April, 2014
Dr. Joseph Dioha
The Director,
Renewable Energy Department
Energy Commission of Nigeria,

Amokwu Ifeanyichukwu Theophilus
Doctoral Candidate Graduate School of Public Administration, NIDA Thailand

This is to introduce Mr. Amokwu Ifeanyichukwu Theophilus (5410131017) who is interested in carrying out the data gathering aspect of his PhD work in your organization. Mr. Amokwu is currently a doctoral candidate under the supervision of Dr. Ploy Suebvises at the Graduate School of Public Administration of the National Institute of Development Administration in Thailand, and is expected to complete all requirements for the degree by August 2014.

His dissertation deals with the effects of a predominant fossil fuel economy mentality on the adoption of renewable energy technology for rural electrification and development in Nigeria. He is expected to gather qualitative data through content analysis and in-depth interview of willing officials in your organization, and we will appreciate all the help and assistance you can accord him.

Attached to this introductory letter is a consent form that all participants willing to partake in his research study are expected to read and sign in fulfilment of our institution's research ethics requirement.

Please be assured that any information obtained from your organization through interviews, documentation, questionnaires, or participant observation will be kept strictly confidential and research findings will be analyzed and reported at an aggregated level only.

Should you require additional information, please contact Mr. Amokwu directly through his e-mail address: ait.philus@grads.nida.ac.th or by phone: +66824886040; +2349038354751.

Thank you in advance for your kind consideration.

Sincerely,
Associate Professor Nisada Wedchayanon, Ph.D.
Dean
Graduate School of Public Administration
National Institute of Development Administration

APPENDIX F

Informed Consent Form

Information Sheet

Purpose of the Study: As part of the requirements for a Doctor of Philosophy at the National Institute for Development Administration, I have to carry out a research study using a qualitative methodology. The study is concerned with investigating how the uptake of renewable energy technologies for rural electrification will be affected by the existing fossil fuel based energy policy of the Federal Republic of Nigeria.

What will the study involve? The study will involve the analysis of existing documents and in-depth interview of willing participants from energy and development related federal and state parastatals in Nigeria. The qualitative nature of the needed data will require a comprehensive data gathering process that might engage a lot of the participants' time.

Why have you been asked to take part? You have been asked to take part in this research because due to your professional position, you are specifically suitable to provide the required data for this study.

Do you have to take part? You don't have to take part in this project – participation is 100% voluntary. This information sheet has been provided along with a consent form to give you a brief overview of what is expected from all participants. If you are willing to participate in this research study please know that you have the option of withdrawing before the study commences or at any time during the study. You are also allowed to have any after thoughts and can withdraw within two weeks of participation as well as exercise the right nullify any data you are not comfortable with.

Will your participation in the study be kept confidential? To the best of my ability, all correspondence will be kept confidential. I will ensure that no clues to your identity appear in the thesis (except with your permission). Any extracts from what you say that are quoted in the thesis will be entirely anonymous.

What will happen to the information which you give? All information provided will be kept confidential from third parties (including workers' superiors, if relevant). The data will be kept confidential for the duration of the study and on completion of the thesis; they will be retained for a further six months and then destroyed.

What will happen to the results? The data will be analyzed and the results presented in the thesis. They will be seen by my supervisor, a second marker and the external examiner. The thesis will be available to future students interested in similar areas of study and will be published in a research journal.

What are the possible disadvantages of taking part? I don't envisage any negative consequences for you in taking part. The in-depth interview is not an audit of your establishment.

Any further queries? If you need any further information or clarification you can contact my supervisor and adviser:

Assistant Professor Ploy Suebvises
+66-2727-3884, 3860
ploy@nida.ac.th

If you agree to take part in the study, please sign the consent form overleaf

Consent Form

I …….....……....…… agree to participate in Amokwu Ifeanyichukwu Theophilus' research study on the implication of fossil fuel on the uptake of renewable energy technology for rural electrification projects in Nigeria.

The purpose and nature of the study has been explained to me in writing, and I am participating voluntarily. I give permission for my interview with Mr. Amokwu to be recorded by means of note taking as well as audio recording.

I understand that I can withdraw from the study, without repercussions, at any time, whether before it starts or while I am participating. I also understand that I can withdraw permission to use the data within two weeks of the interview, in which case the material will be deleted.

I understand that anonymity will be ensured in the write-up by disguising my identity.

I understand that disguised extracts from my interview may be quoted in the thesis and any subsequent publications if I give permission below:

(Please tick one box)

I agree to quotation/publication of extracts from my interview □

I do not agree to quotation/publication of extracts from my interview □

Signed……. Date…….

Investigator's Declaration

I have explained and defined in detail the research procedures in which the participant has consented to participate.

Amokwu Ifeanyichukwu Theophilus

APPENDIX G

Sample of the Coding Legend/Schema

1. Characteristics of renewable Energy that could either promote or mar its deployment.
    a. External physiognomies of renewable energy that could affect its deployment.
        - **CREE1** Environmental/climate change mitigation requirements (Environmental demands)
        - **CREE2** Catalyst for stimulating rural development
        - **CREE3** Energy security
        - **CREE4** Energy politics
        - **CREE5** Perceived value of renewable energy
        - **CREE6** Energy Policy and frameworks
        - **CREE7** Topographical considerations
    b. Internal physiognomies of renewable energy that could affect its deployment
        - **CREI1** Clean energy
        - **CREI2** Domestic supply of energy
        - **CREI3** Abundant supply
        - **CREI4** Cost effectiveness
        - **CREI5** Appropriate technology
    c. Country specific factors that could affect the deployment of renewable energy for rural electrification in Nigeria
        - **CREC1** Underutilization of excess resources
        - **CREC2** Inadequate (renewable) energy policy
        - **CREC3** Deficient electricity industry
        - **CREC4** Antiquated Process
        - **CREC5** Endemic corruption
        - **CREC6** Lack of continuity in Government programmes

2. Perceptual factors
    a. Facilitators
        - **FAC1** Political will
        - **FAC2** Government incentives
        - **FAC3** High analytical competence
        - **FAC4** Knowledge of relevant technological systems
        - **FAC3** Human Capacity
        - **FAC5** Better coordination
        - **FAC6** Training
        - **FAC7** Funding
    b. Inhibitors
        - **INH1** Knowledge / Technological lag
        - **INH2** Poor level of awareness
        - **INH3** Perception of renewable energy technology
        - **INH4** Misplaced priorities in renewable energy projects
        - **INH5** Fossil fuel – Renewable energy dynamics
        - **INH6** Bureaucratic ineffectiveness
        - **INH7** Commitment of the local communities
3. Factors for entrenching renewable energy for rural electrification
    - **LIF1** Advocacy
    - **LIF2** Overcome liability of newness
    - **LIF3** Improved bureaucratic involvement
    - **LIF4** Conscious government participation
    - **LIF5** Increasing awareness

APPENDIX H

Sample Segment of Coded Interview Transcript

Participant: MOP2
Date: 13 May, 2014

Interviewer: Thank you sir for agreeing to meet with me. The aim of this interview is for me to gather data for my PhD research study and my area of research is in renewable energy and electrification in rural development. My tentative topic right now is looking at the effect fossil fuel has on the adoption of renewable energy in Nigeria considering that Nigeria is a fossil fuel rich nation. So most countries that are into renewable energy have kind of developed renewable energy for their people taking into consideration the environment.

While some have taking into consideration the exhaustiveness of fossil fuel. But in a third world nation like Nigeria, from existing literature it seems that we feel that we are so blessed with fossil fuel that we are not even considering that it might one day run out and another thing is that we are not too environmentally conscious. But we have the advantage of learning from other people's mistake. We don't have to wait for the problem to come to us before we can solve it.

Some people might argue that when they talk about renewable energy, what comes to mind will be the environment, let's forget about oil spillage and coal renewable energy. But this research is not basically how we can stop the use of fossil fuel. It's a research that is designed to look at how the existence of fossil fuel in Nigeria has affected our adoption of renewable energy. So like you just said now – "how it can complement". So your contribution will be for you to express yourself on the question. Kind of expatiate on the questions I will ask. They are actually very simple questions and I will need your input.

MOP2:
Okay you are welcome. Let me first of all welcome you. Maybe we start from me. Because from the way I am looking at it, you are looking at what is driving Nigeria into renewable energy when at present we have enough of fossil fuel that we don't need to even go into renewable energy sector.
I think the major concern for Nigeria for now and why we want to look at renewable energy are one; it's the understanding that people are beginning to have **INH3**.
When they look at it on the surface it looks the resources seems to be available especially with consideration to ~~the~~ solar and then ~~the~~ biomass **CREI3**.
The resources seem to be available but people wouldn't understand whether the technology is affordable **CREI3**. You understand?
But government on the other side is looking at affordability because the issue is that

how much of the energy are you going to have from the renewable to match in terms of cost.
How cost effective is this renewable energy that is the major concern that government will look at it **CREI4**.
Let me not go too far. But to some extent that is what government was considering when they launched the power sector road map.
In the power sector road map, government clearly stated that we won't give much attention to renewable energy, you understand **CREE6**.
It will only consider it … it won't neglect it but much of the attention will be on fossil fuel **CREE6 / INH5**.
That was the thinking of government. If you are looking at it now you want power and you want it yesterday. It's not even now that you want the power.
What can deliver this power quickly and easily, and affordably? How easily can you get it … it won't be renewable energy **INH5**.
But the general mass of Nigerians will always look at the availability.
We have these resources. Biomass is there, we have enough solar there, we have so much water **CREI3**.
Someone even told us that we have more water than Switzerland, yet Switzerland has more hydro power plants than we do.
Though they won't understand that while we have more water than Switzerland, we don't have the height difference, we don't have the head **INH2**.
Which is an advantage that Switzerland have over Nigeria and we don't have so much money as Switzerland. So I think maybe from here we can start. So that is basically the understanding that we have in Nigeria.

Interviewer: So what can you say is a key factor that can influence the choice of an energy option in power generation in Nigeria? [[5:40]]

MOP2:
The key factor. The way we do things in Nigeria or the way Nigeria operates – this is more like a personal opinion – it is not the issue of cost per se. it is the issue of the will.
If government wants it, it is as good as done. You understand me? **FAC1**
Because we have a government in Nigeria that yes we listen to the masses but when the government is bent on doing something it doesn't take it anything, it still goes ahead and does it.
So the basic thing for me … people may want to be more scientific to say okay we are looking at cost, we are looking at availability we are looking at … they usually tell you about the cost when they want to be scientific about it **CREI4**.
But it's just the government will. If the president decides today that we are going on renewable, there is nobody who will stop it. The government machinery will be set in place to make renewable work in Nigeria. So it's more of the government will **FAC1 / LIF4**, it's not ehhh.

Interviewer: So as things stand presently,

MOP2:
You know usually in government, there should be the technocrats who should now propose or recommend but that's the reverse in Nigeria actually **INH6 / LIF3**.
The technocrats try to fit into the government decision. It's not what you recommend **LIF3 / LIF4**.
If the president goes somewhere and finds that renewable is working and he wants it to work in Nigeria, no matter the excuses you give, it will still work in Nigeria **LIF4**.
It's more like a personal opinion …. You hardly hear people tell you that this is the real cause why we are doing this but the basic thing is that I have stayed in government for at least about 10 years now and
I understand that most of the things we do, we give reasons why we are doing it. Basically the thing that makes things work in Nigeria is that government wants to do it **FAC1**.

Interviewer: Okay, that is what we have in reality. Ideally the technocrats are supposed to promote renewable energy per se …

MOP2:
Or promote what so ever policy government wants to pick you understand, based on some observations, statistical observations that they have noticed … this is like this, this is like this … so having looked at this we are proposing that we should go in this direction but that is not usually the case. When you are taking that direction, government will come and say no we want this ... **INH6**

Interviewer: So I will split this question now into two folds. First, ideally if we were to follow the path of the technocrats, take for instance people in the ministry of power proposing to the government, okay this is how we want to promote renewable energy. What in your own opinion are the things that the ministry of power would have done to promote, to encourage government to actually look into renewable energy much more than they are doing now?

MOP2:
Well I will still take it to me.
I will make recommendations and if I were to honestly recommend, one, we need energy. That is the number one thing that Nigeria needs. We need this energy, which we don't have adequately **CREC3**.
So the number one thing though unfortunately I belong to the renewable energy department. The position of the power sector road map is actually the kind of position ??? [[9:30]]
First, we have to look at making it available. When you are going for something you first go for … like usually in Nigeria we have this saying that your first car is a necessity the second one is a luxury. You don't first go for luxury. For now renewable energy seems to be a luxury. **CREI1**
What we are actually promoting in Nigeria, we are looking at the environment. How much pollution is Nigeria contributing today to the entire global environment you understand? very little; and yet we don't have this energy. Should Nigeria now be

the one to start promoting the clean energy? you understand? When you don't have it at all. **CREE1**

I am just giving the reasons I may promote (fossil fuel) … it's not that we are going to neglect it, but for now we should drive towards giving this people … you would have tested something before you'll know whether it is good so that you can go for the one that is better. So we will go on the fossil fuel. For me I think the best recommendation is that let us go aggressively on the fossil fuel. **INH5**

But in spite of that there are some places where renewable energy have comparative advantage. In such areas there is no need saying we should go on fossil fuel **CREE5**.

We should not go and use diesel where even the transportation of diesel to that place will be so expensive.

Like you know places like the Mabinla Plateau where we are thinking of making the Mabinla one of the large hydro plant there. In such places you won't be thinking of first taking diesel there. Taking diesel there is expensive. It can make the cost high. But we can have solar there which will be very cost effective **CREI2 /CREE7**

In such areas we can go on renewable, but in this, for us to come to Abuja and say yes we have good sun light you understand, the transmission grid is there, we have good distribution network you understand, that can be supplied from all these conventional sources of electricity and then you want us to still go on solar, of which if you look at it comparatively it will be on the high cost. It doesn't make any sense **INH5 / CREI4**

So while we aggressively pursue the fossil fuel aspect of it, renewable energy will be considered where it has comparative advantages. Especially in the rural areas that have very difficult terrain to access **CREE7**.

I think I am going more personal on this. I don't know why I am being honest with you.

I don't know why I am this honest but if I want to take the real, popular stand I will say that we should go on renewable energy because we want a cleaner planet, this and this and this. But for me it doesn't make sense **CREE1**.

Personally … and if you ask me to put it in writing before any government that wants to listen I will get all the reasons to promote this ideas that I have. You understand. But the government will still be singing the song that everybody wants to hear. Though at times I find it difficult as my writing might not always portray what I am saying now. But at times you also sing the song they want you to sing.

Interviewer: So the second part of the question. Looking now that the way things work in Nigeria, if the government wants something, it will be done. In this kind of climate how can we now make … is there any way the Ministry of Power as the custodian of energy in Nigeria, is there any way it can influence the government's decision for more effort to be made for renewable energy?

MOP2:

The Ministry of Power …. I'm still trying to give you a good reason why that can be done because it is easy to be done. The example I gave ….

If somebody can prove to the president they will start immediately **LIF1 / LIF5**.

I will get a key Minister like the coordinating Minister of the Economy Ngozi

Okonjo-Iweala.
If somebody can get these key people to agree, you understand? Or to adapt the renewable energy thing, the country will start singing that song immediately **LIF1**.
Your question is this: "how would we get them to start promoting renewables?"
That question is coming to somebody who doesn't want to promote the renewable energy. Who looking at [*outburst of laughter*] no no but I can answer, all the same I can still give you the answer on how we can be able to do it.
We can bring cases of where this thing is working out. We can present statistics. Statistics to favor that renewable – you Doctors always favor statistics. You may decide to use the log linear graphs to present cases where renewable is favored, you may decide to go on linear-linear graph to showcase whatever you want to show case. You can present that and forcefully present it. Use this to articulate and get these people around at conferences if you can. Even outside the country where they can see where these things are working out life and ensure that you don't show the disadvantages of the renewable energy to them and ensure that while they are going through that you don't even behave as if the fossil fuel have any advantage. And you may work on their psyche and they will get to buy into it and I think that will work **LIF1**.
You see let me give you another example. When we started the energy efficiency, how did they get government's attention? It was basically because through ECOWAS, we were able to get some of the key people outside of this country, to go to Cuba to see how these bulbs worked and how they had implemented it.
It was only… when they came back nobody could rest again: "this and this, we should advocate we should advocate". Because I have seen it work somewhere. You understand? **LIF1**
They wouldn't know that CFLs have their own disadvantages too.
So as soon as they buy into it, as soon as they see where it is working and how good it is and you forcefully put that, imprint that thing on their mind, they'll want to drive it. So I think that will be the best way to go about it **LIF1 / LIF5**. [[Advocacy]]

Interviewer: Okay, just as an aside, I so much appreciate your frankness and that's the essence of what this whole practice is for me. I don't want to handpick people that will just feed me the answers I want to hear. Whatever you feel please don't hold back … you've already done exactly what it is that I want. I don't want the whole process to be predictable. Because everybody I have been talking to it's been renewable energy, renewable energy but you came out now and told me – this is it for real and this is how it should be and this is what it should be…

MOP2:
and if you are sitting where I'm sitting, and you are still watching the things that I watch, you too will say almost the same thing if you are sincere with yourself, except ….

Interviewer: I really appreciate and I will actually, with your permission cite this example. The Cuba example I will like to cite it. Thank you very much. So from what

you've been saying so far, you've already given me enough information on the impact of government. So who would you say are the key players in the Nigerian energy policy domain?

MOP2: Key players?

Interviewer: the key players, those that … if we want them to change things who are they …. You made mention of the coordinating minister, Mr. President himself, somebody who if one can approach … on a general …

MOP2:
On a general level that is irrespective of the government that is in power.
On a general level, this is difficult for me to decide …. During the Obasanjo regime when we had the NEEDS, the head of NEEDS before vision 2020, we had the NEEDS - the National Economic Empowerment Development Strategies and that was the policy environment that time and as at then Soludo was the CBN governor. I think he was the special assistant. The president, was it on economy or energy I have forgotten. Then you could point him out as a key player. But that administration has gone. We have a minister of National planning now, that should be able to give us the policy direction including energy. He is not that much considered, though you may not give him that. But institutionally, we have energy, we have federal ministry of power, the minister of power. That is institutionally the federal ministry of power is the head. We have … this is electricity not petroleum. We have Federal Ministry of Power, we have the Energy Commission. Central to it, it should actually be the energy commission but unfortunately the way our government work is that Energy Commission can't present a memo to the Federal Executive Council. So they still have to come through somebody and the person they are coming through, the minister they are coming through, is the Minister of Science and Technology. You understand? And these things keep on changing. Initially they were under the ministry of power; which makes it very easy for them to drive the energy sector especially as it relates to electricity. Now they have moved from here like the earth is moving around …. the eclipse **CREC6**.

They have changed their position from here to Ministry of Science. So they are now under the Ministry of Science and Technology but they are none the less they are a key player in the energy sector, including electricity. You can't rule that out. In fact they should be coordinating all energy issues. But if you are talking of electricity specifically on electricity you have the Federal Ministry of Power – then you mention them separate. Then those are the key players. And then other ones which I will still consider under this, as maybe the secondary players; you have the federal okay the federal ministry of water resources is there. To me water resources should be entirely with energy but I don't know why water supply is also attached to it because water resources should be energy **FAC5**.
The resources should be used for energy generation. So I don't know why we have water resources when we talk of water supply. But if we look at it, they should handle more of energy issues than the water supply. And that is where we are having the bulk

….. ???? [[22.40]] but we have so much energy, they are building dams but the dams are built for water control. You understand? Without tapping the energy that is there. So why would you use so much money and you are making a solid structure, you understand? And you end up using just a little part of it. You have them for … you have water for irrigation but the irrigation wouldn't compensate for how much money you have used in building that dam. But that is what we usually do. You build a dam, you wouldn't have any power component on it. You build a dam, a very big dam that you would have harnessed so much energy from it for electricity but they'll just leave it for irrigation. And the irrigation is for pepper and tomatoes which will take like 100 years to compensate for the cost [laughter] **CREC1 / INH4**

So energy, the secondary players – water resources is there. So for now let's put them there as secondary players. We have environment, water resources, which other one? Land control. I think investment should even come in because with the privatization everything is no longer under government. So we have investment, then one will actually market, market Nigeria so investors will come. We have investment. There is an agency for investment. The investment promotion – Nigeria Investment Promotion Commission NIPC. This are the secondary players.

There are other related agencies but I think the principal players are the Federal Ministry of Power and the Energy Commission. They are the ones who should actually give the policy direction when it comes to energy. Okay we have NERC. NERC is coming under …. NERC is a primary player but for me I would have loved to put it as a secondary player because Ministry of Power should actually be given direction to NERC. You understand? But the way that Act establishing NERC, that Act made NERC a primary player. It's very independent from the ministry or even more powerful than the ministry **FAC5**.

Interviewer: So how can these players, both the secondary and primary players be encouraged to promote renewable energy for rural development that is use of renewable energy for electricity for rural development?

MOP2:
Okay let me ask? Who should be doing the encouraging or what should be their motivation to do the encouragement? No, No what should be encouraging them to promote … I don't know how to put it

Interviewer: … what will be their motivation to promote renewable energy? Well at the end of this whole process, I'm supposed to come up with a document, papers to be delivered in some conferences at least two – that's the requirement for the PhD, so if I'm going to make these proposals, they won't be my own opinions. So you asked a question that who should…. What will be the motivation for renewable energy promotion … So the motivation from a basic understanding of what renewable energy should do for a community or for a people the motivation should be development…

MOP2: Okay I forgot rural electrification agency is there too as a [primary player]

Interviewer: Yes. The motivation should be a better life for people in the rural areas. So if we agree that a better life for rural dwellers is enough motivation to promote renewable energy, is there any way the Ministry of Power as the parent body can carry all these players along and if there is, how in your own opinion can we achieve that?

MOP2:
Okay I can understand your question for the rural.
How we can be able to tie up these ministries together or these agencies together to deliver renewable energy for rural development. For now there is what they call inter-ministerial committee on renewable energy. The Ministry of Power is chairing that committee, all these agencies I mentioned are part of that committee **LIF3**.
Why the committee came up was that we noticed that some development projects were going on provided by all these groups and they were going on in an uncoordinated manner, and we wanted to like bring them together so that we won't be wasting government resources in doing what other people have already done **FAC5**.
But that doesn't stop them from fulfilling their mandates. They can still go ahead and do the things that are within their mandates.

Following this, it was observed that there was a need to promote this renewable energy if you actually have a policy on renewable energy together with energy efficiency. So this policy will have all these stake holders involved **CREC2** .
But Ministry of Power vision or Ministry of Power is limited to electricity, to electric power. These other agencies, like you are talking of Ministry of Environment, they are looking at the issues of using solar bulbs, solar bulbs just standing alone or solar lanterns.
They can promote that. Ministry of Energy, Ministry of Power may not be in a better position to promote that kind of arrangement. If we are promoting electricity from solar, that will be from at least, we should have at least a mini grid or should at least even if we are having a standalone, that should be a home system that should at least serve a whole house. You will know that you can use it for some other applications. Not just lighting or a standalone bulb that you can carry anywhere **FAC5 / LIF3**. But ….

So honestly I'm thinking of what should be able to encourage these people to go for renewable energy or what should drive them. Just like you said – rural development **CREE2**,
and like I said before it should be renewable because if you are looking at rural development for now, based on the cost it's most likely renewable except the small hydros you understand? And the hydros we are not limited only to small hydros. It can be both large or small **CREI5**. The larger the better.

So I think the way to develop the nation should be what should actually encourage us **CREE2** and then two to avoid waste. Because if the agencies are working together,

there will be this kind of planning that will integrate all the agencies together **FAC5**, then we know that for this particular year like we were proposing before, there was one time that this was put up that the Ministry of Energy no not the Ministry of Energy the Energy Commission should actually serve as the planning agency for energy. That for each and every … they should have long term plans and short term plans, and these short term plans should actually articulate what other agencies should be able to do.
Not specify that say ministry of environment should do this … but the thing is that if you are going on street lighting, how much megawatts of energy they want to have on street lighting. If you are going to biomass how much targets? And it you have these kind of targets, if we begin to put them in short term and long term, you can develop a strategy for accomplishing this … each and every agency know that you are targeting this **LIF3**.

How are we going to achieve this most especially when we are looking at the private sector coming in. you understand? The environment how are you looking at it? Water resources what effort are you going to make? You understand? **CREE1**
And with this inter-ministerial committee, though that has not been achieved for now with targets we have, though we have some certain targets no one is there to ensure that we put them together **FAC5**.
But I think it will be better if like the units we have in the inter-ministerial committee can begin to pick out that okay … now we have this targets and you from your plans of next year as you have the budget how much of this target have you been able to accomplish? And is it going to be biomass? Is it going to be hydro? And what and what have you been doing? When we've know that this is what you're doing, another agency will come up – this is what we are doing ….
There should be a kind of coordination to know what the other person is doing. I think the best thing is to have a central planning system. That the planning will be central. That will be the only thing that will make them work together. Planning, integrated planning **FAC5**.

Interviewer: So just to wrap up, over the past 25 years even up to the past 34 years, renewable energy has actually been known with in the corridors of power. They've been hearing about it. Even the ECN the Energy Commission, they have already started promoting renewable energy, and from a lay-man's perspective, we are endowed with the natural resources to actually solely depend on renewable energy because there are data from numerous literatures and research that have shown that Nigeria can boast of a large quantity of power from the wind in the North and some part of the South, and that micro hydro can actually sustain most of the communities that run along the River Niger and because of our geographical location, we have enough radiation from the sun to make us depend on solar. Can you say that Nigeria as a nation irrespective of the availability of fossil fuel is actually ready for renewable energy? Is Nigeria ready to adopt renewable energy on the part of the people or even the government whichever way you want to look at it, I will like you to contribute regarding that.

MOP2:

Nigeria has heard so much that at times to take a decision becomes difficult **LIF5**. We are ready for renewable energy. Nigeria is ready and still not ready. We have a situation in the country that in the morning you will have a presentation – somebody introducing a new concept in small hydro to you. They bring the concept, it will be very beautiful; this can give you 1MW. These are the advantages …. It doesn't need this, it doesn't need this, it doesn't need this … we have this kind of savings. You'll mark it right. … in the afternoon you have another person come with a presentation on the same hydro. This time around he will be proposing that when you use this technology … all manner of latest technology they keep on bringing. And then you begin to wonder won't we be making a mistake if we choose this technology that is latest today and in the afternoon it becomes obsolete. You understand? That issue till date is there. Because as soon as you say you are willing to pick up this policy and go on it, you discover that something has come and overtaking it **FAC3**.

Like the issue of solar now, the solar panel, the price is coming down and it's improving every day. Somebody will come and say okay since it seems to be better and it has more advantages over the PV you use limited land and you get high yield and this and this and this. You can easily adopt this. You look at it and you see the benefits and see that truly it's more profitable to do this. In the evening somebody else comes with a different thing and then you are confused.

But the best way out of it is the privatization we are going on with. If the environment is clear, the person who is coming to invest has a decision to make on which technology to choose. Provided the technology is renewable, he has that decision to make and he has the choice, he can pick on that **FAC2**.

But coming to we making the environment fair again for the investors to come in, we have these issues to contend with. You are working on feed-in tariffs, another idea comes up that the feed-in tariff is not the best. Go on this bidding lot. Lot bidding, I think there's one aspect like that. That this one will get in more investors, will get more investors to participate. And another one will come up … there's one person who brought us … one World Bank person … brought an idea that was done was it in Peru or where, I can't … I've forgotten the name … this south American. That they adapted that that it worked for them. So you are now still confused …. Which one will you choose and that you won't be making a mistake. It's like somebody who wants to get married and he has too many ladies to select from. In the morning he sees this one – this one has a fine nose, in the afternoon this one has a fine waist, in the evening he says this one is too fat … you understand that kind of a thing so we could have gone for it, but I think these are the challenges that we have. What we did there… as soon as you are making a choice for that. Federal Ministry of Power Electrical Inspectoral Service Department said that they are going to have a wind farm.

Right from the ministry we have taking that decision, the next department is coming out to criticize it that what they have chosen to do is archaic, it's not economical, it is not viable, it is waste of money – in the same Ministry. By the time you are through with your ministry and present it to maybe some other stakeholders that have a knowledge of it. Another person will start that what you are presenting doesn't make any sense. These are technocrats arguing among themselves. You understand? **LIF5**

And you wouldn't blame them because while you are presenting this, you would have thought of this for a long time, concede the idea, make sure you have ironed all those things you need to iron out. By the time you are done and maybe he just read something last night over the internet and as soon as you are presenting … you discover that the people who are criticizing are always more articulate ….

Interviewer: So is there a way forward for renewable energy

MOP2:
Maybe that's what you can do for your country. I know you are a Nigerian maybe while you are discussing you can come up with … you have interviewed some other people so you would have maybe heard some things from them and you compare them and begin to say what can we actually do about this.
That is why in the first instance I just told you that what we need is the government will. Because who will take the decision and stand by it … that is the problem. If somebody decides today that this is what we are going to do and I want it, it will be done **FAC1**.

Interviewer: Thank you very much, I really appreciate the time I have spent with you

MOP2: Thank you too

APPENDIX I

Sample Coding Scheme Development Chart

Developmental Phase	Selected Descriptor	Explanation
One: This initial version of the coding scheme was based mainly on information and data gotten from the literature review and thought process of the researcher. A simple coding scheme of several key words was set up as the initial literature-based coding guide for the study.	Dynamics between fossil fuel and renewable energy sources; Existence of an adequate renewable energy policy; Political will of the Government; Lack of continuity in Government policies and programmes; Efficacy of renewable energy as a viable option for rural electrification; Capital investment and financial cost of deployment; Role of Government – Subsidies, waivers etc.; Perception of renewable energy technology; Technical know-how and research & development activities; Novelty of Renewable Energy Technologies; Coordination between Government Agencies; Weak institutional framework; Advocacy activities; Creation of awareness; Environmental factor; Proffered motivators for the adoption of renewable energy.	"This preliminary version of the coding scheme is a predefined approach to coding and is primarily developed from the literature review combined with personal experience" (Bloomberg and Volpe, 2012: 255). At this stage codes/descriptors and the categories under which they fell were still pretty much mixed up.
Two: On analyzing the transcribed data from the first two interviews conducted, a better understanding of the initial coding scheme and analysis process, and how the scheme could work better with data from the responses, prompted the adjustment of the initial coding scheme.	Environmental/climate change mitigation requirements; Catalyst for stimulating rural development; Energy security; Energy politics; Perceived value of renewable energy; Energy policy and frameworks; Topographical considerations; Clean energy; Domestic source of energy; Abundant supply; Cost effectiveness; Appropriate technology; Underutilization of excess resources; Nonexistent renewable energy policy; Deficient	The refining of the coding scheme saw the redefinition of some of the initial descriptors and addition of some more. This was to make the descriptors more specific to the issues being discussed as they related to the various aspects of the study that could be addressed by the different sections of the conceptual framework of the study.

Developmental Phase	Selected Descriptor	Explanation
	electricity industry; Antiquated Process; Endemic corruption; Lack of continuity in Government progrmmes; Political will; Government incentives; High analytical competence; Knowledge of relevant technological systems; Better coordination; Training; Funding; Knowledge/Technological lag; Poor level of awareness; Perception of renewable energy technology; Misplaced priorities in renewable energy projects; Fossil fuel – Renewable energy dynamics; Bureaucratic ineffectiveness; Commitment of the local communities; Advocacy; Overcome liability of newness; Improved bureaucratic involvement; Conscious government participation; Increased awareness	
Three: Open coding of the transcripts of the interviews exposed some weakness in the existing coding scheme. Re-reading and comparing the acquired data in the transcripts with the conceptual framework prompted further refinement of the coding scheme. As the literature suggest, this resulted in reduction (eliminating some of the descriptors) and redefinition (Bloomberg and Volpe, 2012).	**External physiognomies that could affect renewable energy deployment:** *Environmental/climate change mitigation requirements; Catalyst for stimulating rural development; Energy security; Energy politics; Perceived value of renewable energy; Energy policy and frameworks; Topographical considerations.* **Internal physiognomies that could affect renewable energy deployment:** *Clean energy; Domestic source of energy; Abundant supply; Cost effectiveness; Appropriate technology.* **Country specific factors that could affect renewable energy**	At this stage of the analysis process, the coding scheme has taken a more refined look and the descriptors could now be grouped under categories which were constructed as responses to the research question that could also be related to the relevant parts of the conceptual framework. These categories were initially classified as: i. External physiognomies that could affect renewable energy deployment; ii. Internal physiognomies that

Developmental Phase	Selected Descriptor	Explanation
	deployment: *Underutilization of excess resources; Nonexistent renewable energy policy; Deficient electricity industry; Antiquated Process; Endemic corruption; Lack of continuity in Government progrmmes.* **Perceptual Factors:** *Political will; Government incentives; High analytical competence; Knowledge of relevant technological systems; Better coordination; Training; Funding; Knowledge/Technological lag; Poor level of awareness; Perception of renewable energy technology; Misplaced priorities in renewable energy projects; Fossil fuel – Renewable energy dynamics; Bureaucratic ineffectiveness; Commitment of the local communities.* **Factors for entrenching renewable energy for rural electrification:** *Advocacy; Overcome liability of newness; Improved bureaucratic involvement; Conscious government participation; Increased awareness.*	could affect renewable energy deployment; iii. Country specific factors that could affect renewable energy deployment; iv. Perceptual Factors; and v. Factors for entrenching renewable energy for rural electrification.
Final: The version of the coding scheme at this stage of the analysis was a product of the constant refinement the previous coding scheme went through as the interview transcripts were read, reread and open coded with minor modifications as the analysis progressed.	**External physiognomies that could affect renewable energy deployment:** *Environmental/climate change mitigation requirements; Catalyst for stimulating rural development; Energy security; Energy politics; Perceived value of renewable energy; Energy policy and frameworks; Topographical considerations.*	At this stage in the analysis process, a more streamlined coding scheme had been arrived at. The categories were now clearly defined and relevant themes from the initial emergent themes from the coding operations were retained and grouped under the

Developmental Phase	Selected Descriptor	Explanation
	Internal physiognomies that could affect renewable energy deployment: *Clean energy; Domestic source of energy; Abundant supply; Cost effectiveness; Appropriate technology.* **Country specific factors that could affect renewable energy deployment:** *Underutilization of excess resources; Nonexistent renewable energy policy; Deficient electricity industry; Antiquated Process; Endemic corruption; Lack of continuity in Government progrmmes.* **Perceptual Factors Facilitators:** *Political will; Government incentives; Human capacity development; Better coordination; Commitment of the local communities; Funding.* **Perceptual Factors Inhibitors:** *Knowledge/Technological lag; Poor level of awareness; Perception of renewable energy technology; Misplaced priorities in renewable energy projects; Fossil fuel – Renewable energy dynamics; Bureaucratic ineffectiveness.* **Factors for entrenching renewable energy for rural electrification:** *Advocacy; Overcome liability of newness; Improved bureaucratic involvement; Conscious government participation; Increased awareness*	proper categories. For instance, the perceptual factors category was now made up of two sub-categories of inhibitors and facilitators. A more relevant descriptor – Human Capacity Development – was formed by merging high analytical competence, knowledge of relevant technological systems and training. This final coding scheme (see APPENDIX G) now contained six distinct categories made up of 35 alphanumeric codes representing the final emergent themes.

Source: Adaptation of the chart in Bloomberg and Volpe, 2012, pp. 255-256.

APPENDIX J

Room for Qualitative Analysis Software

An aspect that has often been missed in accounts of qualitative research has been the presentation of an accurate and transparent picture of the data vis-à-vis the provision of an audit trail of the data analysis process of the research as a whole (Welsh, 2002). In a bid to carry out a research that to a large extent would overcome the problem of transparency, rigor and provision of an audit trail, it is suggested that a qualitative software package like the QSR qualitative data analysis software NVivo can be used as an analysis and data repository tool.

Given the innovations in software technology and the advancement in electronic data handling techniques, a software like NVivo has been found to be ideal for the various types of qualitative data analysis approaches (Welsh, 2002). In line with the ontological and epistemological requirements already stated in the earlier part of this chapter, this research calls for an interpretive data analysis approach – an approach that involves the making sense of the research participants' accounts, and the researcher attempting to interpret what these accounts mean from the corpus of textual data gathered.

Two opposing groups are identified among qualitative researchers (Welsh, 2002). They are "those who feel that software is central to the analysis process and those who feel that it is unimportant and in fact can result in the 'wrong' kind of analysis taking place" (Welsh, 2002, p. 5). While not trying to discredit either proponent, it is thought by the researcher that using NVivo as a support tool for a research such as this would have been done in accord with Welsh (2002, p. 5) submission that "in order to achieve the best results it is important that researchers do not reify either electronic or manual methods and instead combine the best features of each."

The advantages of employing a software like NVivo are numerous. It can help to: (1) Manage data due to its capability to serve as a single repository for the research

data; (2) Manage ideas, providing easy access to sources; (3) Query data, as it can analyze large amount of data; (4) Visualize data, by providing consistency in the analysis; and (5) Assist in creating report from the data as well as help with theory building if possible (Bazeley & Jackson, 2013).

However, it has been documented that researchers run the risk of falling into the trap of seeing NVivo as a method and not a tool, and some have argued that being a computer software, if not properly applied, its use can defeat the aim of what a qualitative research is meant to be. Suggesting "that the richness and complexity of qualitative data does not readily fit with software's 'quantifying' nature, thus risking loss of meaning" (Atherton & Elsmore, 2007; Roberts & Wilson, 2002 as cited in Goble, Austin, Larsen, Kreitzer and Brintnell, 2012, p. 3).

So while it is accepted that qualitative softwares, for instance NVivo can facilitate and expedite qualitative data analysis by simplifying the coding process and display of data especially when working with large quantities of data, the inaccessibility of such software made it impossible to apply it in this study. Although other elements of the research process were used to ensure the rigor of this qualitative study, the use of a qualitative software would have been of immense help in providing methodological rigor and further promoted the reliability and validity of this study.

APPENDIX K

Energy Research Institutes in Nigeria

The National Agency for Science and Engineering Infrastructure (NASENI) is the country's research and development custodian. It coordinates the activities of the eight research institutes involved in one form of energy development or the other. These institutes which are spread across the six geo-political zones of the country include:

1) Scientific Equipment Development Institute (SEDI), Enugu and Minna
2) Electronic Development Institute (ELDI), Awka
3) Hydraulic Equipment Development Institute (HEDI), Kano
4) Engineering Materials Development Institute (EMDI), Akure
5) National Engineering Design Development Institute (NEDDI), Nnewi
6) Power Equipment and Electrical Machines Development (PEEMADI), Okene
7) Prototype Engineering Development Institute (PEDI), Ilesha; and
8) Advanced Manufacturing Technology Project (AMT-P), Jalingo.

Other than NASENI and its institutes, Nigeria also has six independent energy research institutes namely: Center for Energy Research and Development; Centre for Energy Research and Training; National Center for Technology Management; National Center for Energy Research and Development; Projects Development Institute (PRODA); and Sokoto Energy Research Centre (SERC).

APPENDIX L

Data Summary Table for Finding 1: Factors for Entrenching Renewable Energy for Rural Electrification

	Marker	Advocacy	Overcome Liability of Newness	Improved Bureaucratic Involvement	Conscious Government Participation	Increased Awareness
1	ECN1	✓		✓	✓	✓
2	ECN2	✓		✓	✓	✓
3	ECN3	✓		✓	✓	✓
4	MOP1			✓	✓	✓
5	MOP2	✓		✓	✓	✓
6	MOP3	✓		✓	✓	✓
7	MOP4	✓	✓			✓
8	MOP5			✓	✓	✓
9	MOP6	✓	✓	✓	✓	✓
10	MOP7	✓	✓		✓	✓
11	NERC1	✓		✓	✓	✓
12	NERC2	✓		✓	✓	✓
13	REA1	✓	✓		✓	✓
14	REA2	✓	✓	✓	✓	✓
15	REC1				✓	
16	REC2			✓	✓	✓
17	REC3					
Total	17	71%	29%	71%	88%	82%

Source: Interview Responses

APPENDIX M

Data Summary Table for Finding 2: Perceptual Factors - Inhibitors

	Marker	Knowledge/ Technological Lag	Poor Level of Awareness	Perception of Renewable Energy Technology	Misplaced Priorities in Renewable Energy Projects	Fossil Fuel – Renewable Energy Dynamics	Bureaucratic Ineffectiveness
1	ECN1		✓			✓	✓
2	ECN2	✓	✓			✓	✓
3	ECN3	✓	✓	✓	✓	✓	✓
4	MOP1	✓	✓	✓		✓	
5	MOP2		✓	✓	✓	✓	✓
6	MOP3			✓		✓	✓
7	MOP4	✓	✓	✓		✓	
8	MOP5	✓	✓			✓	✓
9	MOP6	✓				✓	
10	MOP7			✓			
11	NERC1	✓	✓	✓	✓	✓	
12	NERC2	✓	✓	✓	✓	✓	✓
13	REA1	✓			✓		
14	REA2	✓	✓	✓	✓	✓	✓
15	REC1	✓		✓		✓	
16	REC2	✓	✓		✓		✓
17	REC3		✓				✓
Total	17	71%	71%	59%	41%	76%	59%

Source: Interview Responses

APPENDIX N

Data Summary Table for Finding 2: Perceptual Factors - Facilitators

	Marker	Political Will	Government Incentives	Human Capacity Development	Better Coordination	Commitment of the Local Communities	Funding
1	ECN1	✓	✓	✓	✓	✓	
2	ECN2	✓	✓	✓	✓	✓	✓
3	ECN3	✓	✓	✓	✓	✓	✓
4	MOP1		✓	✓			✓
5	MOP2	✓	✓	✓	✓		✓
6	MOP3	✓	✓	✓			
7	MOP4		✓	✓		✓	
8	MOP5	✓	✓	✓	✓		
9	MOP6		✓				✓
10	MOP7		✓	✓			✓
11	NERC1		✓	✓	✓	✓	✓
12	NERC2	✓	✓	✓	✓		✓
13	REA1	✓			✓		✓
14	REA2	✓	✓	✓	✓	✓	✓
15	REC1			✓		✓	✓
16	REC2			✓			✓
17	REC3					✓	✓
Total	17	53%	76%	82%	53%	47%	76%

Source: Interview Responses

APPENDIX O

Data Summary Table for Finding 3:

Internal Physiognomies that could Affect Renewable Energy Deployment

	Marker	Clean Energy	Domestic Source of Energy	Abundant Supply	Cost Effectiveness	Appropriate Technology
1	ECN1	✓	✓		✓	✓
2	ECN2				✓	
3	ECN3			✓	✓	✓
4	MOP1				✓	
5	MOP2	✓	✓	✓	✓	✓
6	MOP3					
7	MOP4				2	
8	MOP5		✓	✓	✓	✓
9	MOP6	✓	✓	✓	✓	✓
10	MOP7			✓	✓	
11	NERC1		✓	✓	✓	✓
12	NERC2			✓	✓	✓
13	REA1					
14	REA2				✓	✓
15	REC1			✓	✓	✓
16	REC2					✓
17	REC3					
Total	17	18%	29%	47%	76%	59%

Source: Interview Responses

APPENDIX P

Data Summary Table for Finding 4:

External Physiognomies that could Affect Renewable Energy Deployment

	Marker	Environmental/ Climate Change Mitigation Requirements	Catalyst for Stimulating Rural Development	Energy Security	Energy Politics	Perceived Value of Renewable Energy	Energy Policy and Frameworks	Topographical Considerations
1	ECN1	✓			✓			
2	ECN2	✓	✓					
3	ECN3			✓	✓			
4	MOP1	✓		✓	✓	✓	✓	
5	MOP2	✓	✓			✓	✓	✓
6	MOP3	✓		✓	✓	✓	✓	
7	MOP4					✓		✓
8	MOP5					✓	✓	✓
9	MOP6	✓		✓			✓	✓
10	MOP7						✓	
11	NERC1	✓	✓	✓	✓	✓	✓	✓
12	NERC2					✓	✓	✓
13	REA1					✓	✓	✓
14	REA2		✓	✓		✓	✓	✓
15	REC1					✓		
16	REC2							
17	REC3							
Total	17	41%	24%	35%	29%	59%	59%	47%

Source: Interview Responses

APPENDIX Q

Data Summary Table for Finding 5:

Country Specific Factors that could Affect Renewable Energy Deployment

	Marker	Underutilization of Excess Resources	Nonexistent Renewable Energy Policy	Deficient Electricity Industry	Antiquated Process	Endemic Corruption	Lack of Continuity in Government Progrmmes
1	ECN1		✓	✓			
2	ECN2	✓	✓	✓	✓		✓
3	ECN3	✓		✓	✓		
4	MOP1		✓	✓			✓
5	MOP2	✓	✓	✓			✓
6	MOP3		✓			✓	
7	MOP4						
8	MOP5		✓				✓
9	MOP6		✓	✓			
10	MOP7		✓				
11	NERC1	✓		✓	✓		
12	NERC2	✓		✓	✓	✓	
13	REA1			✓			✓
14	REA2	✓				✓	
15	REC1						
16	REC2				✓	✓	
17	REC3						
Total	17	35%	47%	53%	29%	24%	29%

Source: Adapted from Interview Responses

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