An Empirical Investigation of the Impact of Global Energy Transition on Nigerian Oil and Gas Exports

A thesis submitted for the degree of Doctor of Philosophy (PhD)

by

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Declaration

Candidate's declarations:

I, Bukar Zanna Waziri hereby certify that this thesis submitted in partial fulfilment of the requirements for the award of degree in Doctor of Philosophy (PhD), Abertay University, is wholly my own work unless otherwise referenced or acknowledged. This work has not been submitted for any other qualification at any other academic institution.

Signed……
Date……...

Supervisor's declaration:

I, Professor Reza Kouhy hereby certify that the candidate has fulfilled the conditions of the Resolution and Regulations appropriate for the degree of Doctor of Philosophy (PhD) in Abertay University and that the candidate is qualified to submit this thesis in application for that degree.

Signed……
Date……..

Certificate of Approval

I certify that this is a true and accurate version of the thesis approved by the examiners, and that all relevant ordinance regulations have been fulfilled.

Supervisor……..
Date……...

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Abstract

Net energy exporting countries (NEECs) and net energy importing countries (NEICs) depend on each other for mutual gains. However, NEICs pursue strategic policies to reduce consumption of energy from conventional sources and increase that of renewable energy in order to attain energy security and macro environmental and carbon accountability. On the other hand, NEECs such as Nigeria depend heavily on oil and gas exports to NEICs to generate revenue. As a result of this inter-dependent relationship, this PhD project adopts a dependency theory and strategic issue analysis framework to underpin the study. Accordingly, the study approach is founded on the ideas of pluralism as a social reality and adopted pragmatism as the research approach. Consistent with these approaches, the study was undertaken by analysing both secondary and primary data, including macro-economic statistics of annual time-series dataset (1980-2014) and semi-structured interviews respectively. The quantitative part of the project used Auto Regressive Distributed Lag (ARDL) Bounds testing approach. This method was used to investigate and analyse the effect of renewable energy consumption and carbon emissions reduction on Nigeria's oil and gas exports. The qualitative part involved interviews with twenty senior government officials in Nigeria from six selected Federal Ministries, Departments and Agencies (MDAs), representatives of civil society groups and academicians, to support the quantitative results and answer certain research questions. The short-run quantitative results and qualitative findings show that renewable energy consumption in developed NEICs affects Nigeria's oil and gas exports. However, the reverse holds true for emerging NEICs. Both the quantitative results and the qualitative findings show that carbon emissions reduction in developed NEICs affects Nigerian oil and gas exports in the long run. Also, the quantitative results show that renewable energy consumption in developed and emerging NEICs does not affect Nigerian oil and gas exports in the long run. However, the qualitative findings only support the quantitative results for emerging NEICs but do not support those of developed NEICs. Similarly, the qualitative findings indicate that other external and internal factors such as discovery of shale oil and gas; improvement in energy efficient technologies; the use of long-term contract in other NEECs; stringent nature of the Nigerian Content Law and lack of passage of the Petroleum Industry Bill amongst others currently contribute in affecting Nigeria's oil and gas exports. Moreover, the qualitative findings show that global energy transition has an impact on the Nigeria's oil and gas revenue, savings made to the Nigerian Sovereign Wealth Fund, budget financing and will continue to affect Nigerian revenue and budget if the economy remains undiversified. Finally, the qualitative findings indicate that global energy transition has negatively affected Foreign Direct Investment flow into Nigerian petroleum industry and discoveries of new oil and gas reserves. These findings have several implications. Firstly, Nigerian oil and gas exports are affected by the carbon emissions control regime, which makes future oil and gas revenues uncertain; thereby putting pressure on budget financing and socio-economic growth and development. On this note, there is the need for Nigeria to take cautionary position in the global climate change debate in order not to adversely affect the country's economic interest. Secondly, the consumption of energy from renewable sources in both developed and emerging NEICs is an opportunity for Nigeria to export not only its conventional energy but also renewable energy if commercially harnessed. This suggests that Nigerian should also invest heavily in renewable energy production. Thirdly, the major findings of this study provide evidence in support of the relevance of dependency theory and strategic issue analysis framework within the context of energy transition in NEICs on one hand, and Nigerian oil and gas exports to these countries on the other. This implies the need for Nigeria to focus on developing internal market trajectories to increase domestic utilisation of its conventional energy rather than being dependent on external markets for the sale of the nation's energy resources.

Table of Contents

Dedication

To my late father, who is an educationist and wanted me to be a doctor;

compassionate mother and victims of insurgency in Nigeria

List of Figures

List of Tables

Definitions

ACES	American Clean energy and Security Act
ADF	Augmented Dicker Fuller
APEC	Asian-Pacific Economic Cooperation
ARDL	Auto-Regressive Distributed Lag
AU	Abertay University
Bbl	Barrel of Oil
BOF	Budget Office of the Federation
Bpd	Barrels Per Day
Btu	British Thermal Units
CBN	Central Bank of Nigeria
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanism
CER	Carbon Emission Reduction
CEDE	Carbon Dioxide Emissions from Petroleum
CISLAC	Civil Society Legislative Advocacy Centre
CO_2	Carbon Dioxide
COMD	Crude Oil Marketing Division
CREN	Council for Renewable Energy in Nigeria
CSO	Civil Society Organisation
CUSUM	Cumulative Sum of Recursive Residuals
CUSUMSQ	Cumulative Sum Square of Recursive Residuals
DEA	Data Envelopment Analysis
DNEIC	Developed Net Energy Importing Countries
DPR	Department of Petroleum Resources
ECA	Excess Crude Account
ECN	Energy Council of Nigeria
EIA	Energy Information Administration
EISA	Energy Independence and Security Act
EREC	The European Renewable Energy Council
ESDS	Economic and Social Data Services
ESMAP	Energy Sector Management Assistance Program
EU	European Union
EUAs	European Union Allowances
FAO	Food and Agriculture Organisation
FCT	Federal Capital Territory
FDI	Foreign Direct Investment
FEC	Federal Executive Council
FEE	Financial and Economic Experts
GDP	Gross Domestic Product
GDPE	Gross Domestic Products for Developed Net Energy Importing Countries
GDPDE	Gross Domestic Products for Emerging Net Energy Importing Countries
GHG	Greenhouse Gases
IEA	International Energy Agency
IMF	International Monetary Fund
IOCs	International Oil Companies
IPCCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
JV	Joint Venture
KW	Kilowatts
MDAs	Ministries, Departments, Agencies
MJ/ M2	Million Joule per Square Metre
MNOCs	Multinational Oil Companies

MOF	Ministry of Finance, Nigeria
MOIP	Mandatory Oil Import Quota Program
MTEF/FSP	Medium Term Expenditure Framework and Fiscal Strategy Paper
NASS	National Assembly
NCERD	National Centre for Energy Research and Development
NEEC	Net Energy Exporting Countries
NEIC	Net Energy Importing Countries
NEITI	Nigerian Extractive Industries Transparency Initiative
NIPC	Nigerian Investment Promotion Commission
NNPC	Nigerian National Petroleum Corporation
NOE	Nigerian Oil and Gas Exports demand
NOREV	Nigerian Oil and Gas Revenue
NPC	National Planning Commission
NREAP	National Renewable Energy Action Plan
NSWF	Nigerian Sovereign Wealth Fund
OAGF	Office of the Accountant General of the Federation
OAOPEC	Organisation of Arab oil Producing Exporting Countries
OECD	Organisation for Economic Co-operation and Development
OPD	Oil Price in Dollars
OPEC	Organization of the Petroleum Exporting Countries
PIB	Petroleum Industry Bill
PP	Philips Perron
PPP	Polluter Pays Principle
PPT	Petroleum Profit Tax
PPTA	Petroleum Profit Tax Act
PSC	Production Sharing Contract
PTDF	Petroleum Technology Development Fund
REC	Renewable Energy Consumption
REDE	Renewable Energy Consumption in Developed NEICs
REEE	Renewable Energy Consumption in Emerging NEICs
RES	Renewable Energy Sources
RFS	Renewable Fuel Standards
RTFO	Renewable Transport Fuel obligation
SAS	Statement of Accounting Standard
TCF	Trillion Cubic Feet
UK	United Kingdom
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNFCCC	United Nation Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
US	United States
USEPA	The United States Environmental Protection Agency
WECD	World Commission on Environment and Development

Chapter 1.
Introduction

1.1 Background

Conventional energy source[1] is an important global primary energy that has stimulated socio-economic activities and generated technological advancement in almost all spheres of life. The impacts of conventional energy source in both net energy exporting countries (NEECs) and net energy importing countries (NEICs) cannot be ignored. According to International Energy Agency Key World Energy Statistics (2015), conventional energy accounts for 52.5% of the total global primary energy supply. Similarly, Energy Information Administration (2015) reports that conventional energy sources accounts for 62.0% of overall total global primary energy demand.

However, the Organisation of the Petroleum Exporting Countries (OPEC[2]) supply constitutes an estimated 43.0% of the total global energy production as at 2015 (OPEC Annual Statistical Bulletins, 2016). Hence, it is not surprising that oil and gas revenue constitutes a significant proportion of total government revenue in most OPEC member countries. However, according to the Organisation of the Petroleum Exporting Countries Annual Statistical Bulletins (2015), OPEC members' value of petroleum exports is decreasing at a considerable rate since 2013. For instance, the aggregate OPEC members' petroleum exports revenue was 45.80% lower in 2015 than in 2014.

Despite their numerous socio-economic advantages, conventional energy sources are intertwined with many problems. Conventional energy is considered as a finite resource that will not be available in the future. In addition, there is concern for supply disruption due to political instabilities in most net energy exporting

[1] The term conventional energy sources, fossil fuel and oil and gas are used interchangeably throughout this study

[2] These comprises of 13 countries which includes: Algeria, Angola, Ecuador, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates and Venezuela.

countries (NEECs[3]), especially OPEC members. In addition, the process of production and consumption of energies from conventional sources comes with environmental implications, which cause global warming.

According to the Intergovernmental Panel on Climate Change (IPCC) (2014), about 60% of total global carbon emissions is primarily caused by conventional energy sources. Similarly, International Energy Agency (2015), states that oil and gas are responsible for 53.4% of total global carbon emissions by fuels. However, some scholars disagree with the IPCC reports and suggest that there is no clear evidence showing future rise in global temperature (Woodward and Gray 1993; Klotzbach 2006; Elsner, Kossin and Jagger, 2008). For instance, Woodward and Gray (1993) and Klotzbach (2006) argue that global warming has no any relationship with increases in the level of carbon emissions.

Regardless of the surrounding debates, the importance and consequences of conventional energy sources, the world driven, by the net energy importing countries (NEICs[4]), has advanced numerous strategies and policies to substitute conventional energy sources. The strategies adopted involved physical, political and market based approaches. In addition, the Kyoto Protocol agreement specifically highlights the development of renewable energy, improving energy efficiency and reduction in oil and gas consumption as a solution mechanism in achieving the emission reduction targets. Hence, it is expected that these strategies and policies would accelerate the development and consumption of alternative energy sources including renewable energy. According to current reports, renewable energy supplied about 19.1% of global final energy consumption, 22% of electricity (Renewable Energy Network 21's report, 2015) and is expected to account for 40% of total global primary energy by the year 2040 (EREC, 2004). Based on Renewable Energy Network for the 21st Century (REN21) report (2015), over 150 countries have adopted various forms of

[3] This acronym stands for Net Energy Exporting Countries and is used throughout the study.
[4] This acronym stands for Net Energy Importing Countries and is used throughout the study.

strategies, targets and have developed support policies towards the development of renewable energy in order to account for significant share in their total energy mix.

For the European Union (EU) member countries, a broad based renewable energy policy framework known as the vision "20–20–20" was adopted to achieve 20% renewable energy development and 20% reduction in carbon emission by the year 2020. Moreover, the European Union established the National Renewable Energy Action Plan (NREAP) 2010 as a general framework under Directive 2009/28/EC of the European Parliament on the transition roadmap to renewable energy sources in order to attain energy and climate security, employment as well as technological and regional development. The USA's approach to the energy transition is slightly different compared to the EU member countries. In addition to the renewable energy, the development and use of non-conventional energy sources are pursued to achieve energy security. Similarly, other emerging countries especially the NEICs are keying in to the global agenda. For instance, China's Renewable Energy Law (2005 as amended) provides the bedrock for the country's energy transition road map to end its energy and climate concerns (Schuman and Lin, 2012). Also, other developing countries are supported by the developed countries through the Kyoto Protocol's Clean Development Mechanism to invest in clean energy sources (Polidano et al., 2000).

Numerous studies on the impact of renewable energy consumption have been conducted in the literature within the perspectives of NEICs using different methodologies and approaches (see for example, Sari and Soytas, 2004; Szklo and Schaeffer, 2006; Payne, 2009; Menegaki, 2011; Jorgenson, 2012; York, 2012; Smith, 2014). Most of these studies established that renewable energy sources bring higher economic and environmental sustainability, energy security compared to reliance on conventional energy sources. Similarly, there is a great deal of existing literature, which empirically investigated the impact of global carbon emissions on NEECs using different approaches (see, Berg et al., 1997; McKibbin et al., 1999; Persson, et al., 2007; Johansson, et al., 2009; Suranovic,

2013; Dike, 2013 and 2014; McCollum, et al., 2014). They established that carbon emissions reduction would have significant effects on OPEC members' oil and gas revenue. As a result, OPEC member countries have voiced out their concerns on the global energy transition, because of its potential impact on their oil and gas exports revenues (Yamin 1998; OPEC, 2000). However, the works of Barnett, Dessai, and Webber (2004), Persson, et al., (2007) and Johansson, et al., (2009) argues that NEECs would not lose in the energy transition regime.

Nigeria is one of the leading NEECs in Africa and a key member amongst OPEC member countries (British Petroleum Statistical Review, 2016; OPEC Annual Statistical Bulletins, 2016). Thus, it is important to empirically examine the impacts of renewable energy consumption and carbon emissions reduction in NEICs on Nigerian oil and gas exports. In addition, the study seeks to undertake semi-structured interviews with public and other stakeholders to support and provide further insights into the quantitative results. The interviews also solicit for further insights into the impact of global energy transition on Nigerian oil and gas revenue, budgets and plans to mitigate these impacts. The remaining chapter is structured as follows. The next section explains the research problems and the gap found within the body of reviewed literatures. Section 1.3 presents the aim and objectives of the study. The research hypotheses and research questions are stated in section 1.4. Section 1.5 focuses on the theoretical underpinnings of the research, while the research approach of the study is captured in section 1.6. The chapter finally concludes by outlining the structure of the thesis in section 1.7.

1.2 Statement of the Problem and Justification for the Study

The epic quest for alternative sources of energy to substitute conventional energy sources is the major agenda for most countries. This may be related to the increasing concentration of fossil fuel reserves in the unstable OPEC (Shafiee and Topal 2009; Umbach 2010). Other reasons for the energy transition are peaking of reserves in Organisation for Economic Cooperation and Development (OECD)

countries (Moriarty and Honnery 2012) and the carbon emissions effect associated with fossil fuel consumption (Intergovernmental Panel on Climate Change Reports, 1990; 1995; 2014). In addition, oil price volatility, financial and asset loss and uncertainty in energy supply among others Awerbuch and Sauter, 2006; Chang, 2009).

On the one hand, most of the countries involved in the energy transition regime are NEICs to sustain their economic growth (Sari and Soytas, 2004; Apergis and Payne, 2010a). Moreover, NEICs want to achieve energy and environmental sustainability, minimise the risk of oil price shocks and supply disruption through less consumption of fossil fuels (Apergis et al. 2010; Von Eije, von Eije, and Westerman 2012; Tugcu, Ozturk and Aslan 2012; Shabbir, Shahbaz and Zeshan 2014). One of the ways for achieving these objectives is by consumption of energy from renewable source, which is considered as a viable substitute for oil and gas energy.

On the other hand, the energy transition to renewable energy sources has attracted the attention of OPEC member countries. This is because of its potential effect on foreign direct investment, global fossil fuel consumption and resultant effects on their export revenues (Organization of the Petroleum Exporting Countries, 2000; Subroto, 1994; Yamin, 1998; McKibbin et al., 1999; Bernstein, Montgomery and Rutherford 1999; Linden, et al., 2000; Pershing; 2000; Ghanem et al., 1999; Bhattacharyya 2011). According to Energy Sector Management Assistance Programme (2004) and Barnett, Dessai and Webber (2004) oil and gas revenue accounts for 15% to 70% of total government revenue and between 9% and 40% of GDP in major net energy exporting countries.

Nigeria is ranked as Africa's largest producer of oil, thirteen largest oil producing country in the world and the most oil revenue dependent country amongst OPEC member countries (British Petroleum Statistical Review, 2016; Energy Information Administration, 2015 and Energy Sector Management Assistance Programme, 2004). Nigerian oil and natural gas total proved reserves stood at

37.1 billion barrels of oil and 180.5 trillion standard cubic feet (scf) of gas, according to British Petroleum Statistical Review (2016). In terms of oil and gas production, Nigeria accounts for over 2.3 million barrels and 50.1 in billion standard cubic metres per day respectively as at 2015 (British Petroleum, 2016). Prior to the sharp fall in oil and gas production, exports volume and price, oil and gas revenue accounts for 74% of Nigerian total revenue, 95% of foreign exchange earnings and 34% of GDP; while the non-oil and gas sector accounts for the remaining balance (Budget Office of the Federation, 2014; Central Bank of Nigeria, 2013). This suggests the dominance of oil and gas revenue in Nigerian total government revenue, foreign exchange earnings and budget financing.

However, revenue performances for 2015 and 2014 revealed dramatic decreases in oil and gas revenues by about 50% and 37% respectively (Budget Office of the Federation, 2016; Central Bank of Nigeria; National Assembly, 2016). As a result of significant fall in oil and gas exports and price, the 2015-2017 MTEF/FSP[5] was revised to reflect current economic realities, thus the 2016-2018 MTEF/FSP was produced (Budget Office of the Federation, 2016; National Assembly, 2016). As contained in 2016-2018 MTEF/FSP, projected revenue to be realised from oil and gas would considerably reduce by from about 50% in 2015 to 38%, 45% and 44% for the year 2016, 2017 and 2018 respectively (Budget Office of the Federation, 2016; National Assembly, 2016). This suggests the fluctuations in oil and gas exports volume and oil price has caused wide gap in Nigerian budgeted and actual revenue and budget financing. This gap is anticipated to intensify with the increasing level of global energy transition to renewable energy and carbon emissions reduction by net energy importing countries.

It appears that there is no savings and strong alternative revenue sources to support the potential oil and gas revenue loss. Similarly, it appears to show that the current state of infrastructure and economic growth in Nigeria are grossly

[5] In the 2015-2017 Medium Term Expenditure Framework and Fiscal Strategy Paper (MTEF/FSP), oil and gas revenue was projected to generate about 72% of Nigerian total government revenue for the 2015-2017 financial years.

inadequate. In addition, rising population level, unemployment, poverty and general insecurity requires huge financial resources to be addressed. Based on current United Nations estimates (2016), Nigeria's population stood at 187 million and it is expected to more than double to 398 million surpassing US by the year 2050. According to the current available statistics from National Bureau of Statistics (NBS) (2012), 70% of Nigerian are surviving below the poverty benchmark compared with the year 1980, which is only 27.2%. This suggests that despite the huge oil and gas revenue accruing to the country, Nigerian are poorer now than as at 1980. Consequent to the problems described above, the study has identified the gaps below in the literature, which serve as justification for conducting this PhD research project.

Firstly, the reviewed literature suggests that studies on the impact of renewable energy use were undertaken either at global context or in the perspective of developed and emerging NEICs. For example, see Sari and Soytas, (2004); Szklo and Schaeffer, (2006); Akella, Saini and Sharma, (2009); Apergis and Payne, (2009); Jorgenson, (2012); Shabbir, Shahbaz and Zeshan (2014); York, (2012) and Smith, (2014). To the best of the author's knowledge, there are no any existing studies, which has investigated the impact of global energy transition on developing NEICs.

Secondly, most of the studies used variety of methodologies over certain periods such as Structural Equation Modelling (SEM) Approach, Data Envelopment Analysis (DEA), Panel Threshold Regression (PTR) model, Panel Co-Integration Techniques, Multivariate Panel Data Framework amongst others. This study adopted the ARDL-Bounds testing of co-integration to investigate the impact of renewable energy consumption and carbon emissions reduction by net energy importing countries on Nigeria as an oil exporting and developing country. In addition, follow-up semi-structured interviews were conducted in order to support the quantitative findings and solicits for further insights into the impact of global energy transition on Nigerian oil and gas revenue, budgets and plans to mitigate these impacts.

Thirdly, researchers and funders have shown little interest in the potential implications of renewable energy consumption on net energy exporting and dependent economies because definitive literature on energy transition research still remains undeveloped characterised by dispersed and obscure data sources (Grubler, 2012). This study attempts to contribute to the existing scanty body of literatures in this area, specifically within the perspective of net energy exporting and developing countries.

1.3 Aim and Objectives of the Study

Therefore, the aim is to empirically evaluate the impact of renewable energy consumption and carbon emissions reduction by net energy importing countries on Nigerian oil and gas exports. Other specific objectives developed through the literature review, in the light of the main aim, are:

i. To investigate and analyse how carbon emission reduction in developed NEICs affect Nigerian oil and gas exports.
ii. To investigate and analyse how renewable energy consumption in developed NEICs affect Nigerian oil and gas exports.
iii. To investigate and analyse how renewable energy consumption in emerging NEICs affect Nigerian oil and gas exports.
iv. To compare and analyse the effect of renewable energy consumption in developed NEICs and emerging NEICs on Nigerian oil and gas exports.
v. To investigate and analyse the perceptions of public decision and policy makers in ministries, departments and agencies (MDAs) and other stakeholders in Nigeria about the impact of the global energy transition on Nigerian oil and gas revenue, budgets and plans to mitigate these impacts.
vi. Lastly, to recommend strategic plans to public policy and decision makers in Nigeria on how to address the impact of the global energy transition.

1.4 Research Hypotheses and Research Questions

Reflected and derived from the literature reviews and research objectives, three hypotheses are developed for the study. These hypotheses are directly related with three objectives of the study. More specifically, hypotheses one, two and three are related with objectives one, two and three respectively. The empirical result obtained from the test of hypothesis one was employed to evaluate the impact of carbon emission reduction in developed NEICs on Nigerian oil and gas exports. While the empirical results obtained from the tests of hypotheses, two and three are used to assess the overall impact of the renewable energy consumption in both developed and emerging NEICs on Nigerian oil and gas exports.

Below are the three hypotheses for the study.

H_0 1: Carbon emission reduction in developed NEICs has no influence on Nigerian oil and gas exports.
H_a 1: Carbon emission reduction in developed NEICs has influence on Nigerian oil and gas exports.

H_O2: Renewable energy consumption in developed NEICs has no influence on Nigerian oil and gas exports.
H_a2: Renewable energy consumption in developed NEICs has influence on Nigerian oil and gas exports.

H_O 3: Renewable energy consumption in emerging NEICs has no influence on Nigerian oil and gas exports.
H_a 3: Renewable energy consumption in emerging NEICs has influence on Nigerian oil and gas exports.

Moreover, a qualitative comparative analysis was conducted based on the tested hypotheses two and three in order to answer research question one and achieve objective four. In addition, semi-structured interviews were undertaken to support the quantitative results and solicits for further insights into the impact of global energy transition on Nigerian oil and gas revenue, budgets and plans to

mitigate these impacts. The insights generated from the public and other stakeholders are expected to answer the raised research question two and achieve objective five. Finally, objective six is to make strategic recommendations to public policy and decision makers in Nigeria on how to address the impact of the global energy transition. The following are the research questions of the study.

Q1: Are the effect of renewable energy consumption in developed NEICs on Nigerian oil and gas exports higher than that of the emerging NEICs?

Q2: What are the perceptions of public decision and policy makers in MDAs and other stakeholders about the impact of the global energy transition on Nigerian oil and gas revenue, budgets and plans to mitigate these impacts?

1.5 Theoretical Underpinnings of the Research

This study believes that due to the inter-dependent relationship between countries, the energy transition in dominant countries may influence resource dependent countries (NEECs). The dominant countries referred to as the NEICs rely substantially on oil and gas (conventional energy sources) imports from NEECs to meet their energy requirements. These NEICs accounts for about 60% of the total global primary energy consumption (Internal Energy Agency, 2015). However, these NEICs pursue strategic policies to reduce conventional energy in their energy mix and increase the use of renewable energy in order to attain energy security, economic and environmental sustainability.

On the other hand, the resource dependent countries labelled as NEECs depend heavily on oil and gas exports to the NEICs for foreign exchange earnings and importation of variety of goods (Energy Sector Management Assistance Programme, 2004; Jeffrey, 2012). Nigeria is ranked first in terms of dependence on oil and gas revenue (Energy Sector Management Assistance Programme, 2004). Due to Nigeria's high dependence on oil and gas exports, the energy transition in NEICs is considered as a strategic issue to Nigeria. Therefore,

consistent with dependency theory and strategic issue analytical framework, renewable energy consumption and carbon emissions reduction by NEICs is hypothesised to influence Nigerian oil and gas exports to these countries.

1.6 Research Approach for the Study

Social science researchers are encouraged to keep pace with social dynamism and move away from the traditional strict adherence of either being quantitative or qualitative. However, the nature of the social phenomenon to be explored determines the appropriate research methodology and approach to be adopted (Morgan and Smirrcich, 1980; Hussey and Hussey, 1997; Gill and Johnson, 2010; Hassan, 2012). Consequently, this study is motivated by the belief about existence of pluralism of reality, which appreciates the objective, subjective and intersubjective reality and their interrelations (Johnson and Christensen, 2010).

On the one hand, the objective dimension posits that knowledge of the social reality is only derived through systematic protocols, techniques, hypothesis testing and theories that provide the causal explanation about the social reality (Blaikie, 2010). On the other hand, the proponents of subjective reality recognize knowledge to emanate from the perception of human experience and mind construct. However, the pluralist believed that both extremes dimensions (objective and subjective realities) could be combined in order to obtain valid knowledge of social reality which is either independent on the human consciousness or mind set (Kuhn, 1970; Burrell and Morgan, 1979).

Similarly, based on the objectives of the study, the author adopted the mixed method approach. Mixed method approach involves the combination of methods, philosophies and paradigms considered as pragmatism in the research literature (Blaikie, 2010; Saunders, Lewis and Thornhill, 2012). Consistent with mixed method, the study moves back and forth within the realms of objective and subjective realities and the interrelations between them to generate testable hypotheses using systematic protocols, techniques, and theories that provide the causal explanation about the social reality (Blaikie, 2010; Johnson and

Christensen, 2010). Moreover, semi-structured interviews were undertaken to support the quantitative findings and provide full understanding of investigated phenomenon from multiple perspectives. Thus, by adopting the pragmatic approach, the study employed both deductive and inductive approaches. The researcher is not only being independent with the problem investigated but became part of it to understand the problem from the insider perspective.

Based on these approaches, two different sets of data were collected; secondary data (annual time series) and primary data in the form of semi-structured interviews which were analysed. Hence, the study findings emanated from both quantitative and qualitative data. Therefore, the study is divided into two parts. The first part has investigated and analysed how renewable energy consumption in NEICs and carbon emissions reduction in developed NEICs affect Nigerian oil and gas exports demand. The annual time series data from 1980-2014 were collected and analysed. The data was analysed using the Auto Regressive Distributive Lag (ARDL) Bounds testing approach of co-integration to empirically estimate the three models[6].

The second part is concerned with primary data collected in the form of semi-structured interviews in order to support the quantitative results and further seek the perceptions of public decision and policy makers and other stakeholders in Nigeria about the impact of global energy transition on Nigerian oil and gas revenue, budgets and plans to mitigate these impacts. Twenty participants were interviewed; fifteen from six different federal ministries, departments and agencies while two are academicians from universities. The remaining three participants are from civil society group comprising of two senior public analysts and one senior independent researcher.

[6] Models 1 and 2 were about Nigerian oil and gas exports to developed NEICs. On the one hand, model 1 (hypothesis 1) selected carbon emissions of these NEICs as one of the key independent variable and on the other hand, model 2 (hypothesis 2) specified renewable energy consumption of these NEICs as one of the major independent variable. Similarly, model 3 (hypothesis 3) was about Nigerian oil and gas exports to emerging NEICs and renewable energy consumption of these NEICs represented one of the major independent variables.
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1.7 Structure of the Thesis

Figure 1.1 below depicts the snapshot view of the thesis structure. Overall, the thesis is structured into nine chapters. This chapter is the preamble, which provides general background information about the global energy transition and its impact on net energy exporting countries such as Nigeria. The chapter also explains the reasons for undertaking this study, as contained in the statement of the problem and justification for the study. Subsequently, the chapter presents the research aim and objectives, research hypotheses and the research questions of the study. The theoretical underpinnings of the thesis and the approach used for the study are discussed lastly in this chapter.

Chapters two, three and four are designated for the study's literature reviews. Chapter two discusses the theoretical frameworks underpinning global carbon emissions reduction. Similarly, the chapter presents the conceptual framework for environmental and carbon accountability that was derived from environmental and carbon accounting. Subsequently, the chapter reviews literatures on carbon emissions reduction policies specifically in net energy importing countries. In this regard, the chapter finally connects how the carbon emission reduction may influence economic interest and developmental growth of net energy exporting countries.

Chapter three presents and discusses global energy transitions with emphasis on the consumption of energy from renewable energy sources in net energy importing countries, various policies, measures and targets formulated in these countries to ensure the growth and consumption of renewable energy sources. The chapter further discusses past global energy transition and the factors that led to transitions. Finally, the chapter reviews empirical literatures on the impact of energy consumption from renewable energy sources.

Chapter four reviews budget and the framework of governmental budgeting in Nigeria. Moreover, the chapter discusses Nigerian budgetary process and the annual budgets. Thereafter, the chapter gives the connection between oil and gas exports revenue and Nigerian budgets. In addition, the chapter reviews the

various sources of oil and gas revenue that accrues to the various government accounts as well as how it is distributed. The chapter concludes by appraising the overall impact of the oil and gas exports revenue and how external factors such as the global energy transition might affect Nigerian oil and gas exports revenue and it seems there is no apparent strategic plan for mitigating the impact.

Chapter five presents the relevant theoretical frameworks underpinning studies of this kind. Consistent with the above, the chapter adopts and discusses dependency theory and strategic issue analysis analytical framework and explains how each of them underpin the study. The chapter specifically explains how dependency theory and strategic issue analytical framework fits into the debate of the energy transition in NEICs on the one hand and Nigerian oil and gas exports on the other hand. Lastly, the chapter develops and presents the research theoretical framework, which linked the derived research hypotheses to each of the research objectives.

Chapter six discusses the research methodology and methods of the study. In the chapter, philosophical assumptions and paradigms underpinning social science research are explained. Subsequently, the chapter identifies and discusses pluralism and pragmatic paradigm (mixture of both subjective and objective philosophical approaches of social science research) as the adopted philosophical assumption and paradigm that guide the researcher. As a result of the philosophical position, the chapter presents triangulation and mixed method as the research method of the study. Consistent with the research approach, detailed explanations about the nature, sources, and methods of analyses for the secondary data and primary based data in the form of semi-structured interviews is presented in this chapter six.

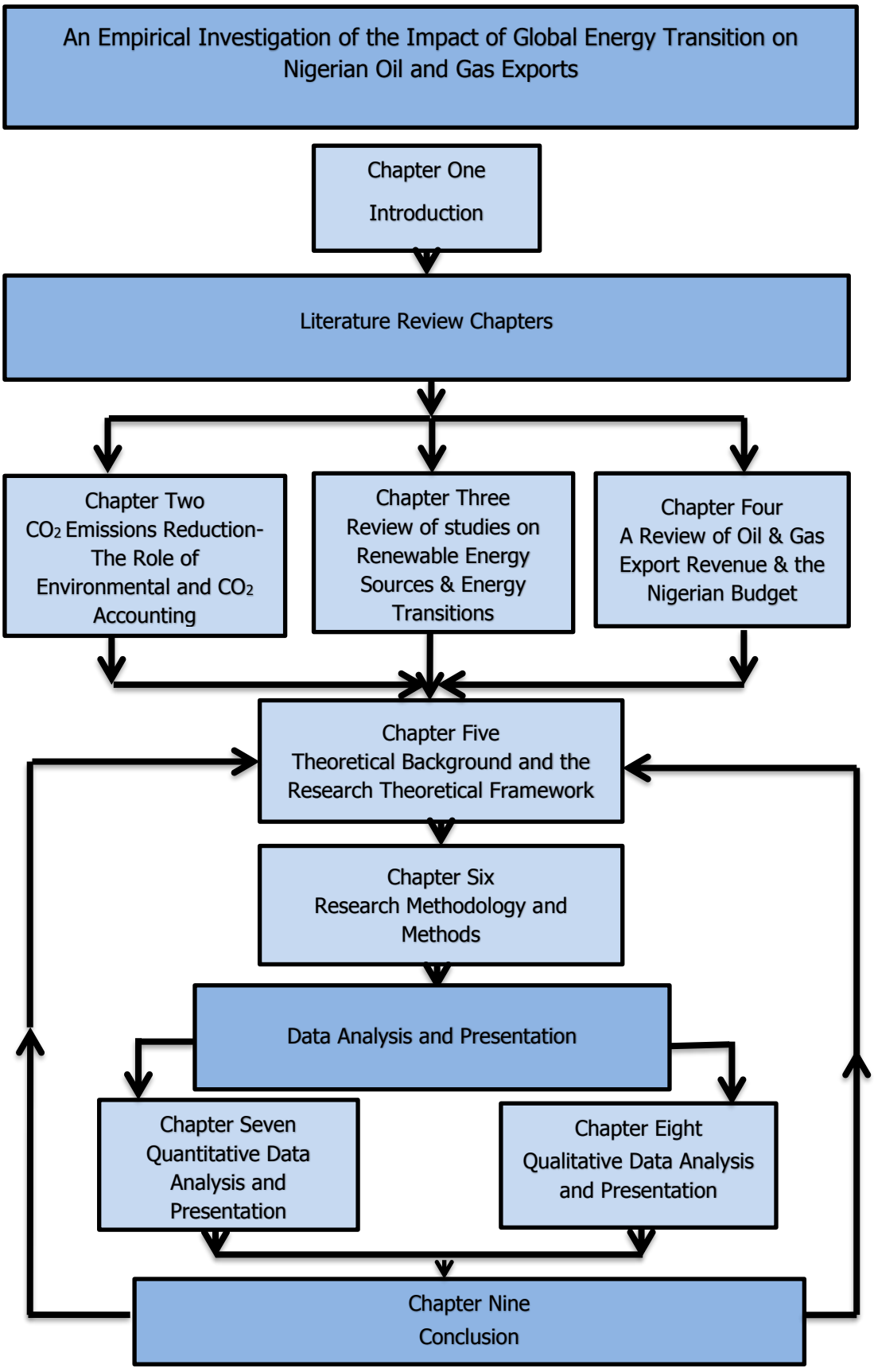
The analysis of the secondary based data collected in the form of annual time-series is presented in chapter seven. A rigorous econometric and statistical screening test is employed on all the models to ensure fitness and robustness. Using the ARDL-Bounds testing approach, the datasets on each of the three

models were estimated and analysed sequentially. Finally, the chapter presents the quantitative results, analysis and findings.

Chapter eight is designed to the analysis of the primary based data in the form of semi-structured interviews. Using manual based approach, the interviews were organised, analysed and interpreted systematically. At the end, the chapter presents the semi-structured interviews findings categorised into those that support the quantitative results and those that are related to research question two, which aims to achieve objective five.

The last chapter of thesis discusses in details the major research findings established in the previous two chapters. Subsequently, it highlights the practical policy implications and recommends the strategic plans for policy makers in order to mitigate the impact of energy transition. The chapter finally outlines the study contributions that emanates from the academic exercise, boldly pinpoints the limitations of the study and followed with areas for future study as well as ways for improvement.

Figure 1-1 Thesis Structure



Chapter 2.
Carbon Emissions Reduction- The Role of Environmental and Carbon Accounting

2.1 Introduction

This chapter reviews and discusses the theoretical background of pursuing environmental and carbon accountability at national, regional and global dimensions. Similarly, the chapter develops a conceptual framework of macro environmental and carbon accountability using the components and elements of environmental and carbon accounting. Moreover, the chapter explains the various carbon emissions reduction strategies, policies, measures adopted nationally and internationally. Consequently, the chapter reviews empirical studies on the impact of global carbon emissions reduction on net energy exporting countries (NEECs).

This chapter is organised as follows: Section 2.2 deals with theoretical basis for environmental and carbon accountability and derivation of the conceptual framework of macro environmental and carbon accountability. Section 2.3 discusses the first pillar of the conceptual framework (environmental accounting and its component and elements). Section 2.4 discusses the second pillar of the conceptual framework (carbon accounting and its component and elements). Section 2.5 critically analyses macro carbon accountability. Section 2.6 reviews empirical studies on the impact of global carbon emissions reduction on net energy exporting countries. Finally, section 2.7 recaps and concludes the chapter.

2.2 Theoretical Basis for Environmental and Carbon Accountability

The global concerns and clamour for environmental and carbon accountability may have arisen from continued degeneration of natural assets sequel to unsustainable actions and behaviours of its inhabitants (Gordon, 1954; Scott, 1955; Hardin, 1968; Smith, Hall and Mabey, 1995; Barton, 1999a; Al-Oquili and Kouhy, 2006; Stechemesser and Guenther, 2012; Hassan and Kouhy, 2015). For instance, Hardin (1968) made a descriptive analogy of the situation:

> "Visualize a pasture opens to all. Upon which herdsmen could stack as many cattle as they saw fit. Each herder, would further his/her self-interest by adding animals to the pasture, yet if all herders pursued this strategy, the collective result would be overgrazing: thus, freedom in the commons brings run to all" (p.16).

This expression depicts the picture of how people exploit the collective resource pool for their personal gain. Each person competes on the scarce resources to maximize significant reward, at the detriment of the resources itself. However, the potential individual benefit derived is accompanied by potential societal cost. The constant use of these natural resources without considering the rate of depletion and its consequences result in what is termed as the tragedy of commons. The depletion of oil and gas reserves, carbon emissions, ozone layer depletion, global warming and other forms of environmental degradation are classical examples depicting the tragedy of the commons as it stands today.

The present tragedy of the commons as described by Hardin (1968) was largely due to the principal concerns for economic growth and development as advocated by the neoclassical economist. Thus, the adverse consequence on natural assets sequel to the economic actions was not in any way under consideration (Hassan, 2012). The natural public assets, otherwise known as the environment, are subjected to degeneration without bearing responsibility for such actions from stakeholders. During these periods of economic maximisation, most stakeholders including academics and professional bodies did not prioritise the protection of the environment. This resulted in the tragedy of the commons whereby the earth inhabitants, especially humans, continuously degenerate natural assets that belong to all and for which they are not held accountable (Hardin, 1968). Barton (1999a) argues that the natural capital[7] be regarded as public assets, which are

[7] The term capital is one of the concepts of economics and accounting literature considered as resources that possess the capacity of giving rise to production and flow of goods or services (Ekins et al, 2003). Conventionally, capital can be land, labour and goods. However, with the increased environmental concern, what is termed as capital has changed within the accounting literature, which recognizes four different types of capital: natural assets, human, social/organizational and goods (Ekins, 1992; Jorgenson and Wilcoxen, 1993).

to be held in trust by the government on behalf of the nation for the benefit of current and future generations. Hardin (1968) mentioned that:

> "…ruin' is the destruction toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a common brings ruin to all…" (p.20).

In the environmental and carbon accounting literature, the tragedy of the commons is termed as an external cost[8]. As indicated in the Intergovernmental Panel on Climate Change reports (1990; 1995; 200; 2007; 2014) and Stern Report (2006), the environment is under severe threat because of carbon emissions. Carbon dioxide (CO_2) is a major greenhouse gas emitted from human actions towards achieving economic growth and development. However, carbon dioxide physically exists in the atmosphere as part of the ecosystem's carbon cycle but increasing human activities have amplified the carbon dioxide level in the atmosphere thus influencing the ability of natural sinks to remove CO_2 from the atmosphere. The primary human activity that causes CO_2 is the burning of conventional energy sources such as coal, natural gas and oil used for electricity generation and transportation. The Stern Report (2006) states that:

> "There is now clear scientific evidence that emissions from economic activity, particularly the burning of fossil fuels for energy, are causing changes to the Earth's climate".

However, the nature and severity of the threat is debatable (Morris, 1997; Lewis, 2007 and Jones, 2010). Nevertheless, the scientific evidence depicted that the natural assets are under threat and the world is faced with environmental problems, which need solving. These include ozone layer depletion (Farman, 1990 and Stern, 2006), reduction in air and land quality (Wilkinson and Woodin, 1990) and depletion of natural resources such as oil and gas reserves (especially in developed countries) (Harman, 1990). Jones (2010) asserts that there is insignificant evidence, regrettably, to suggest any subsequent improvement in

[8] These encompass general costs attributed to individuals, society and the environment. Examples of societal cost includes depletion of natural resources, carbon emission, pollution and waste.

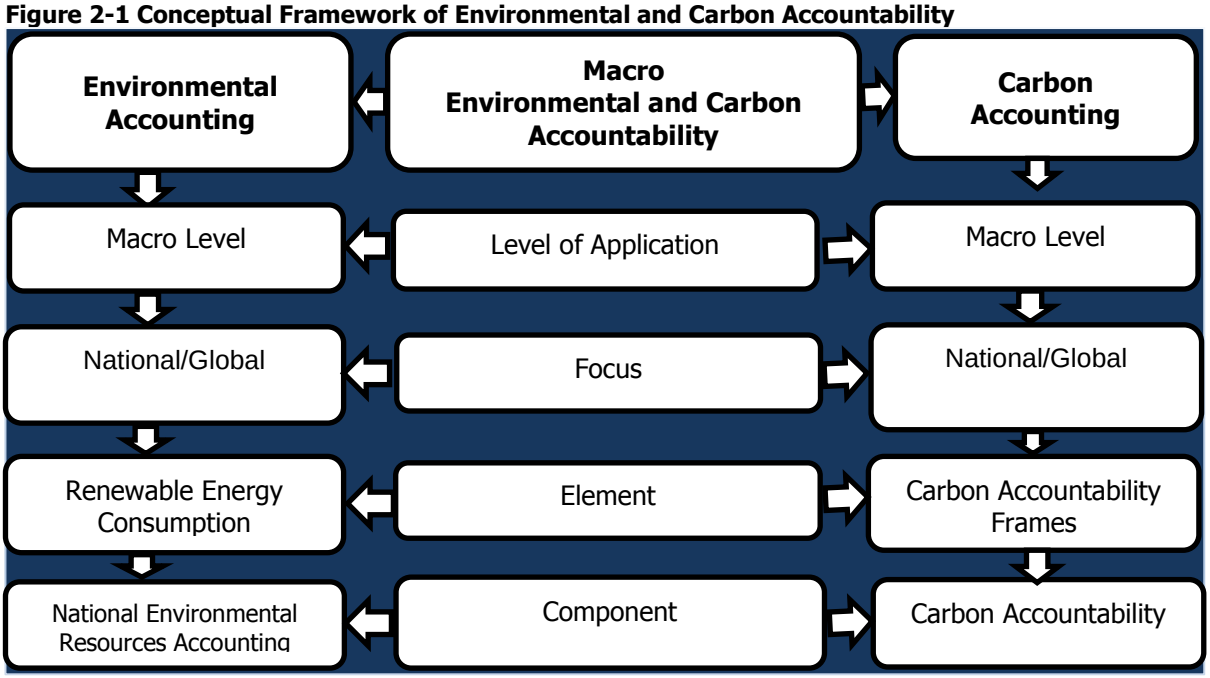
environmental sustainability unless with less fossil fuel consumption. Environmental threats such as carbon emissions produced mainly from fossil fuel usage, is identified as environmental risks (Beck, 1992; 1999).

> "Ecological disaster and atomic fallout ignore the borders of nations. Even the rich and powerful are not safe from them. These are hazards not only to health, but also to legitimacy, property and profit" (p. 23).

For now, the major global environmental risk is climate change, countries are exposed, and threatened by these risks, hence advocates for environmentalism called for the protection and maintenance of the natural assets through multi-disciplinary and geographical collaboration. However, Hardin (1968) believed that government control and regulations are the panacea to the tragedy of commons. However, some scholars have expressed reservation as to the efficacy of government in dealing with environmental problems. For instance, Ostrom et al., (2010) argues that self-discipline, societal re-orientation and establishment of institutions may help achieve sustainable development. Consequently, several professions rose up to the calling.

One of the contributions from the accounting profession towards achieving the sustainable development goals and specifically global carbon emissions reduction is the introduction of environmental and carbon accounting. Figure 2.1 beneath gives the conceptual framework of macro environmental and carbon accountability derived from environmental and carbon accounting and are subsequently discussed.

Figure 2-1 Conceptual Framework of Environmental and Carbon Accountability



Source: USEPA, 1996; Schaltegger and Burritt, 2000) and Ascui and Lovell, 2011

This conceptual framework of Macro Environmental and Carbon Accountability as shown in Figure 2.1 above is derived from the combination of environmental accounting and carbon accounting. Both environmental and carbon accounting could be applied either at micro or macro level. The focus of this study is the application at macro level, which has its components National environmental resources accounting and carbon accountability. Natural resources accounting is a components of environmental accounting that deals with macro-economic and environmental measures that focus on consumption of natural resources such as renewable energy and protection of natural assets (Stechemesser and Guenther, 2012).

Drawing from the above, the net energy importing countries adopted the consumption of renewable energy to achieve environmental and macroeconomic objectives. On the other hand, macro carbon accountability is a component of carbon accounting that deals with carbon emissions reductions measures at regional and national levels. Macro carbon accountability is operationalised through the triple carbon accountability frames. Below are the details discussions of Figure 2.1 above.

2.3 Environmental Accounting

As shown in Figure 2.1, environmental accounting is the first pillar within which the components and elements of conceptual framework of macro environmental and carbon accountability was derived. In a general sense, the process of linking environmentally induced financial impacts and ecological impacts of a defined economic system is termed as environmental accounting. However, the term environmental accounting as defined by Schaltegger and Burritt (2000) "is a subset of accounting that deals with activities, methods and systems (as well as) recording, analysis and reporting of environmentally induced financial impacts and ecological impacts of a defined economic system such as plants, firms, regions and countries" (p.63).

The attempt by the accounting discipline to integrate environmental consideration to the conventional accounting was recognised as a milestone towards the achievement of global environmental sustainability. Hitherto, the accounting profession mainly deals with recognising, measuring, classifying and disclosing only financial information primarily to finance providers and market players. Consequently, it is accused of propagating social conflicts (Tinker, 1985; Lehman, 1992), environmental degradation and supports depreciation of natural capital (Maunders and Burritt, 1991), anti-public interests (Briloff,1990) and gender discrimination (Cooper, 1992). However, environmental accounting now recognises, classifies, discloses and reports social and environmental information to all stakeholders. Similarly, in contrast to conventional accounting, environmental accounting undertakes to secure and protect the environment from degradation, promote social order as well as advance the appreciation of natural capital within the environment.

The United States Environmental Protection Agency (USEPA) categorised environmental accounting into three distinctive types, namely: financial

accounting[9], managerial or management accounting[10] and environmental national resources accounting (Spitzer and Elwood, 1995). Table 2.1 below highlights the classifications of environmental accounting.

Table 2-1 Classification of Environmental Accounting

Types of Environmental Accounting	Focus	Level	Audience
National Resource Accounting	Nation	Macro	External
Financial Accounting	Firm	Micro	External
Management Accounting	Firm, Division, Facility, Process or Product	Micro	Internal

Source: USEPA, 1996

In terms of applications, environmental accounting could be operationalised at either micro (firms and plants) or macro levels (regions and countries) depending on the objectives, circumstances and needs (Spitzer and Elwood, 1995; Schaltegger and Burritt, 2000). However, both financial and management environmental accounting are operationalised and applied at micro levels to meet the information needs of stakeholders.

On the other hand, environmental national resource accounting is a form of accounting that addresses environmental activities, methods and systems as well as recording, analysing and reporting of environmentally induced impacts and ecological impacts at national, regional and global levels (Stechemesser and Guenther, 2012). In other words, it is a macro-economic and environmental measure that focuses on the consumption of natural resources such as renewable

[9] Stechemesser and Guenther (2012 p. 19) asserts that "the inclusion of environment-related information into financial data, such as earnings and expenses for environment related investments or environmental liability can be described as environmental financial accounting". Consequently, the reporting of this environmental financial information by companies to external stakeholders is made in accordance with existing national laws and international standards. Nevertheless, the reporting of environmental performance to the public by companies, for now is not obligatory but voluntary.

[10] Environmental Management accounting is defined "as a process which involves life cycle costing, full-cost accounting, benefits assessment, and strategic planning for environmental management through the development and implementation of appropriate environment-related accounting systems and practices" (Savage and Jasch, 2005).

energy and protection of natural assets. The framework for natural assets protection could be drawn from Principle 2 of the United Nation's Rio Declaration on Environment and Development (1992) which states as thus:

> "The sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction".

Consequently, countries are making concerted efforts to reduce dependence on oil and gas. This is non-renewable energy and primarily responsible for carbon emissions and global climate change preferably within the context of environmental national resource accounting (Turner, 1987 and Simon, 1989). From this perspective, environmental national resource accounting is identified as the first component under "*macro*" environmental accounting with the element: "renewable energy consumption". Therefore, this study will focus on renewable energy deployed by net energy importing countries for both macro environmental accountability and economic advantage. Renewable energy sources are the topic of discussion in the next chapter. However, the next section discusses carbon accounting.

2.4 Carbon Accounting

Carbon accounting is the second pillar of the component and element of macro carbon accountability within the context of this study. Carbon accounting is a new accounting discipline that deals with measuring and removals of emissions in the atmosphere (Stechemesser and Guenther, 2012). According to KMPG (2008), the integration of the aspects of climate change mitigation into the field of accounting is often regarded as carbon accounting. In the perspective of Ratnatunga (2007), the term carbon accounting is the mechanism for calculating the quantum of carbon dioxide, either emitted by a source or sequestered in a biomass sink. For Bebbington (1997), carbon accounting is a new accounting discipline that assumes some conception of "whole".

This suggests that carbon accounting is wide in scope and could be applied in many contexts. However, as a discipline, carbon accounting is an integral part of environmental accounting that was based on normative viewpoints mainly coming from an ethical perspective, political concerns and discourse about the environment (Stechemesser and Guenther, 2012; Ascui, 2014). Generally, carbon accounting means different things to many different people and with varied contextual applications (see Table 2.2 below for details). However, Stechemesser and Guenther (2012) employing a systematic literature review, established that carbon accounting is categorized into two broad taxonomies: physical and monetary. The former focuses on global, national, carbon accounting, and the latter concentrates on management and financial accounting respectively. Table 2.2 below provides the summary about carbon accounting classification.

Table 2-2 Categorizations of Carbon Accounting

Typical scope	Global	National	National, installation or project	Organisation	Organisation, product, event or supply chain	
Ascui & Lovell (2011)	Physical	Political	Market-enabling	Financial	Social/Environmental	
Guenther & Stechemesser (2012)	Physical with a focus on global and national level			Monetary with a focus on Financial Accounting	Physical with a focus on carbon footprint	Monetary with a focus on Management Accounting
Bowen & Wittneben (2011)	"Carbon counting"	"Carbon Accountability"		"Carbon Accounting"		

Source: Ascui and Lovell, 2011: 980

From the Table 2.2 above, carbon accounting is summarily categorized into four major scopes. Namely: (a) global carbon counting (b) national carbon accountability (c) organizational carbon footprint accounting and (d) project/product carbon management accounting. Firstly, global carbon counting mainly deals with physical measurement of carbons at either global or national levels using scientific protocols by scientists and scientific organizations. Secondly, national carbon accountability focuses on carbon governance issues such as physical, political and market-enabling measures by allocating responsibilities and removal of carbon emissions at a variety of levels within countries. Thirdly, organizational carbon print accounting deals with the

monetary aspect of carbon accounting with emphasis on carbon data management, financial and management carbon accounting within an organization. Finally, project/product carbon management accounting is concerned with the carbon accounting footprint at product or project levels. It important to note however that, both carbon global counting and national carbon accountability focuses on macro levels (countries, regions and global) whereas the application of organizational carbon footprint accounting and project/product carbon management remains at micro level.

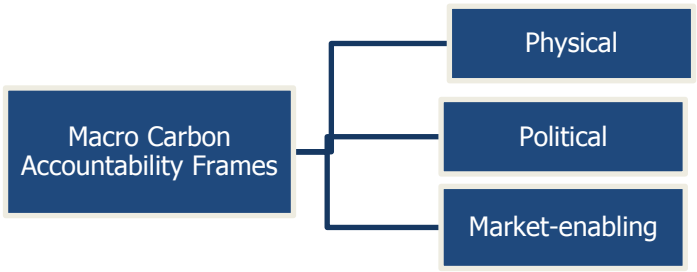
Ascui, (2014) viewed carbon accounting as a wide range of activities, performed on various subjects at different levels, for a variety of mandatory and voluntary purposes. As an emerging field, carbon accounting is primarily developed to provide solution to contemporary environmental problems facing the world today. Thus, it could be argued that the term carbon accounting could be applied in numerous contexts, whether at micro level (organizational scale and project scale) or at macro level (national and global scale), depending on the objective to be achieved. For organizational and project scale applications, see (Bebbington and Larrinaga-Gonzalez (2008) and Alig et al. (1997) respectively. For national scale, see (Lenzen, Pade and Munksgaard, 2004).

In respect to carbon accounting application in organizations, Bebbington and Larrinaga-Gonzalez (2008) concluded that most firms have adopted the concept of carbon accounting in both financial and management aspects. Similarly, Alig et al., (1997) state that carbon accounting helps organization towards carbon emissions reduction. More specifically, organization uses carbon accounting in terms of product production process and packaging. However, the study of Lenzen, Pade and Munksgaard (2004) focuses on national scale and concluded that carbon accounting at the national scale provides for holistic carbon emissions reduction framework through macro carbon accountability, which is a combination of global counting carbon and national carbon accountability.

Thus, macro carbon accountability encompasses physical measurement, political strategies and economic measures towards carbon accountability. This study is primarily interested in macro carbon accountability as the second element of environmental resource accountability. Thus, macro carbon accountability provides the framework for carbon emissions reduction in developed net energy importing countries (NEICs) via the carbon accountability frames. These accountability frames as stated by Ascui and Lovell (2011) includes physical, political and market enabling as well as financial and social/environmental. However, Guenther and Stechemesser (2011) attribute only physical carbon accountability as element of macro level carbon accountability. Similarly, the recent study by Ascui and Lovell (2014) excluded market enabling carbon accountability and established the application of physical and political carbon accountability at the macro level.

This study adopted three macro carbon accountability frames: physical, political and market enabling offered by Ascui and Lovell (2011). This is because they directly relate with the carbon accountability at the macro level (Ascui and Lovell, 2011). However, this study argues that physical, political and market-enabling carbon accountability plays a significant role in macro environmental and carbon accountability. Moreover, governments have an obligation to account for carbon through allocating responsibilities for and removal of carbon emissions. This process of accountability reflects and strengthens the bounds of relationship of the accountee and accountor (Maunders and Burrit, 1991). Figure 2.2 below depicts the macro carbon accountability frames, which are subsequently discussed in detail.

Figure 2-2 Macro Carbon Accountability Frames



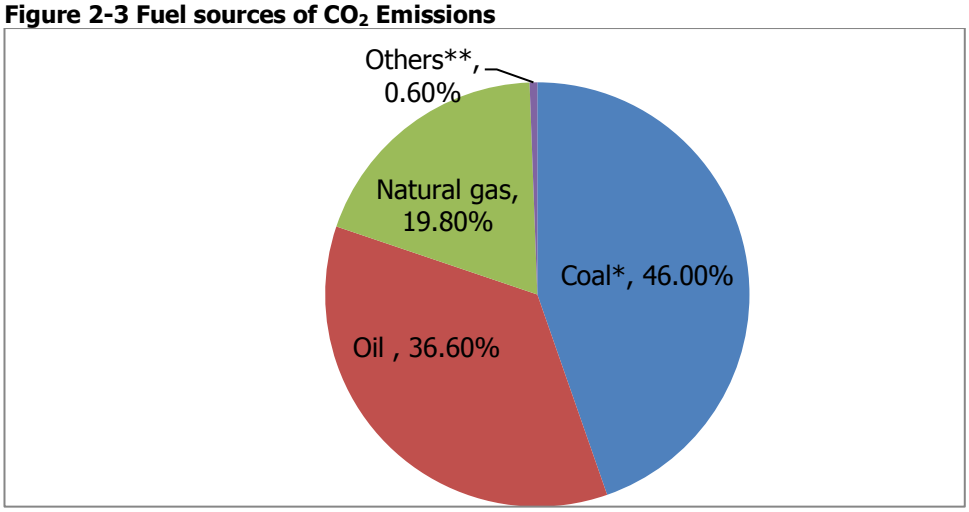
Source: Ascui and Lovell, 2011

2.4.1 Physical Macro Carbon Counting

Physical carbon counting is the first under the macro carbon accountability frames. Physical carbon counting evolved due to the establishment of evidence by scientists on the existence and potential effects of physical carbon emissions released to the biosphere largely contributed by fossil fuel consumption. Consequently, it provides the bedrock for the development of other macro carbon accountability frames (Ascui and Lovell, 2011). Hence, it could also be argued that physical carbon counting is responsible for the tensions, inconsistencies and uncertainty in carbon accounting literature.

Thus, physical carbon counting is primarily concerned with scientific process of physical measurement, estimation and allocation as well as removal of carbon emissions at the macro levels (Ascui and Lovell, 2011 and 2012). Ascui and Lovell (2011) further state that through the scientific process, an estimate of the human-induced contribution of carbon emissions from combustion of fossil fuel was made known, which has the potential of causing climate change and global warming. Subsequently, successive scientists expanded on the idea, which resulted to its development (Ascui and Lovell, 2011). Figure 2.3 below gives the fuel sources of CO_2 emissions arising from the consumption of energy sources with carbon content.

Figure 2-3 Fuel sources of CO_2 Emissions



Sources: IEA, 2015.

* It includes peat and oil shale. ** includes industrial waste and non-renewable municipal waste.

Figure 2.3 above shows that oil and gas contributes about 53.4% of total global carbon emissions by fuels. Similarly, the Intergovernmental Panel on Climate Change (IPCC's) Assessment Reports (2014) have established the significant role of fossil fuels in causing climate change and global warming. These reports had specifically emphasized that stabilization of global temperature depends on carbon emissions reduction via renewable energy use, reduction in fossil fuel consumption and supports the development of policies and institutions for abating climate change (Robinson, 1998; Grubb, 2001; UNFCCC, 2013).

Pales and Keeling (1965) noted that carbon concentrations have certainly exceeded the pre-industrial levels and rising steadily. Omer (2010) states that "pollutants such as carbon emissions do not remain confined to the area near the source of emission or to the local environment, and can be transported over long distances, and create regional and global environmental problems" (p.2278). In order to stabilize the global temperature to the 1990 estimates (355.09 PPM), respective countries, particularly the developed ones have agreed to reduce oil and gas consumption in order to reduce their carbon emissions.

Thus, global oil and gas energy resource is faced with substitution arising from environmental concerns due to pollution and environmental degradation (Russell, Kouhy and Lyon, 1998). This has potential implications to net energy exporting

countries such as Nigeria. However, Ascui and Lovell (2011) asserts that by 1980s, scientific concern about human-induced global warming had overflowed the purely scientific frame to become a subject of intense political and economic debate. Thus, there has been intense debate on the climate change between various stakeholders and interest groups.

Global climate change has been a subject of discourse in public media, scientists and academia. However, it became a global issue with the findings of Hansen and Lebedef, (1987, 1988) and Folland et al., (2001), which suggests an increasing trend in global average temperature over the period from 1987-1988 and 1867-1990 respectively from 240ppm to 390ppm. Similarly, other researchers used different methods to investigate world temperature and concluded that there is a significant increasing trend in the global temperature (Bloomfield and Nychka, 1992; Bloomfield, 1992). Moreover, the Intergovernmental Panel on Climate Change (IPCC[11]) Assessment Reports (1990) asserts that the global average temperature has increased over the years and is expected to increase in the future. Nevertheless, in these studies, the reason for the upward trend in the temperature is not apparent.

However, the IPCC's Assessment Reports (1995, 2000, 2007, and 2014) stated that the continuous rise in the global atmospheric pressure is mainly attributed to an increase in carbon emissions from human actions. Thus, IPCC reports and other studies on increasing global temperature caused by concentration of carbon emissions have generated much attention amongst researchers and policy

[11] The Intergovernmental Panel on Climate Change (IPCC) was established by UN General Assembly resolution in 1988 to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts (IPCC, 2013). Thus, the establishment of the IPCC was meant to provide both scientific and policy frameworks to the global environmental agenda. The IPCC is a "boundary organisation" that connects physical and political carbon accountability frames. Hence, the scientific reports prepared by the IPCC are purely scientific based prepared by committee of scientists, which in turn presented to policy makers (Miller, 2001; Fogel, 2005). Before the establishment of the IPCC, several international conferences were held since 1980s to analyse and solve the problem of climate change. Even though the IPCC does not conduct any research. It only relies on scientist's voluntary contribution from all over the world on climate change (IPCC, 2013). It is for this reason that Laframboise (2011) argued that environmental lobby groups dominate the IPCC and mostly its key reports for policymakers are finalised not by the scientists but by government bureaucrats pursuing political objectives.

makers (Woodward and Gray, 1993). For instance, Woodward and Gray (1993) and Klotzbach (2006) disagreed with the IPCC reports and argued that there is no clear evidence showing a future rise in global temperature. They further argue that global warming has no relationship with the increase in the level of carbon emissions. Furthermore, Woodward and Gray (1993) also show that past temperature increase is mainly due to the natural changes in global Thermohaline Circulation (THC). For this reason, Elsner, Kossin, and Jagger (2008) argued that available data and information on climate change are inadequate and unreliable to make valid conclusions about the relationship between rise in atmospheric pressure and carbon emissions. Elsner, Kossin, and Jagger (2008) and Gray et al., (2001) further states that the global temperature is in fact cooling instead of warming as reported by the IPCC.

However, because of the IPCCC reports, environmental campaigners and vanguards for global cleaner energy began agitation for global action against global warming. Several environmental groups across the world emerged, calling for drastic measures to deal with climate change. To address the problem of climate change adequately, political and economic options were considered. Consequently, a global environmental summit was held, where an international agreement on climate change was reached. In addition, an organisation for mitigating the effects of climate change was established. More specifically, there seems to be a significant link between physical and political macro carbon accountability. The next section discusses political macro carbon accountability.

2.4.2 Political Macro Carbon Accountability

The continued debate on the climate change grew proportionately leading its way to the United Nations General Assembly. The attention accorded by the United Nations culminated in the United Nations General Assembly resolution 45/212 in 1990 (United Nations, 1990). This resolution passed by the UN gave birth to the adoption of the UN Framework Convention on Climate Change (UNFCCC[12]) at the

[12] In 1992, the United Nations Framework Convention on Climate Change (UNFCCC) World Earth Summit was held at Rio de Jeneiro to address the climate change.

Rio Earth Summit in 1992 (United Nations, 1992). This convention mandates all signatory countries ("parties") to account for carbon at their respective national level. Hence, article 4.1 (a) requires all parties to "develop, periodically update, publish and make available ...national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the conference of parties" (United Nations, 1992). Furthermore, the IPCC produced guidelines for National Greenhouse Gas Inventories in 1995. However, both UNFCC and its subsidiary instrument, the Kyoto Protocol, revised the guideline in 1996 that provided the framework for national carbon accounting as stipulated.

The Kyoto Protocol[13] to the United Nations Framework Convention on Climate Change (UNFCCC) was the first international environmental agreement adopted at the third conference of the parties to the UNFCCC held in Kyoto, Japan, in December 1997 and entered into force in 2005. The Kyoto protocol agreement specified quantitative emission reduction targets, which require the estimation and reduction of anthropogenic emissions within national boundaries (Ascui and Lovell, 2012). The United Nations Framework Convention on Climate Change was drawn up and the treaty was signed by the developed countries (which are mostly responsible for about 60% of the world's annual carbon emissions) to reduce their carbon emissions level to pre-1990 industrial levels (Olivier et al., 2013). The overall objective of the UNFCCC is:

[13] The agreement was sequel to the 1992 UNFCCC Rio Earth Summit on climate change held in Brazil (Bernstein et al., 1999; Yamin, 1998). The Kyoto agreement sets binding obligations and targets on developed countries to reduce carbon emissions level to pre-industrial level (UNFCCC, 2013). The commitment in the carbon emissions reduction road map is now in the second stage of 2013-2020 as the first period of 2008-2012 has ended with little success. To achieve the second phase, certain emission reduction targets were set in the protocol in a manner that reflects national circumstances in terms of emission rate, wealth, and capacity to make the reductions. Furthermore, the UNFCCC categorise countries of the world into three: Annex I, Annex II and non-Annex I countries. The developed countries and most of the Former Soviet Union and Eastern European nations are referred as the Annex I nations. The Annex II is a subset of Annex I, exclusive of Former Soviet Union and Eastern Europe. Thus, Annex I nations have greater responsibilities of reducing carbon emissions under the UNFCCC than non-Annex I nations. This is because of the differences in previous level of emission and their capacity on carbon emissions stabilisation commitments. Moreover, the agreement specifically highlights the development of renewable energy, improving energy efficiency and reduction in oil and gas consumption as a solution mechanism in achieving the emission reduction targets.

> "Stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (Article 2 of the UNFCCC).

Moreover, the UNFCCC organises a global climate change summit every four years to review its past performance and establish plans on how best to tackle the global warming problem. Thus, political accountability set global policy path and encourage countries to mitigate climate change problems through disclosure, reporting and carbon emissions reduction. In this regard, political macro carbon accountability is anchored on carbon emissions reduction policies and institutions[14]. However, the debate of climate has been greatly politicised and overtaken by environmental ideologists (Inhofe, 2003; Laframboise, 2011). Thus, Inhofe (2003) opines that environmental ideologists who lack scientific knowledge have taken over the climate change issue. Thus, most developed net energy importing countries have realised that political macro carbon accountability may not provide the much needed effectiveness to address global carbon emission reduction (Michaelowa et al., 2007). To effectively achieve a carbon free world, these countries introduced economic measures rather than relying mainly on policymaking.

2.4.3 Market-Enabling Carbon Accountability

The adoption and use of market-based macro carbon accountability is meant to provide an extension from the political macro carbon accountability measures. Ascui and Lovell (2011) posits that there would be better chance of mitigating carbon emissions using market mechanisms than merely policy making. Thus, Johnston, Sefcik and Soderstrom (2008) and Ascui and Lovell (2010) mentioned that the USA had used a market approach to mitigate carbon emissions at lower

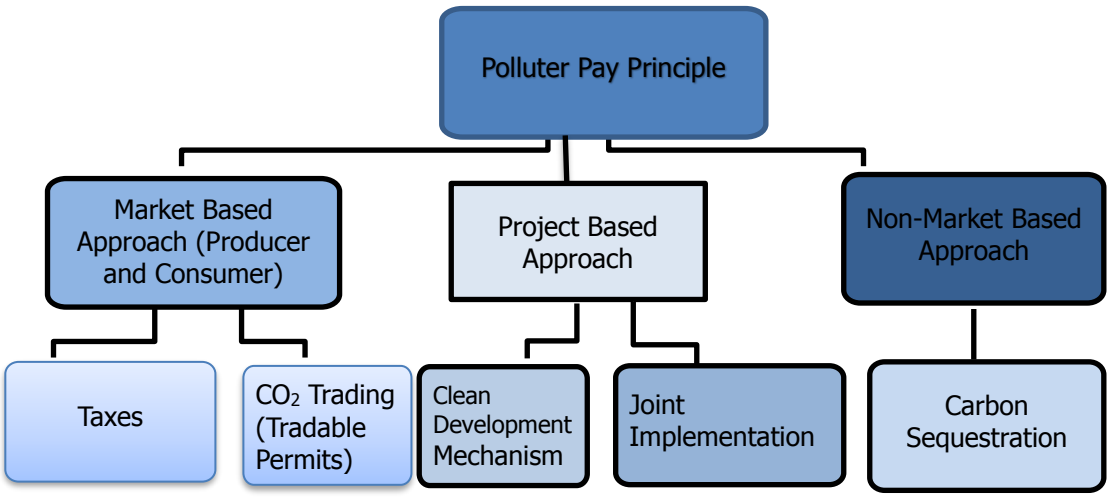
[14] The Intergovernmental Panel on Climate Change (IPCC) which established by UN General Assembly resolution in 1988 to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts (IPCC, 2013). Similarly, in 1992, the United Nations Framework Convention on Climate Change (UNFCCC) World Earth Summit was held at Rio de Jeneiro to address the climate change. In this conference, the United Nations Framework Convention on Climate Change was drawn up and treaty was signed by the developed countries (which are mostly responsible for about 60% of the world's annual carbon emissions) to reduce their carbon emissions level to pre-1990 industrial levels.

than estimated cost. Thus, a market-enabling frame attempt to limit carbon emissions through the Polluter Pay Principle (PPP) as enshrined in the Kyoto Protocol agreements. According to the Principle 16 of the U.N.'s Rio Declaration on Environment and Development (1992):

> "National authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment".

Hence, in order to internalise the environmental social cost, the Polluter Pay Principle is adopted to reduce carbon emissions, as shown below in Figure 2.4.

Figure 2-4 Components of Polluter Pay Principle



Source: United Nations, 1992

The Polluter Pays Principle (PPP) advocates for the polluter to bear full responsibility for his/her action, as contained Figure 2.5 above. The principle advocates for macro carbon accountability on the basis for making polluters accountable through the application of economic instruments and environmental law underpinned by ecocentric philosophical assumptions (Panaiotov, 1997). To ensure the success of the "PPP" principle, two positions were adopted. These were market based and non-market based approaches. These methodologies are geared towards taxing the consumption of fossil fuels and regulating the natural

environment against damage and degradation arising from socioeconomic activities. Firstly, the market-based approach comprises the use of economic instruments such as taxes and carbon emission trading.

Carbon tax is one of the fiscal instruments[15] adopted especially in European countries to reduce their carbon emissions levels at least cost to overall society. Carbon tax otherwise known as energy taxes is the taxation of energy according to its carbon content (Ekins and Barker, 2001). However, other scholars such as Ngwakwe (2012) referred to it as green taxation, which is applied to reduce carbon emissions. They further argued that carbon tax appears to have the characteristic of good tax system[16]. With these tax characteristics, the fundamental objective of carbon tax is to increase the relative price of fossil energy compared to other energy sources. Other objectives include reducing carbon emission, accelerate transition to low and zero energy sources, reduce demand for fossil fuel based energy and finally stimulate the development of low carbon and energy efficient technologies.

It is important to note that the nature of taxes differs across nations and regions. Overall, market-enabling carbon accounting has been a veritable tool for carbon emissions reduction and it has been used by countries in reducing their national emissions. However, there has been strong resistance for the introduction of these carbon emission instruments because of its economic consequence on net energy exporting countries (Ekins and Barker, 2001). It could be argued that carbon tax may have significant effect on the oil and gas price and oil and gas consumption.

[15] Fiscal instruments are sets of market-based instruments such as environmental taxes, removal of distortionary subsidies, cap on resource use/emission and loan guarantees aimed at channelling investments in innovation and facilitate deployment of sustainable energy technologies (Roy, et al., 2013).

[16] It solves identified economic problem through the private/social costs of emitting carbon; serves as a viable sources of revenue; it is simple and cheap to administer; it serves as a stimulant to achieve economic growth.

Carbon emission trading is another market-enabling[17] macro carbon accountability instruments for reducing carbon emission. This scheme was introduced at the international level to help countries meet their carbon emissions reduction commitments at least cost. Thus, carbon emission trading allows for the allocation of emission permits through (i) auction by the government (ii) grand fathering (free allocation based on current emission). In this way, the participant (countries and companies) are given a right to emit but limited to a cap. This cap is usually outlined in the Kyoto protocol or other targets. If a country happens to emit beyond the cap, they are obliged to buy additional credit from other participants who pollute less. Thus, the transfer of right to emit, otherwise called permit is generally referred to as emission trading, usually traded in the carbon market.

The carbon market is categorised into two: voluntary and policy driven carbon markets (Ascui and Lovell, 2012). Government does not regulate the former; non-state actors strive voluntarily towards carbon offsetting. However, policy driven carbon markets are under state regulation as it allocates responsibilities for carbon emissions reduction. For instance, the 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) provided the basis for policy driven carbon market through three "flexible mechanisms" (Hepburn, 2007). These are: emissions trading, the Clean Development Mechanism (CDM), and Joint Implementation (JI), jointly making a framework for an international market in greenhouse gas emission trading, motivated by emission obligations (United Nations, 1998).

Emission trading is the first policy driven carbon emissions reduction strategy designed to allow trading of carbon between countries with binding targets. Binding countries that have exceeded their emissions cap normally meet their domestic carbon obligations by purchasing credits from other countries that have

[17] Market enabling approach comprises the use of economic instruments such as taxes and carbon emission trading to limit carbon emissions through the Polluter Pay Principle (PPP) as enshrined in the Kyoto Protocol agreements.

a surplus. Since 2005, the EU has established the emissions trading system. The objective is for member countries to meet up with the 20% emissions reduction target under the Kyoto protocol. However, before the adoption by the EU, individual countries within the EU such as United Kingdom and Australia have implemented the carbon trading schemes in 2002 and 2003 respectively (Hepburn, 2007). While emission-trading remains a market-based approach, both CDM and JI are project based mechanisms that attract carbon credits (Certified Emission Reduction for CDM and Emission Reduction Units for JI) for developed countries to meet their Kyoto protocol commitment by embarking on carbon emissions reduction projects in developing and developed countries respectively. As expressed by Hepburn (2007):

> "All the three mechanism rest on the "coasian solution" for the tragedy of the commons-privatise the common and trade the resulting property right. It is clear from the economy theory…. that well informed consenting parties are likely to improve the lot of both parties" (p.379).

However, some scholars have contrary view as to the efficacy of the state regulated carbon market to solve environmental problems (Lohmann, 2006; Hepburn, 2007; Bumpus and Liverman, 2008). Bumpus and Liverman (2008) argued that the regulated market driven carbon trading does not reflect the true characteristic of free market. Similarly, Hepburn (2007) asserts that the government of the EU member countries after lobbying allocated the EU emission permits arbitrarily. Consequently, Lohmann (2006) opined that "if one has to trade something, one has to own it, and these ownership rights has gone free of charge to the agents that have been largely responsible for creating the problem in the first place" (p.104).

In addition to the market-based approaches, other non-market based approaches were adopted in order to achieve macro carbon accountability. The carbon capture and storage (sequestration) is recognised as one of the non-market based approaches. Gibbins and Chalmer (2008) used the term Carbon Capture and Storage (CCS) as a general range of technologies developed to capture carbon emissions from fossil fuel use at a particular point to be transferred to

safe zone rather than being emitted to the atmosphere. However, Lal (2008) argued that carbon sequestration is the transfer of atmospheric carbon into other long-lived pools using biotic (natural) and abiotic (engineering) techniques in order to reduce the volume of carbon increase into the atmosphere. Despite the perceived role of CCS in reducing carbon emissions, it constantly requires energy support compared to other carbon emissions control mechanism. The next section critically analyses carbon macro accountability.

2.5 Macro Carbon Accountability: A Critical Analysis

As seen from the literature, several authors, institutions and disciplines have attempted to explain different macro carbon accountability frameworks, their applications as well as impacts. Similarly, in each of these frameworks, there are different stakeholders, each applying carbon accounting differently. Thus, the development of macro carbon accountability started from the establishment of physical carbon counting and its effect through scientific evidence by the scientist. As earlier stated, through physical carbon accountability, the scientists have ascertained continued rise in global atmospheric temperature due to human-induced activities mainly caused by fossil fuel combustion. Although several scientists such Woodward and Gray (1993), Klotzbach (2006), Elsner, Kossin and Jagger (2008) have refuted the above claims.

Subsequently, it proceeded to political carbon accountability which involved carbon emissions reduction policies made by policy makers and governments. Through political carbon accountability, most political leaders have taken responsibility to reduce the cause and effect of carbon emissions through various policy frameworks. This includes the Kyoto protocol agreement, 20 percent reduction of carbon emission by the year 2020 (for EU member states). Moreover, economic measures through market mechanisms (market enabling carbon accountability) driven by government regulation and non-market (voluntary carbon accountability piloted by non-state and corporate actors) were adopted. In addition, through project based and non-market mechanism, carbon reduction responsibilities are transferred to both organizations and countries (monetary

carbon accounting). It can be observed that all the frameworks are closely related and dependent on one another in a symbiotic relationship. Moreover, multi-actor approaches for carbon emissions reduction are employed at macro scale to achieve global carbon accountability.

This signifies that neither of the frameworks would stand alone in the carbon accountability regime. However, on the one hand, the diversity of carbon accounting across disciplines and institutions as shown in the literature signifies broad based commitment towards carbon emissions reduction. On the other hand, the similarity between the different taxonomies (micro and macro) of carbon accounting depicts commonality of basis and approach across disciplines, institutions and societal response to climate change challenges. Even though, the diversity in the literature demonstrates the vagueness and undeveloped nature of the area.

Carbon accounting is being designed to contribute and support towards the mitigation of the spread of carbon emissions and solve general environmental problems at product, organizational, national as well as global levels. At the micro level of products and organizations, significant amounts of literature exist on carbon disclosure and reporting. However, only a handful of research directly evaluating the politics, economic measures and practices of carbon accountability exist from the macro perspective (Cook, 2009; MacKenzie, 2009).

This distinction between macro levels of carbon accounting with other forms of carbon accounting is imperative because the former is directly related to macro carbon accountability that involves different countries. However, it could be observed that these classifications have converged in one way or the other. In both cases, the overall objective of macro environmental and carbon accountability is for countries to jointly achieve carbon emissions reduction targets by reducing the consumption of carbon intensive energy sources and increasing renewable energy use (Ermolieva et al., 2010). The achievement of

this objective may have potential in reducing global oil and gas consumption, since oil and gas is responsible for 53.4% of total global carbon emissions by fuels (International Energy Agency, 2015). The next section provides empirical studies about the impact of carbon emissions reduction on net energy exporting countries (NEECs).

2.6 Empirical Studies on Impact of Carbon Emissions on NEECs

There is a numerous existing literature that investigated the impact of global carbon emissions on NEECs using different approaches. Example of these studies are as follows: Berg et al (1997); McKibbin et al (1999); Linden et al (2000); Barnett, Dessai, and Webber (2004); Persson, et al (2007); Johansson et al (2009); Suranovic (2013) and McCollum, et al (2014).

For instance, McCollum, et al., (2014) empirically analysed the development of fossil fuel consumption, trade and price under different climate policy regimes using multi-model frameworks. The findings of the study suggest that climate mitigation policies could reduce oil importations and consumption, increase share of renewable energy and mitigate energy security concerns. Similarly, Berg et al., (1997) concluded that economic based carbon emissions reduction policies would have significant effects on OPEC members' oil and gas revenue. In addition, a study by Radetzki (2002) also showed that global carbon emissions reduction measures arising from the execution of Kyoto commitments would negatively influence global oil and gas consumption. Another scholar (McKibbin et al., 1999) used the G-Cubed model to investigate the impact of carbon emissions reduction policies on net energy exporting countries. They found that net energy exporting countries might suffer 13% decrease in their oil and gas exports to net energy importing countries. Similarly, using the GREEN approach, Pershing (2000) concluded that net energy exporting countries would suffer of loss revenue from oil and gas exports arising from carbon emissions measures.

Similarly, Bartsch and Müller (2000) corroborated the above findings and established that climate mitigation policies in developed countries causes decline in oil and gas revenue in net energy exporting countries. Similarly, the findings

from Barnett, Dessai, and Webber (2004) acknowledged that OPEC will be affected by the global climate control regime; however, the degree of the impact will vary amongst these countries. Bernstein, Montgomery and Rutherford (1999) investigated the economic impacts of cutting carbon emissions in industrialised countries using a multi-sector and multi-region model (MS-MRT). The study revealed that cutting emissions has negative consequences on energy exporting countries. However, Persson, et al., (2007) and Johansson, et al., (2009) established that net energy exporting countries stand to gain rather than lose because of carbon emissions reduction policies.

Based on these empirical studies, the focus is on OPEC member countries as a whole. However, with regard to being more country specific, one barely finds existing literature on the topic. In addition, different methodologies are used which resulted in different findings. Findings from these studies have led to the emergence of three opposite views. One point of view suggests that carbon emissions reduction is a limiting factor to oil and gas revenue (Berg et al., 1997; McKibbin et al. 1999; Bernstein, Montgomery and Rutherford 1999; Lynch, 1999; Linden, et al. 2000; Pershing, 2000; Radetzki, 2002; Bartsch and Müller 2000; Suranovic, 2013; Dike, 2013; McCollum, et al., 2014). The second opinion is contrary to the first (Persson, et al., 2007; and Johansson, et al., 2009). The third point of view agrees that carbon emissions reduction may influence oil and gas revenue of net energy exporting countries, however, with conditions (Barnett, Dessai, and Webber 2004). The proponents of third view argue that the possible impact of reducing global carbon depends on the structure of the economy and the stage of economic growth of the oil dependent country concerned.

Therefore, this study will consider a chosen single net energy exporting country (Nigeria) and investigate the impact of carbon emissions reduction in developed net energy importing countries on Nigerian oil and gas exports. As at 2015, Nigeria contributes about 2.6% and 1.4% of total global oil and gas production respectively (British Petroleum Statistical Review, 2016). The country is also ranked as Africa's largest oil producer, thirteen largest oil producing country in the world and the most oil revenue dependent country amongst OPEC member

countries (British Petroleum Statistical Review, 2016; and Energy Sector Management Assistance Programme, 2004). On the other hand, developed net energy importing countries are responsible for a significant percentage of the total global fossil fuel consumption (International Energy Agency, 2015). In addition, about 60% of total global carbon emissions are primarily due to fossil fuel consumption (Intergovernmental Panel on Climate Change reports, 2014). Hence, considering the significant contribution of oil and gas energy sources to carbon emissions and the efforts by the net energy importing countries (NEICs) to reduce carbon emissions, this first research question is raised.

> How carbon emissions reduction in developed NEICs affects Nigerian oil and gas exports?

This first research question was transformed into hypothesis one as shown in chapter one in order to be tested empirically. The hypothesis is restated below.

> **H_0 1:** Carbon emission reduction in developed NEICs has no influence on Nigerian oil and gas exports.
>
> **H_a 1:** Carbon emission reduction in developed NEICs has influence on Nigerian oil and gas exports.

2.7 Summary and Conclusion

This review narrated the degeneration of the natural assets, including environment and the concerns expressed by individuals, pressure groups and societies. More specifically, the review provided the accounting theoretical underpinnings for the protection of the environment via carbon emissions reduction at national and global perspectives (macro level). Thus, the analysis from the chapter relates to the policies, plans and targets for carbon emissions reduction in developed net energy importing countries. Similarly, the chapter reviewed empirical studies on the impact of carbon emissions reduction on net energy exporting countries.

From this review and analyses, the chapter revealed wide range of issues. Firstly, the natural assets, such as the environment, have been degenerated due to human economic activities mainly from the release of carbon emissions. These carbon emissions arise because of energy consumption from carbon related energy sources. It is evident that energy consumption from oil and gas happens to be one of the major contributors of carbon emissions.

Secondly, the chapter revealed that there is a global consensus across countries, disciplines and institutions, which recognises carbon emissions as the prime cause of climate change and global warming. Thus, the review specifically pinpoints the contribution from the accounting as a professional discipline towards global carbon emissions reduction regime via environmental and carbon accounting.

Thirdly, the chapter showed that developed NEICs, which are the major consumer of energy from oil and gas have outline various plans and targets to reduce carbon related energy with a view to achieve macro environmental and carbon accountability.

Fourthly, the review established that through carbon emissions reduction in NEICs, there would be a global reduction of energy consumption from oil and gas.

Finally, it was found that carbon emissions reduction might or would influence oil and gas exports of net energy exporting countries. This is the key aspect of the review, which involves achieving macro environmental and carbon accountability on the one hand and the economic impact on net energy exporting countries on the other hand. The next chapter will focus on global energy transition with emphasis on the review of energy consumption from renewable as a substitute for conventional energy.

Chapter 3.
Global Energy Transitions: Renewable Energy Sources in Focus

3.1 Introduction

The previous chapter discussed carbon emissions reduction, the role of environmental and carbon accounting. As mentioned in section 2.3, the current chapter reviews literature on the consumption of renewable energy as a substitute for conventional energy. In the process, the chapter discusses past global energy transitions. Moreover, the chapter highlights the various renewable energy policies adopted in net energy importing countries and the reasons behind it. Thus, the chapter paves the way for achieving the objective of the study.

The rest of the chapter is outlined as follows. Section 3.2 discusses the various renewable energy sources. The next section discusses some of the key drivers for the energy transition to renewable energy. Section 3.4 reviews the various renewable energy policies in NEICs. While section 3.5 chapter reviews empirical studies on the impact of energy consumption from renewable energy. Finally, section 3.6 summarises and concludes the chapter.

3.2 Renewable Energy Sources

As defined by Muneer and Asif (2007) and Boyle and Alexander (2004), renewable energy are sources of energy derived from natural sources, which are inexhaustible, abundant and environmentally friendly. The major renewable energy sources are solar energy, wind power, biomass and hydropower considered as substitute for conventional energy (Chien and Hu, 2007; Krewitt et al. 2007; Chien, and Hu, 2008; Sadorsky, 2009b; Apergis et al. 2010; Apergis and Payne, 2011a; Tugcu, Ozturk and Aslan 2012; Payne, 2012; von Eije, von Eije and Westerman, 2013). Below are brief explanations for each of the renewable energy sources used globally.

3.2.1 Solar Energy

This is the most vital source of all the renewable energy supplies as it forms the foundation upon which early human energy needs were based (Boyle and

Alexander, 2004; Mabro, 2006. Solar energy is a type of energy derived from the power of the sun to generate heat, grow agricultural crops through the process of photosynthesis. However, solar power is usually associated with solar energy technology, which converts it into electricity. The light and heat generated mostly vary from time of the day, location, climate, weather conditions and seasons (Mabro, 2006). For instance, through solar, the development of solar photovoltaic (PV) technology enables direct conversion of sunlight into electricity through semi-conductor devices called solar cells (Varun, Prakash and Bhat, 2009).

The photovoltaic components are incorporated with other parts such as storage batteries to make up solar PV systems and power plants. The volume of energy generated from the PV systems and power plants are highly reliable, due to its in-build storage system that stores the energy for future use. However, some researchers have emphasized that making the best use of solar energy requires a reasonable understanding of geographic potentials, economic viability and technical expertise (De Vries, Van Vuuren and Hoogwijk, 2007).

For example, economic viability requires the estimation of the average cost at which the total energy can be produced at a given time and place. This virtually depends on a variety of factors such as investment costs, available technology, labour wages and skills, and interest rate. However, Omer (2008) argues that:

> "It is …. technically and economically feasible to supply all man's needs from the most abundant energy source of all, the Sun" (p.2270).

Furthermore, solar energy is inexhaustible and pollution free, which makes it highly attractive source of energy compared to other renewable energy sources (Omer, 2008). The next subsection explains wind energy.

3.2.2 Wind Energy

Wind power is the second type of renewable energy considered for this study. According to International Renewable Energy Agency (2015), wind power is the conversion of wind energy into a useful form of energy, such as using wind turbines to generate electricity, windmills for mechanical power, wind pumps for propelling water and water related technologies. Generally, wind power is divided

into onshore and offshore. The former is localised on land surface area and the latter at sea. Both types of wind turbines are widely used to generate electricity for residential and industrial purposes. Similar to any other renewable energy, wind energy is also an alternative to fossil fuels, due to its abundance, renewable nature, and environmentally friendliness with nearly zero carbon emissions content.

Over the years, because of increasing demand, the production of wind turbines is increasing considerably worldwide. Presently, wind energy accounts for 42% of the total global renewable energy supply and is projected to increase to 55% by the year 2020 (International Energy Agency, 2015). Although, when compared with other renewable energy sources, wind power does not involve the use of water and vast land. However, it has potential environmental impacts such as noise, visual impact and bird's death caused by rotating blades. Moreover, offshore wind energy could have possible effects on aquatic species, which could endanger their survival (Mabro, 2006; Al-saleh, 2009). The next subsection will explain biomass.

3.2.3 Biomass

Biomass is another type of renewable energy extracted directly or indirectly from plants and animal origin to produce energy. Biomass from plants could be from starch and sugar based crops such as bio-fuels, biodiesel, and bio-ethanol. Similarly, it is produce from non-food biomass such as organic wastes, forestry residues, high yielding woody or grass energy crops and algae, among others (Bauen, et al. 2009).

Several countries have initiated and adopted policy known as the bio-fuel mandate to make bio fuel a global energy source especially in the transport sector (Marpaung, 2010). Currently, many different countries have adopted 20 percent and 50% binding targets to use bio-fuels by the year 2020 and 2050 respectively in their transport sector (Aston Llyods 2010; Marpaung, 2010). These include the EU renewable energy directive, UK's Renewable Transport Fuel obligation (RTFO) and US Renewable Fuel Standards (RFS) among others.

In addition, tax incentives, discount and subsidies to support production and consumption of bioenergy were employed by various governments globally to encourage massive output (Marpaung, 2010). More importantly, is the significant benefits accruing from bio-fuel such as agricultural and rural development, impact on carbon emissions reduction, and providing climate safety and energy security (Mousdale, 2008; Ng, Ng and Gan, 2010).

Despite the perceived merits of biofuel, the production of biofuel has been criticised due to the means of its production. As most of biomass are produced using food crops such as Sugarcane, Cassava and Palm Oil. These are food crops meant to provide food for the ever increasing and hunger striking global population. Rojagopal and Zilberman (2007) argued that biofuel production is characterised by intensive land, water, energy and chemicals inputs. Production of biofuel as a substitute for fossil fuel in the transport sector is seen as a risk to environmental quality, food security and huge financial costs (Rojagopal et al., 2007; Peters and Thielmann, 2008).

3.2.4 Hydropower

Hydropower is the generation of electricity using the gravitational force of water flow. It is the most widely used form of renewable energy. Hydropower produces no direct waste, and has a considerably lower output level of carbon emission than fossil fuel powered energy plants. Worldwide, an installed capacity of 777GW supplied 2,998MWh of hydroelectricity as at in 2013.

In summary, renewable energy comprises of solar, wind, biomass, and hydropower and ocean energy. These renewable energy sources explained in details above are expected to substitute conventional energy sources. However, conventional energy is the dominant source of energy in the present global energy mix. However, they are characterised with numerous problems, which drives the net energy importing countries towards renewable energy sources. Apart from economic, environmental and carbon accountability (see chapter 2), other factors have also been responsible for the energy transition to renewable energy. These include oil and gas reserve peak and depletion, oil and gas price

volatility, the dominance of OPEC in the energy industry and energy security concerns (Foxon, Hammond and Pearson, 2010; Moriarty and Honnery 2012). The next section discusses the drivers for the global energy transitions.

3.3 Drivers for Global Energy Transition to Renewables

Several studies have identified various reasons driving the global energy transition to renewable energy sources (Gray et al, 2001; Awerbuch and Sauter, 2006; Hayward, 2009; Foxon, Hammond and Pearson, 2010; Moriarty and Honnery, 2012; Willigers and Hausken, 2013). For instance, Foxon, Hammond and Pearson (2010) suggests that concerns over oil and gas price volatility and the excessive market power of Organisation of the Petroleum Exporting Countries (OPEC) as one of the drivers of the energy transition. However, Moriarty and Honnery (2012) argue that oil and gas reserve depletion may be responsible for the global energy transition to renewable energy sources.

Although renewable energy generated mainly from natural sources of animate energy, stone, solar, water, windmills and plants were used in the pre-industrial period (Bhattacharyya, 2011), the outputs from these energy sources are limited to meet growing energy needs of societies globally because of growth in economic activities, technology and demographic parameters (Nakicenovic, Grübler and McDonald, 1998).

Subsequently, the era of coal-based economy emerged and it marked the beginning of the first energy transition from the natural sources to coal (Clark and Jacks, 2007; Allen, 2012). However, coal has been in use as an energy source in the manufacturing sector, transportation and power generation until today. It is important to note that the transition to coal based economy was linked with increased energy demand, energy supply gap, economic growth and advancement of technology but not due to increase in prices of existing energy substitutes and environmental factors.

Consequently, the second energy transition was from coal to the present dominant oil and gas energy sources. Coal ceased to become the dominant global

energy not because of being limited in supply as in the case of renewable energies used before the first transition. Instead, it is because of the discovery of better substitute with unique characteristics of availability, affordability and portability. Oil and gas energy serves as the dominant primary energy sources that drive the world economy (Yergin, 2006). However, there has been an epic quest to substitute the influential oil and gas as the dominant global energy source. This relates to the global concern for energy security, environmental and economic consequences of conventional energy sources and oil price volatility (Awerbuch and Sauter, 2006; Umbach 2010; Moriarty and Honnery 2012; Intergovernmental Panel on Climate Change Reports, 2014). Below are the details explanations of each of the other factors that drive towards renewable energy in net energy importing countries.

3.3.1 Energy Security Concerns

There has been concern for security of supply in the future due to the finite nature of conventional energy sources. According to Hubbert (1949), conventional energy resources are finite and depletes over time based on the reserves and the rate of production. Also, Hayward (2009) asserted that there is uncertainty of energy supply in the future as 42 years of total oil proven reserves, 60 years of total natural gas proved reserves and 130 years of total coal proved reserves are not far from today. This implies that continuous dependence on conventional energy means more depletion of the resources (Boyle and Alexander, 2004).

Available statistics and studies also indicate the peaking[18] of oil and gas reserves in many countries by the year 2020. For instance, oil exploration activities in the UK North Sea, a major source of Europe energy supply have peaked and started dwindling with associated high cost of production, and anticipated huge decommissioning liabilities (Russell and Lyon, 1999; Russell, Kouhy and Lyon, 1998; Willigers and Hausken, 2013). Similarly, Raltson (2008) argued that, oil

[18] Maass (2005) defined peaking of oil and gas as "the maximum point at which reservoirs can no longer produce increasing amounts of oil and gas, as a result, production begins to decline".

production in many countries has already peaked. In the same vain, the association for the study of peak oil and gas (ASPO) (2009) argued that peaking in reserve output is not only a function of geological depletion but also by national energy security, politics and future earnings (hoteling).

Thus, peaking of oil and gas reserves and the projected increase in global energy demand have driven the NEICs to have concerns over conventional energy to meet their energy requirements. However, securing sustainable energy pathways has remained a topmost priority for NEICs since after the first oil price shock of 1973 (Yergin, 2008; Hook et al., 2012). Moriarty and Honnery (2012) argued that oil and gas reserve peaking and depletion are among the fundamental drivers of energy transition from the dominant fossil fuels to renewable energy sources. However, with the discovery of new conventional energy frontiers across the world, hydrocarbon would continue to remain as dominant source of energy (Umbach, 2010).

Secondly, the availability of substantial oil and gas deposit in OPEC member countries (Grubb, 2001; Greene, Hopson and Li, 2006; Jefferson, 2008). Available statistics shows OPEC member countries accounts for over four-fifth of global oil reserve and 43% of total world crude oil production as at 2015 (Organisation of the Petroleum Exporting Countries, 2016). This suggests that the future energy supply lies with the OPEC member countries. However, the Middle East and other OPEC member countries have been the most volatile in the last decades (Umbach, 2010). Thus, the concern for most net energy consuming countries especially the developed countries is that, with the continued internal crisis in most of the OPEC countries and peaking of non-OPEC oil supply by 2020, the reliability and sustainable of energy supply may not be guaranteed. Hence, the fear of influence of OPEC as a major market power in the international energy scene causes great concern to energy security of most developed net energy importing countries.

Thus, energy security concerns entails concern for supply disruption arising from resource depletion, instability in most OPEC countries and the concentration of

oil reserve in OPEC are the primary concerns of most net energy importing countries (Markard, Raven and Truffer, 2012; Moriarty and Honnery, 2012). This signalled key issues such as the need for diversification of energy corridors, finding substitute for oil and gas. The long-term objective of the energy transition to renewable energy is to ensure the gradual phasing out of fossil fuels. The next subsection will explain environmental consideration as the second driver to global energy transition.

3.3.2 Environmental Concerns

Over the years, individual, groups and countries globally have taken the clamour for the sustainability of the environment as a fundamental issue (Gray et al, 2001; Hassan and Kouhy, 2015). This may be attributed to the Intergovernmental Panel on Climate Change Reports (1990; 1995; 200; 2007; 2014) and the Stern Report (2006). These reports showed an increasing trend in the concentration of carbon emissions arising from combustion of fossil fuel, which causes climate change and global warming. It is for these reasons that, a large number of countries, particularly the NEICs, responsible for consuming 60% of the world's primary energy and producing nearly the same share of carbon emissions, are embarking on energy transition (Intergovernmental Panel on Climate Change Report, 2013; REN21, 2014; International Energy Agency, 2015).

Consequently, most of the NEICs have a common energy policy that primarily centres on promoting energy efficiency, developing renewable energy and reducing carbon emissions through reduction of fossil fuel consumption. This implies that the discontinuous use of conventional energy by the developed countries means less crude oil imports demand from net energy exporting countries and more reduction of carbon emissions level. Thus, environmental concern has been a strong driving force behind the shift towards renewable energy source as extensively discussed in the previous chapter.

3.3.3 Oil and Gas Price Volatility

Over the years, oil price has been fluctuating in cyclical trends, which causes uncertainties to major key stakeholders in the oil and gas industry. Oil price data from 1861-to date shows the level of volatility, which is attributed to several factors such as high cost of production, political instability in OPEC member countries, and global economic depression. However, Wang and Lai (2010) opines that oil price is determined by demand and consumption decision of NEICs, OPEC supplies and futures oil trading. Oil price volatility has been affecting the economy of most countries in different ways. For instance, studies have established that increase in oil price has negative impact on NEICs and the opposite for NEECs Cunado and de Gracia, 2003; Jiménez-Rodríguez and Sánchez, 2005; Hunt and Ninomiya, 2005). However, the positive impact of oil price shocks varies among NEECs (Rodriguez and Sanchez, 2004). Overall, the trend of oil price fluctuations has resulted to economic dislocation, unemployment, and inflation to most countries (Kilian, 2008). This is because energy price volatility happens due to fluctuation in demand and supply that are in most cases beyond the control of nation's economy (Kilian, 2008).

More importantly, the first oil price hike of 1973, perhaps caused by the Arab oil embargo and decline in US oil reserves has caused significant economic and social effect for most western countries (Baldwin, 2002). Since then, NEICs such as Europe and US began the quest for alternative to fossil fuel. As their energy demand continuously increases and hydrocarbon reserves decrease, reliance on OPEC supply to meet their energy requirement increase day by day (Yergin, 2008). Thus, the control of crude oil production and supply to the energy market by OPEC has been relatively responsible for the volatility in global oil price. However, several studies have shown that the market speculation is largely responsible for the oil price increase (Kaufmann, 2011). Subsequently, the impact of oil price increase on the budget of NEECs is significant; thus, a factor that drives towards the present global energy transition. Based on the foregoing factors, NEICs have outlined plans, policies and targets to transit from energy consumption of conventional energy to renewable. The next section discusses

the global renewable energy policies, in particular, Europe, US and China that are major Nigerian oil and gas exports destination.

3.4 Global Renewable Energy Policies

Upon the revelation about the importance of renewable energy to their economic and environmental needs, various regions and countries adopted various policies, measures and targets to exploit energy from renewable to lessen dependence on imported fossil fuel. Oil and gas importation from Nigeria constitute one of the energy sources especially for Europe, USA, China and India. The Nigerian National Petroleum Corporation (2014) reports that Nigerian oil and gas export to Europe accounts for 46% of total exports while United States of America accounts for 3%. In Asia, China and India accounts for about 19% of Nigerian total crude oil and gas exports. The regional or country policies towards transiting to renewable energy is discussed below.

3.4.1 Renewable Energy Policies in Europe

After the industrial revolution of 1840, energy has been in high demand in European countries. With the decline in oil and gas production in the OECD countries and clamour for climate and energy security intensity, the EU becomes more concern about future supply particularly, after the Arab oil embargo of 1973 (Maltby, 2013). This stem up the path for energy transition from fossil fuel to renewable energy sources generally considered climate friendly. For instance, the pioneer countries in the EU that introduced specific policies on renewable energy transition were Denmark (1979), Portugal (1988), Germany (1989) and lastly the United Kingdom, 1990 (Kitzing, Mitchell and Morthorst, 2012). Presently, the entire EU countries have adopted and implemented various policies for energy transition to reduce oil and gas consumption and attain energy security (Maltby, 2013).

Unlike the US, that has access to unconventional energy sources; the EU is transiting to renewable energy sources to attain energy and climate security. In addition, the EU has been a forerunner in the energy transition mission. The various energy transition policy frameworks developed by the EU include the

followings. The 1997 white paper on strategy to develop renewable energy to be 6-12% of EU's share of final energy demand, the 2001 directive on 22% of electricity from renewables, and also the 2003 directives on 5.75% on biofuel and other renewable energy fuel in transport, all meant to be achieve by 2010 (European Commission, 1997a, 2001b and 2003d).

Following a review of the targets, varied outcomes were revealed; some have surpassed the targets while others countries could not meet the target. Thus, in 2007, the Commission set a broad based renewable energy policy framework tagged the European Union renewable energy roadmap which serves as a legally binding target of 20% for renewable energy in the electricity, transport, and heating and cooling sectors and 10% of transportation fuels from biofuels or other non-fossil sources by 2020 (European Commission, 2007c). This is widely referred to as the vision "20–20–20" adopted to achieve 20% renewable energy development and 20% reduction in carbon emission by the year 2020.

Moreover, the European Union established the National Renewable Energy Action Plan (NREAP) 2010 as a general framework under Directive 2009/28/EC of the European Parliament on the transition roadmap to renewable energy sources in order to attain energy and climate security, employment as well as technological and regional development. Excerpt of the policies and target are as thus:

> (1) The control of European energy consumption and the increased use of energy from non-fossil sources such as wind, solar, biofuels, aero thermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases together with energy savings and increased energy efficiency to reduce greenhouse gas emissions and comply with the Kyoto Protocol to the United Nations Framework Convention on Climate Change.
>
> (2) In order to reduce greenhouse gas emissions and energy imports dependence within the EU, the growth of energy from non-fossil sources should be related to increased energy efficiency.

Apart from the above comprehensive renewable energy policy, each member country has adopted specific national policies and target to achieve energy

transition towards renewable energy sources. However, these national policies were adopted within the broader EU policies.

Table 3-1 EU Member States Renewables Targets for 2020

Member State	Share of Renewables in 2005 %	Share of Renewables in 2020 %
Austria	23.3	34
Belgium	2.2	13
Bulgaria	9.4	16
Cyprus	2.9	13
Czech Republic	6.1	13
Denmark	17	30
Estonia	18	25
Finland	28.5	38
France	10.3	23
Germany	5.8	18
Greece	6.9	18
Hungary	4.3	13
Ireland	3.1	16
Italy	5.2	17
Latvia	32.6	40
Lithuania	15	23
Luxembourg	0.9	11
Malta	0	10
The Netherlands	2.4	14
Poland	7.2	15
Portugal	20.5	31
Romania	17.8	24
Slovak Republic	6.7	14
Slovenia	16	25
Spain	8.7	20
Sweden	39.8	49
United Kingdom	1.3	15

Sources: European Parliament and European Council, 2009.

The EU as a block as stated above has been a major importer of Nigerian oil and gas over the decades. Another importer of Nigerian oil and gas is the US, which has also policies towards transiting to renewable energy sources and this could potentially reduce its oil and gas import volume.

3.4.2 Renewable Energy Policies in U.S.A

The US senate in its Ninety-Six Congress second session advocated for the expansion and consuming renewable energy sources for economic, political and environmental reasons (US Senate, 1980). The outcome of the report provided the pathways for US energy transition. Over the years, US have made

tremendous progress towards achieving energy security. For instance, the Energy Independence and Security Act (EISA) of 2007 specifically aim to lessen US reliance on gasoline, increase alternative fuel usage and reduce carbon emissions by 9 per cent by the year 2030.

This is expected to be achieved through improved vehicle fuel economy and to increase supply of renewable alternative fuel in accordance with the mandatory Renewable Fuel Standard (RFS), which obliges transportation fuel from renewable fuel to be 36 billion gallons by the year 2022. The Act further stipulates that the Corporate Average Fuel Economy (CAFE) standard at 35 miles per gallon for cars and light truck by the year 2020. In addition, EISA also includes grant packages to encourage the development of hybrid electric vehicle technologies and other biofuels. The policies are expected to reduce total gasoline consumption significantly, although the absence of required infrastructure has constituted a challenge to achieve the targets (Broch, Hoekman and Unnasch, 2013).

To ensure energy transition to be successful, the US have collaborated with international agencies, global climate change summit and regional economic blocs such as Asian-Pacific Economic Cooperation (APEC) as a pillar to attain low carbon economy and green growth (APEC, 2011). Moreover, the removal of oil subsidy in APEC and net energy exporting countries has been an agenda for reducing fossil fuel consumption globally. Such a reduction is aim at lessening pressure on existing reserve to solve their energy poverty.
Based on International Energy Agency (2012) reports, US adopted new appliances standard, and state level supports schemes for renewable, enhanced CAFE and tax credit for renewable energy sources as current framework for rapid success. Since before the enactment of the EISA 2007, the US government launched to explore for other sources of energy for complimenting US energy supplies after the 1973-74 oil embargo (Baldwin, 2002).

It is evident that US is the second largest carbon emitter country in the world (International Energy Agency, 2015). However, the energy transition policies and

targets adopted could potentially reduce its ranking. The American Clean energy and Security Act (ACES), 2009 passed by the US House of Representatives has proposed reduction of domestic carbon by 17% and 80% before 2020 and 2050 respectively through cap and trade policy instrument. In addition, the US senate in their draft bill of the American Power Act (APA) 2010 have proposed almost same with the ACES, 2009 but with 83% for 2050. These law as proposed by the US Congress when becomes effective could significantly reduce oil and gas importation and consumption by almost the same percentage in real terms. Tol (2009) opined that economic decarbonisation happens automatically in the US since 1917 at a rapid rate, but lower than economic growth. However, with the enacted of environmental policies and targets, it is expected to accelerate decarbonisation faster than before.

Going by these assertions and since carbon emission and oil and gas consumption have negative bidirectional causality, the intensity of oil and gas could significantly reduce in the US. Kotchen, Boyle and Leiserowitz (2013) argues that, application of policy instruments such as cap and trade program, carbon tax and regulation as a tool to reduce carbon emissions and achieve potential targets might be very effective considering the positive response from Americans. In contrast to EU, the US as a single country, has been a major importer of Nigerian oil and gas before the discovery and subsequent production of shale oil and gas in the year 2013. Similarly, the Asian region led by China has been a dominant importer of Nigerian oil and gas. However, the country has put in place policies towards transiting to renewable energy sources, which may reduce its oil and gas import volume.

3.4.3 Renewable Energy Policies in Asia-China

Asian countries led by China that are been considered as emerging NEICs were also part of the global energy transition regime. For instance, China has been a net energy importing country since 1993 and depends substantially on imported oil and gas over these years (International Energy Agency, 2015). In addition, it is the highest consumer of energy and carbon emitter in the world accounting for about 1256 MTOE and 21% respectively (British Petroleum, 2015). China has

been under severe criticism from environmentalist over the years for its excessive carbon emission. To attain energy and climate security, China has evolved energy transition pathways in line with other NEICs.

China's 2005 Renewable Energy Law (as amended) provides the bedrock for the country's energy transition road map to end its energy and climate concerns. This broad based energy transition framework provides national targets, a feed in tariff system and funding mechanisms amongst others (Schuman and Lin, 2012). The participation of China at the United Nations Climate Change Conference, Copenhagen in December 2009 offers the country to articulate its energy transition policies. Based on 2005 levels, China initiated to cut carbon intensity in relation to GDP by 40-50% and increase the stake of renewable energy and nuclear from about 10% to 15% by 2020 (Schuman and Lin, 2012). Similarly, based on the 2007 scenario, China pledged to reduce its oil and gas imports bill by $40 billion and $170 billion in 2020 and 2030 respectively (International Energy Agency, 2009).

Similarly, the framework is designed to make total investment in the 450 Scenario of nearly $1500 billion in low carbon power generation plants out of which 73 % are renewable over the next 20 years. Thus, decreasing the share of fossil fuels in its energy mix has been the corner stone of China's high clean energy development strategy. The next section presents the empirical studies on the impact of renewable energy.

3.5 Review of Empirical Literature on Renewable Energy

Numerous studies on renewable energy are found in the literature on different countries over certain periods and with various methodologies, approaches and findings (see for example, Sari and Soytas, 2004; Szklo and Schaeffer, 2006; Payne, 2009; Sadorsky, 2009a and 2009b; Menegaki, 2011; Jorgenson, 2012; Tugcu, Ozturk and Aslan, 2012; York, 2012; Smith, 2014). The study by Akella, Saini and Sharma (2009) on the social, economic and environmental impacts of renewable energy systems concluded amongst other things that renewable energy reduces dependence on imported fossil fuels. Similarly, York (2012)

conducted a study and concluded that on the average; per unit consumption of renewable energy by a particular country displaces about one quarter unit of fossil-fuel energy.

In a related study, Smith (2014) established that renewable energy fuels sources such as biofuels, biodiesel and hydrogen are viable to replace oil and gas in the transportation sector. However, Szklo and Schaeffer (2006) concluded that, "alternative energy sources would no longer be sources of energy that compete with oil over the short term, but would rather constitute feedstock for integrated alternative systems, complementing, first, and replacing, in the long term, oil" p.2521).

Similarly, other studies have shown that the path of renewable energy sources brings higher economic and environmental accountability, energy security compared to reliance on fossil fuel. For instance, in an assessment of disaggregate energy consumption using a generalized forecast error variance decomposition analysis for Turkey over the period 1969–1999, Sari and Soytas (2004) concluded that consumption of alternative energy sources such as waste, hydraulic power and wood has impacted positively on employment rate and economic growth in Turkey.

Using a different approach, Wolde-Rufael (2004) investigated the causal relationship between disaggregated energy consumption and economic growth in Shanghai for the period 1952-1999 and the results shows that renewable energy sources play a significant role in causing economic growth. Similarly, Domac. Richards and Risovic (2005) investigates the socio-economic drivers in implementing bioenergy projects and concluded that renewable energy consumption significantly boost economic growth by increasing employment level, monetary gains and earnings.

Drawing a conclusion from the empirical oil–GDP literature, Awerbuch and Sauter (2006) finds that by dislodging oil and gas as dominant energy source, renewable energy production and consumption can help countries avoid costly

macroeconomic losses as a result of oil price shock, loss of employment and financial and assets loss. Awerbuch and Sauter (2006) further argued that 10-20% share of renewable energy in the total energy mix has the potential of reducing 10% of oil and gas prices which in turns avoid GDP and asset loss.

Chien and Hu (2007) examined the relationship between renewable energy and technical efficiency in 45 developed and emerging economies using Data Envelopment Analysis (DEA) from 2001-2002 and established that consumption of renewable energy improves technical efficiency of production capacity and GDP. They further argued that the consumption of renewable energy sources leads to economic growth in the long run through energy import substitution and expansion of business and new employment opportunities caused by the renewable energy industries. Krewitt et al., (2007) concluded that renewable energy has the potential of substituting oil and gas, mitigate global warming and provide as much as half of the world's energy needs by 2050.

Using Structural Equation Modelling (SEM) Approach, Chien and Hu (2008) analysed the effect of renewable energy on gross domestic product (GDP) in 116 countries for 2003. Chien and Hu (2008) concluded that renewable energy has a significant positive influence on economic growth through capital formation rather than on trade balance, which suggests that renewable consumption paths do not have an import substitution effect on oil and gas. Thus, the study confirms the earlier study, which shows positive relationship between renewable energy and GDP through the path of increasing capital formation (Chien and Hu, 2007).

Chang, Huan and Lee (2009) used a panel threshold regression (PTR) model to investigate the influence that oil and gas prices have on the development of renewable energy for OECD countries under diverse economic system over the period from 1997 to 2006. Chang, Huan and Lee (2009) concluded that a country's level of economic growth determines the consumption of renewable energy sources to minimize the risk of price volatility. In other words, countries with higher economic growth consume more renewable energy during period of high-energy prices than with lower economic growth. The empirical results also

indicate indirect relationship between GDP and contribution of renewable energy-to-energy supply.

Sadorsky (2009a) estimated an empirical model of renewable energy consumption on GDP, carbon emissions and oil price for the G7 countries from 1980-2005 using Panel Cointegration techniques and finds that increases in long term economic growth and carbon dioxide emissions significantly increases renewable energy consumption and that oil price negatively affect renewable energy consumption. Thus, the study determines GDP and carbon emission as important drivers of renewable energy consumption while oil price as negative factor affecting renewable energy. This implies that when countries achieve economic growth, they will become more concern over environmental and economic sustainability such as carbon emission, energy security and oil price volatility.

Sadorsky (2009b) investigated the relationship between renewable energy consumption and income in 18 emerging economies using Panel Cointegration Techniques from 1994-2003. The study found that increases in real per capita income and energy prices positively affect renewable energy consumption in emerging economies. As emerging economies will be transiting to become developed economies, the increased consumption of renewable energy could not only reduce carbon emission but also lessen dependence on imported energy, provides safeguards against oil price shocks thereby affecting global fossil fuel consumption.

Furthermore, Apergis and Payne (2009) investigated the relationship between carbon emissions and energy usage in Central America. The study finds bidirectional relationship between carbon emission, energy usage and economic growth. This suggests that as countries attain economic growth, the level of carbon emission increases and effort to reduce the emission causes significant effect on economic growth. Using a Toda-Yamamoto technique within the context of multivariate framework and by including capital and employment as independent variables, Payne (2009) assessed the causal relationship between

renewable and non-renewable energy consumption and real GDP growth in the US for the period 1949-2006. The findings indicated no causal relationship between renewable and non-renewable energy consumption and economic growth. This suggests that energy consumption plays relatively marginal role in the influencing economic growth thus making energy conservation policies incapable of adversely influencing real GDP.

Apergis and Payne (2010a) examined the relationship between renewable energy consumption and economic growth for a panel of twenty OECD countries over the period 1985–2005 within a multivariate framework to determine the degree to which renewable energy consumption influences growth and finds that renewable energy consumption significantly increases GDP and vice-versa. It could be argued that the bidirectional relationship between both variables shows the importance of renewable energy in inducing growth as against imported energy sources. Apergis and Payne (2010b) used Multivariate Panel Data Framework and studied the relationship between renewable energy consumption and economic growth within 13 countries of Eurasia for the period 1992-2007. They reveal interdependent relationship between renewable energy consumption and economic growth both in short and long run.

Also, in an examination of the relationship between renewable energy consumption and economic growth for a panel of 11 countries within common wealth over the period 1985–2005 using a multivariate framework, Apergis and Payne (2010c) established a bidirectional causality between carbon emission and economic growth. The result indicates feedback hypotheses where economic growth effect carbon emission and vice-versa. Using a Panel Error Correction Model, Apergis et al., (2010) examined the causal relationship between CO_2 emissions, nuclear energy consumption, renewable energy consumption, and economic growth for a group of 19 developed and developing NEICs for the period 1984–2007. They found out a statistically significant positive relationship between renewable energy and carbon emissions but a statistically significant negative relationship between nuclear energy and carbon emissions.

Thus, the above findings established that nuclear but not renewable energy reduces carbon emission. Moreover, the study determines bidirectional causality between renewable energy consumption and economic growth. This suggest that even though expansion of renewable energy does not reduce carbon emission but can reduce dependence on imported energy and minimize energy supply disruption and oil price shocks risk in net energy importing countries argued (Apergis et al., 2010).

Menegaki (2011) undertook an empirical study on the causal relationship between economic growth and renewable energy for 27 European countries, using Multivariate Panel Framework of Random Effect Model during the period 1997-2007. The study established no relationship between renewable energy and GDP but showed short run relationship between renewable energy and greenhouse gas emission. The study suggests that current capacities of renewable energy are insufficient to drive socio-economic activities while reducing carbon emission.

Apergis and Payne (2011a) investigated the relationship between renewable energy and non-renewable energy consumption and economic growth for 80 different countries using a multivariate panel model over the period 1990-2007 concluded that bidirectional causality exists between renewable energy and non-renewable energy consumption and economic growth both in the short and long run. The result of the study also showed negative bidirectional causality between renewable and non-renewable energy consumption, which is an indicative of substitutability between the two energy sources.

Similarly, using a Panel data on Six American countries for the period 1980-2006, Apergis and Payne (2011b) examined the relationship between renewable energy consumption and economic growth. They established a long-run equilibrium and statistically significant positive relationship between real GDP, renewable energy consumption, real gross fixed capital formation, and the labour force. More importantly, the results show a bidirectional causality between renewable energy consumption and economic growth in both the short- and long-run.

Using the PVAR approach on Europe and Eurasian countries for the period 1965-2009, Tiwari (2011) found that non renewable energy sources not only have negative impact on the growth rate of GDP but increase carbon emissions. However, the study showed renewable energy sources affects positively on the growth rate of GDP, employment and environmental sustainability through reduction in carbon emission. Using a different method, Shahbaz and Lean (2012) established that fossil fuels consumption accounts for significant level of carbon emission, which causes environmental degradation and global warming in Pakistan. Similarly, Shahbaz and Lean (2012) argued that production and consumption of renewable energy mitigate carbon emission, boosts socioeconomic activity and provide platform for oil and gas substitute.

Tugcu, Ozturk and Aslan (2012) investigated the long run and casual relationships between renewable and non-renewable energy consumption and economic growth by using classical and augmented production functions in G7 countries for the period 1980-2009. The results from the classical production showed the existence of bidirectional causality between non-renewable energy consumption and economic growth. Moreover, the findings from the augmented production function indicate no causal relationship between renewable energy consumption and economic growth in France, USA, Italy and Canada. However, the study concluded that both renewable and non-renewable energies play a significant role in inducing economic growth. In his study, Payne (2012) found that renewable energy legislation and policies since 1978 had a positive and statistically significant impact on renewable production and consumption. The result further showed shocks in GDP and carbon emission positively influence renewable consumption.

Summarily, the literature reviewed so far points to the fact that the path of renewable energy sources brings higher economic and environmental sustainability, energy security for net energy importing countries compared to reliance on fossil fuel. Thus, renewable energy is considered as a substitute for oil and gas. In addition, most energy importing countries regard the energy consumption from renewable energy as a panacea to economic and macro

environmental and carbon accountability. Considering the significance of Nigerian oil and gas exports to net energy importing countries, the study raised this second research question:

> How renewable energy consumption in NEICs affects Nigerian oil and gas exports?

Subsequently, this research question was transformed to hypotheses two and three, as shown in chapter one in order to address objective two and three. The hypotheses are restated as thus:

H_o2: Renewable energy consumption in developed NEICs has no influence on Nigerian oil and gas exports.

H_a2: Renewable energy consumption in developed NEICs has influence on Nigerian oil and gas exports.

H_o 3: Renewable energy consumption in emerging NEICs has no influence on Nigerian oil and gas exports.

H_a 3: Renewable energy consumption in emerging NEICs has influence on Nigerian oil and gas exports.

Similarly, from the results of the tested hypotheses two and three, the study raised the first research question as thus:

> Are the effect of renewable energy consumption in developed NEICs on Nigerian oil and gas exports higher than that of the emerging NEICs?

3.6 Summary and Conclusion

This chapter reviewed and discussed global energy transitions with emphasis on renewable energy sources. The chapter discussed various sources of renewable energy, factors that drive their development and consumption especially in NEICs. Moreover, the chapter explained past global energy transition and the

factors that led to the transitions. Similarly, the chapter presented the various policies, measures and targets formulated in NEICs to ensure the growth and consumption of renewable energy sources in order to contribute significantly to their total primary energy mix and subsequently replace oil and gas as the dominant global energy source. Finally, the chapter reviewed empirical literatures on renewable energy sources and revealed that most of these literatures are in the perspective of NEICs.

This review revealed quite a number of information. First, consumption of energy from renewable were derived from various sources, which could be used in transportation, electricity generation, heating and cooling. These forms of energy are abundant, inexhaustible and have less impact on the environment compared to consumption of energy from oil and gas.

Second, the review indicated that the world had experienced energy transition in the past and now, another transition is underway from the consumption of conventional energy to energy from renewable source in view of the exhaustibility, environmental and security concerns of the latter. It is on this note that most NEICs have demonstrated commitment towards development of renewable energy in order to account for significant share in their total energy mix, achieve macro environmental and carbon accountability, energy security, and reduce the economic impact associated with the consumption of energy from oil and gas.

Third, the chapter revealed that Nigeria's NEICs such as the EU, USA and China have adopted various forms targets and support policies towards the development of renewable energy in order to account for significant share in their total energy mix. For instance, tax incentives, discount and subsidies were employed in many countries to support the development and consumption of energy from renewable.

Fourth, the review further showed that several studies were undertaken in the perspective of developed and emerging net energy importing countries, which

states that development and consumption of energy from renewable energy sources brings higher socio, economic and environmental benefits as well as energy security compared to the use of energy from conventional energy sources.

Finally, the chapter suggests that consumption of energy from renewable is a potential substitute for oil and gas energy. Thus, oil and gas as the dominant global primary energy is faced with substitution effects due to its associated problems. As a result, potential reduction in global consumption of energy from conventional energy is anticipated. This might or would affect oil price and oil and gas exports volume of most net energy exporting countries such as Nigeria that depends significantly on revenue realized from oil and gas exports. The next chapter reviews oil and gas exports revenue and the Nigerian budget.

Chapter 4.
Review of Oil and Gas Exports Revenue and the Nigerian Budget

4.1 Introduction

The previous chapter reviewed and discussed global energy transitions with emphasis on renewable energy sources. Specifically, the previous chapter dealt with renewable energy consumption in net energy importing countries (NEICs). This chapter reviews the impact of oil and gas export revenue and budget process and financing in Nigeria. More specifically, the chapter intends to identify the significance of oil and gas export revenue in financing the Nigerian annual budget.

The chapter is structured into ten sections. A general background review about oil and gas revenue and budget financing in Nigeria is the focus of section 4.2. Section 4.3 discusses budget and framework for governmental budgeting in Nigeria. Section 4.4 deals with stakeholders in the Nigerian budgetary process and the annual budget. Nigerian oil and gas activities, Nigerian oil and gas exports destinations are discussed in section 4.5. The various sources of oil and gas revenues in Nigeria are discussed in section 4.6. The next section discusses the various accounts that accommodate oil and gas revenue and the basis of revenue distribution in Nigeria. Section 4.8 explains the overall impact of oil and gas revenue on Nigerian budgeted and actual revenue and the annual budget. Section 4.9 discusses the stakeholders that represent the government in the conducted semi-structured interviews. Finally, section 4.10 concludes the chapter.

4.2 Review of Oil Revenue and Budget Financing in Nigeria

Since Nigeria began exporting oil and gas, the revenue realised from the sale of crude oil and gas has played a dominant role in financing Nigerian budgets. However, because of internal and external challenges, the dominance of oil and gas in financing Nigerian budgets has continuously been threatened. The internal challenge is largely from fluctuations in production output while the external

challenges are from fluctuations in oil and gas exports, oil price, available of substitutes and global environmental regulations amongst others. The occurrence of these challenges during any financial year has been causing gaps between budgeted and actual revenue, which could be deficit or surplus. Deficit revenues have been negatively affecting government's budget over the years and whenever it occurs, governments resort to borrowings in order to finance the deficit (Soludo, 2003; Ministry of Finance, 2015; Thisday Newspaper, 2016; Debt Management Office Nigeria, 2016).

This is consistent with El-Anshasy and Bradley (2012) who reported that net energy exporting countries attempt to sustain government expenditure and public sector employment in the period of oil price decrease without sufficient reserves for continued financing of such expenditures. Indeed, several studies have shown that Nigeria's vulnerability to oil and gas revenue shock is enormous as a result of insignificant contribution of the non-oil and gas sector to the overall economy (Martin and Subramanian, 2003; Ogbonna and Ebimobowei, 2012; Jibrin, Blessing, and Ifurueze, 2012; Niworu, 2012; Kareem et al., 2012; Ojo and Boboye, 2012).

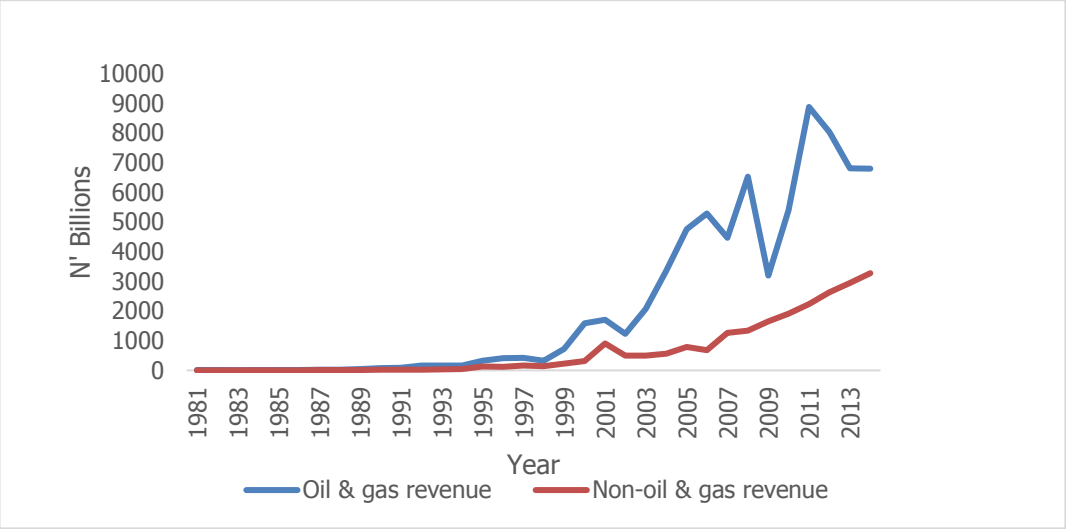
Conversely, excess oil and gas revenues have been affecting Nigerian annual budgets in form of excessive spending rather than saving for the future (Daily Trust Newspaper, 2016). In an effort to overcome this problem of excessive spending sequel to increasing oil and gas revenues, government established the Excess Crude Savings Account (ECSA)[19] and later Nigerian Sovereign Investment Authority (NSIA[20]), with the aim of saving excess revenue above annually benchmarked oil price per barrel.

Despite this effort, fluctuations in oil and gas exports and revenue cause significant impact on Nigerian budget financing and the overall economy. More specifically, oil and gas revenue has significant effect on resource allocation,

[19] The Excess Crude Account is an account established by a presidential directive based on political arrangement between the three tiers of government. See section 4.6.2 for full details
[20] See section 4.6.3 for detailed information

distribution and functioning of government apparatus. Prior to the discovery of oil, the revenue generated from non-oil and gas sectors had a significant impact on the Nigerian budget. Figure 4.1 below shows the dominance of non-oil and gas revenue in the 60s, 70s and early 80s.

Figure 4-1 Nigerian Total Revenue (Oil and Gas and Non-Oil and Gas)



Source: CBN, 2015

This Figure showed both Nigerian oil and gas and non-oil and gas revenue from 1981-2013. However, according to the Central Bank of Nigeria (2015), the share of non-oil and gas revenue was 72% of the total government revenue in 1970. Thus, since the discovery of oil and subsequent production, the revenue generated from oil and gas has had a significant impact on the Nigerian budget. On the other hand, the contribution of the non-oil and gas sector in terms of revenue to the overall government budget began to decline at an alarming proportion. Since the restoration of democracy in the year 1999, after two decades of military rule, oil and gas revenue was far more than the non-oil and gas revenue. In the year 1999, oil and gas revenue was N724, 422.50 million and the non-oil revenue was N224, 765.40 million; in the year 2004, the oil revenue realised rose to N3, 354,800.00 billion or 86% of the total government revenue (Central Bank of Nigeria, 2005).

In 2005, the oil and gas revenue was N4, 762,400.00 billion, representing an increase of 42 percent over that of 2004. This constitutes 86 percent of the total government revenue. The non-oil and gas revenue was N785, 100.00 million, representing 14% of the total government revenue. The oil and gas revenue for year 2009 was N3, 191,937.98 billion representing 66 percent of the total revenue, while non-oil and gas revenue was N1, 652,654.37 billion. This constitutes 34% of the total government revenue realised for that year. It can be observed that for the first time over two decades, with the exception of 2001, the non-oil and gas revenue contributed 34% to the total revenue.

In the year 2010, the revenue accrued from oil and gas was N 5396091.05 billion and the non-oil revenue was N224, 765.40 million while the non-oil and gas revenue was N1, 907,580.50 billion (Central Bank of Nigeria, 2009). However, in the year 2012, the oil revenue realised rose to N8, 025.95 billion or 88% of the total government revenue (Central Bank of Nigeria, 2011). In the year 2014, however, oil revenue was N 6814.43 billion, representing a 70% of total government revenue. This shows a 15% decrease over that of 2012. The non-oil and gas revenue was N785, 100.00 million representing 30 percent of the total revenue. Similarly, revenue performances for 2015 and 2014 revealed dramatic decrease in oil and gas revenue by about 50% and 37% respectively (Budget Office of the Federation, 2016; Central Bank of Nigeria 20116; National Assembly, 2016).

As a result of a significant fall in oil and gas exports and price, the 2015-2017 MTEF/FSP[21] was revised to reflect current economic realities, thus the 2016-2018 MTEF/FSP was produced (Budget Office of the Federation, 2016; National Assembly, 2016). It has been indicated within the literatures that energy transition away from conventional energy sources may have potential effect on global oil and gas consumption and resultant effects on the oil and gas exports

[21] In the 2015-2017 Medium Term Expenditure Framework and Fiscal Strategy Paper (MTEF/FSP), oil and gas revenue was projected to generate about 72% of Nigerian total government revenue for the 2015-2017 financial years.

revenues of NEECs (Yamin 1998; Organization of the Petroleum Exporting Countries, 2000).

According to the KPMG Africa Report (2013:9), "Developments in the international energy market and in the country's own domestic crude supply situation will continue to have a major impact on Nigeria's macroeconomic risk assessment in the short to medium-term". This suggests that government fiscal revenue may be significantly vulnerable to oil and gas demand in net energy importing countries as well as oil price volatility. In addition, internal factors such as divestment by the multinational oil companies and massive oil theft, have also affected Nigeria's oil and gas exports volume negatively (Katsouris and Sayne, 2013; Agbaeze, Udeh, and Onwuka, 2015 and Boris, 2015).

Hence, the transition away from the dominant oil and gas by the net energy importing countries and aging of Nigeria's onshore oil fields with slow investment in the Nigeria oil and gas sector would be a major problem to government fiscal revenue flow. Thus, as contained in 2016-2018 MTEF/FSP, projected revenue to be realised from oil and gas would considerably reduce by 38%, 45% and 44% for the year 2016, 2017 and 2018 respectively (Budget Office of the Federation, 2016; National Assembly, 2016).

Despite the continued decline in Nigerian oil and gas exports and revenue and its potential impact on the budget, the oil and gas revenue is expected to account for significant share in total government revenue. Based on the current available data, oil and gas revenue accounted for 67% Nigerian total revenue, 79.8% of foreign exchange earnings and 13.6% of GDP; while the non-oil and gas sector accounts for the remaining balances (Central Bank of Nigeria, 2015; National Bureau of Statistics, 2016Q1; World Bank, 2016). Therefore, with the increasing transition to renewable energy and commitment to reduce oil and gas consumption in order to reduce the level of carbon emissions especially in net energy importing countries, Nigeria as a net energy exporting country may experience further decline in oil and gas exports to NEICs. This would further

increase the gaps in actual and budget oil and gas exports revenues. The next section discusses budget and framework for governmental budgeting in Nigeria.

4.3 Framework for Governmental Budgeting in Nigeria

Budget is the quantitative expression of the plan of action of government for a defined period of time which are compared with the actual results to determine variations if any (Adams, 2013). According to Olomola (2009), budget serves as an instrument to plan for expected revenues and expenditures, act as a framework for control and allocate resources for project execution. Thus, budget is the quantitative plan of action detailing the anticipated revenues to be generated and the expenditure to be spent over a specified period of time usually a year. The Nigerian annual budget is a comprehensive fiscal policy document that shows the different sources of federal government revenue and how is being appropriated among the competing social and economic needs.

In accordance with the Nigerian budget frameworks explained below (see subsection 4.31, 4.3.2, 4.3.3 and 4.3.4), the annual budget is prepared. For instance, Part III, Section 18-19 of the Fiscal Responsibility Act (FRA), 2007 stipulates that the annual budget be prepared from Medium Term Expenditure Framework and FSP. As obtainable in many oil revenue dependent countries, the oil and gas exports revenue finances significant part of the Nigerian budget. According to the Budget Office of the Federation (2015), over 70% of the expenditures of government (both recurrent and capital) are financed by oil and gas export revenue.

Since the resumption of democratic governance in 1999, oil price[22], production volume[23] and exchange rate[24] are been used in the preparation of the Nigerian

[22] The introduction of the oil-price-based fiscal rule has helped in separating the annual budget from the oil price shock. Moreover, it stabilised the management of the economy by making expenditure and revenues more predictable (Abiola and Okafor, 2013).

[23] The Nigerian government bases its annual budget on the anticipated production level over the budgeted period.

[24] Globally, oil and gas business is undertaken by a single international currency, the United State Dollar (US$). Thus, Nigeria establishes its Annual budget based on the expected oil price measured in US Dollars.

annual budgets. However, it appears that other external determinants such as global consumption of renewable energy, carbon emission reduction was not included in the budget preparation.

The primary aim of budget is to facilitate budgeting process and ensure budgetary control. Thus, budgetary control is considered as the process of linking the responsibility to the budget and the continuous comparison of actual results with the anticipated level in order to remedy the variance therefrom. According to Schick (2004:84), a good government budget should have five[25] basic characteristics to be used as a criterion. Similarly, budgeting helps in efficient allocation of resources, evaluate performance and gives an insight to the policy direction of government. Moreover, budget provides an estimate of expected revenue and how it is being distributed in line with the policy direction of government. The focus of government is designed to enhance economic growth and social welfare of citizens through government revenue. Thus, the provision of basic infrastructure and services are being articulated and implemented via government budget.

In the process of budget preparation, certain legal frameworks are followed. In the case of Nigeria, the main statutory frameworks that guided budget preparation of the budgets are the 1999 Constitution, the Finance (Control and Management Act 1958[26], Fiscal Responsibility Act 2007[27] and finally, the Medium Term Expenditure Framework and Fiscal Strategy Paper which provides a 3 years plan on the budgets. The next subsection discusses the each of the statutory frameworks identified above, starting with the 1999 Constitution.

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[25] The budget should establish sustainable revenue framework for the medium term and beyond; be a medium of allocating resources to priority of government; serve as a tool for government operation to deliver efficient public service delivery; have the mechanism to prevent leakages in budget implementation; reflect socio-economic realities of stakeholders (citizens, communities and the economic environment).

[26] This act provides for the control and management of the public finances of the Federation and for matters connected therewith.

[27] It is an Act that provide for prudent management of the nation's resources, ensure long-term macro-economic stability of the national economy, secure greater accountability and transparency in fiscal operations within a medium term fiscal policy framework, and the establishment of the fiscal responsibility commission to ensure the promotion and enforcement of the nation's economic objectives; and for related matters.

4.3.1 The 1999 Constitution of the Federal Republic of Nigeria

Section 1 (1) of the 1999 Constitution states inter-alia "this constitution is supreme and its provisions shall have binding force on the authorities and persons throughout the Federal Republic of Nigeria. In this regard, the Constitution has spelt out in unequivocal terms the statutory functions, responsibilities and duties of persons and authorities in the country. As regards budget, the duties of President of the country are stated in section 81(1) as thus, "The president shall cause to be prepared and laid before each House of the National Assembly at any time in each year estimates of the revenues and expenditures of the Federation for the next following financial year."

On the other hand, section 80 subsection (1-4) is explicit on the unconstrained power of the National Assembly to scrutinise and determine the contents of the budget. In the exercise of this power, the current National Assembly uncovered inherent errors and padded figures found in 2016 Budgets (Leadership Newspaper, 2016). In addition, Chapter V, part 1 (E) of the Constitution gave the National Assembly certain powers and control over public funds as a means of monitoring and regulating the generation and allocation of government funds. Based on these sections, it is explicit that the president has the executive power to initiate the annual budgets, and the National Assembly to deliberate, scrutinise and finally send the annual budget to the president for his assent.

4.3.2 Finance (Control and Management) Act 1958

This Act provide for the control and management of the public finances of the Federation and for matters connected therewith. Finance (Control and Management) Act 1958 provides the framework to control and manage the operations of government funds. Furthermore, the Act governs and regulates the accounting procedures, the books of accounts to be maintained and the techniques to be followed in the preparation of government accounts and financial statements (Anyafo, 1994). For instance, the use of cash and fund basis in the preparation of government accounts are stipulated in this Act. However, several scholars and accounting bodies have criticised the mandatory use of cash basis in public sector accounting practice (National Council on Governmental

Accounting (NCGA) 1981; Ngwu 1998; Oshisami 1992; Gary 1992). They conclude that the use of cash basis renders accrual basis of accounting unlawful and could impede on achieving long-term goals. It is on this basis that the NCGA endorses the use of accrual basis in conducting governmental activities.

4.3.3 Fiscal Responsibility Act 2007

The National Assembly enacted this Act in 2007 to govern the fiscal actions of public office holders in the country. The fundamental objective is to ensure fiscal control, financial discipline and strengthen accountability and transparency in the management of public resources. It is against this background that the fiscal responsibility commission was establishment to ensure the promotion and enforcement of the nation's economic objectives; and for other related matters therefrom.

4.3.4 Medium Term Expenditure Framework and FSP

According to the World Bank (1998), the Medium Term Expenditure Framework and Fiscal Strategy Paper (MTEF/FSP) is a multi-year macroeconomic and fiscal framework that allows expenditures to be "driven by policy priorities and disciplined by budget realities" (p.32). This comprehensive fiscal policy framework provides projected fiscal targets, estimates of revenues and expenditures, including government liabilities with the purpose of predicting and achieving macroeconomic and fiscal objectives normally within three years of national budget. According to the World Bank's Public Expenditure Management Handbook (1998a), "The MTEF consists of a top-down resource envelope, a bottom-up estimation of the current and medium-term costs of existing policy and, ultimately, the matching of these costs with available resource in the perspective of the yearly budget process" (p.46). Table 4.1 below categorise the stages of a typical MTEF.

Table 4-1 Six Stages of a Comprehensive MTEF

Stage	Characteristics
i. Development of Macroeconomic/Fiscal Framework	• Macroeconomic model that projects revenues and expenditure in the medium term (multi-year)
ii. Development of Sectoral Programs	• Agreement on sector objectives, outputs, and activities • Review and development of programs and sub-programs • Program cost estimation
iii. Development of Sectoral Expenditure Frameworks	• ·Analysis of inter- and intra-sectoral trade-offs • Consensus-building on strategic resource allocation
iv. Definition of Sector Resource Allocations	• Setting medium term sector budget ceilings (cabinet approval).
v. Preparation of Sectoral Budgets	• Medium term sectoral programs based on budget ceilings.
vi. Final Political Approval ·	• Presentation of budget estimates to cabinet and parliament for approval.

Source: PEM Handbook (World Bank, 1998a: 47-51), adapted.

In 2005, Nigeria embarked on a series of reforms in the public service and in accordance with the recommendation of the World Bank (Federal Ministry of Finance, 2006). Consequently, Nigeria enacted the Fiscal Responsibility Act in 2007 mentioned above. Part II, Section 11-17 of the Fiscal Responsibility Act (FRA), 2007 specified the use of Fiscal Strategy Paper (FSP) within an MTEF for the periods of three years' projection. The MTEF/FSP was designed using the oil-price-based fiscal rule, which minimised the magnitude of oil price fluctuation in the annual budget. In this regard, the MTEF provides revenue (both actual and forecasted), expenditure and revenue framework, a consolidated debt statement and a statement on contingent liabilities for the next three financial years (FRA Act, 2007).

The overall aim is to minimise disconnection between policy objectives with planning and ensure greater budget predictability in the generation and allocation of resources. Moreover, it is geared to improve macro-economic balance through the development of a consistent and realistic revenue framework, diversifying revenue sources, and improving the allocation of resources to strategic priorities, among other things. Specifically, the MTEF is intended to achieve the followings: (i) improved macroeconomic balance, especially fiscal discipline. (ii) Better inter- and intra-sectoral resource allocation. (iii) Greater budgetary predictability for line

ministries. (iv) More efficient use of public monies. (v) Greater political accountability for public expenditure outcomes through more legitimate decision-making processes. The next section discusses stakeholders in Nigerian budgetary process and the annual budget.

4.4 Stakeholders in Nigerian Budgetary Process and Budget

The primary stakeholders in the Nigerian budgetary process are the executive and the legislative arms of government. The budgetary process involves inputs from the executive and the legislative arm of government. On the one hand, the executive is responsible for the budget preparation and onward submission to the National Assembly for approval. In addition, they are statutorily responsible for the implementation of the budget in accordance with the approved budget generally referred as the appropriation act. On the other hand, the legislative arm is statutorily empowered by law to invite the various units of the executive government (Ministries, Departments and Agencies) to defend their respective budgets. Subsequently, the National Assembly debate deliberate and make inputs into the budget, pass it into law and then forwarded to the president for his/her assent to become binding law consistent with the provisions of the Nigerian constitution.

Consequently, budgetary control measures are put in place to ensure optimal budget performance. For instance, the law provides that the executive government should not undertake any action without a prior budget for it. Thus, the concept of budgetary control assumes that all government revenue and expenditure be budgeted for and passed by the National Assembly and approved by the president. Hence, it could be argued that the Nigerian government instituted budgetary control measures in its national annual budget in order to ensure budget implementation. However, studies have cited a large budget process cycle, lack of monitoring and implementation as well as failure of retirement of unspent fund as some of the fundamental challenges facing the national annual budgets (Malgwui and Unegbu, 2012; Adams, 2013). Below are the detailed discussions on the key stakeholders in the budgetary process, the executive and the legislative arms of government.

4.4.1 Executive Arm of Government

President and members of Federal Executive Council (FEC[28]) represents the executive arm of government. The primary responsibilities of the executive arm of government are specified in Part II 5 (1) of the 1999 Constitution. This section directly empowers the President or indirectly through the Vice-President and Ministers of the Government of the Federation or officers in the public service of the Federation to take public decision and execute policies and programme of government. The executive arm of government articulates public policies and programmes by preparing a document called budget and forward it to the National Assembly for approval.

In addition, staffs and members of the FEC appear before the National Assembly to defend their budget estimates proposals in the annual budget. In addition, the executive arm is statutorily responsible for the implementation of the budget in accordance with the approved budget generally referred as the appropriation act. Consequently, senior public policy and decision makers saddled with executing economic and financial policies of government at certain MDAs were purposively selected to represent the executive arm of government for the primary data collection using semi-structured interviews, as discussed in chapter six. The MDAs selected are itemised and discussed in section 4.9 below. The next subsection discusses the legislative arm of government.

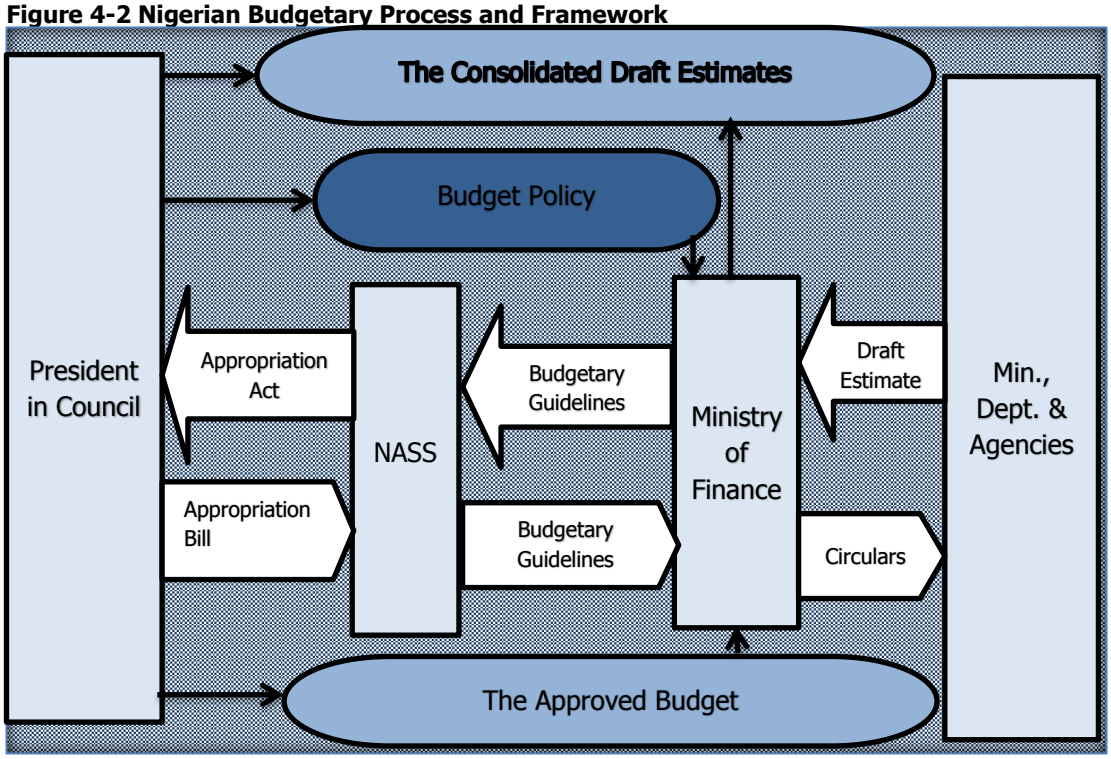
4.4.2 Legislative Arm of Government: The National Assembly

The legislative arm of government comprises of the Senate[29] and the House of Representatives[30]. These groups of elected officials formed the National Assembly (NASS). Contrary to the executive arm of government, the legislative arm of government is statutorily saddled with the responsibility of enacting laws, deliberating and approving the national yearly budget and making national public

[28] FEC comprises of all the appointees of the President such as Secretary to the Government of the Federation, Cabinet Ministers and Advisers.
[29] Each of the 36 states in Nigeria is represented by three senators and plus one from the Federal Capital Territory making 109.
[30] The House of representative is made of 360 members elected from the 36 States, each State having handful of members depending on the population and number of local Government Councils.

policies amongst others. Moreover, the NASS oversee the activities of the executives on any matter stated in the exclusive legislative list -economy, account and finance, trade and others. The substances of these powers are to provide stability, check, balances, and good governance. The Nigerian budget is prepared through a series of processes before metamorphosing into a legal document and an economic instrument.

Figure 4-2 Nigerian Budgetary Process and Framework



Sources: Adams, 2013

Figure 4.2 shows the diagrammatic presentation of the Nigerian budgetary framework. The President and its executive council formulate the policies in which the budget is prepared and forwarded to the Ministry of Finance. This Ministry issues a circular to all Ministries and Departments to submit their draft estimates. The Ministry of Finance will now prepare the consolidated draft estimates and submit to the Federal Executive Council (FEC). The President will now forward it to the National Assembly as an Appropriation Bill. Subsequently, the National Assembly will liaise with all the Ministries and Departments to depend their budgets. Thereafter, they will deliberate on the budgets, pass it as an appropriation act, and submit it to the president for his assent. The President will

append his/her signature on it, which then becomes the budget for the year. Subsequently, the executive arm of government will then execute the budget. Despite the existence of proper budgetary mechanism enumerated above, there are still problems[31] associated with budget formulation and implementation in Nigeria. The next section discusses oil and gas activities and the various oil and gas export destinations.

4.5 Hydrocarbon Activities in Nigeria and Exports Destinations

4.5.1 An Overview of Oil and Gas Activities in Nigeria

Generally, oil and gas operations is classified into upstream, mid-stream and downstream. In Nigeria, however, the mid-stream is apparently not in existence. Thus, upstream operation involves finding and producing crude oil and gas up to the initial point capable of being used or sold (Rebecca and Gallun, 2008). It is further divided into onshore (land) and offshore (water) upstream activities. An onshore upstream activity involves carrying out crude oil and gas exploration on land surface area, whereas offshore deal with crude oil and gas exploration operations in a sea area. The downstream activities mostly involved refining, marketing and the distribution of petroleum product to final consumer.

In Nigeria, upstream oil and gas operation is dominated by the Multinational Oil Companies (MNOCs). The exploration of oil and gas operations are executed through joint venture agreement between the Multinational Oil Companies and the Nigerian National Oil Corporation (NNPC) where the latter serves as a non-

[31] For instance, in the 2016 budget, the National Assembly uncovered avoidable errors during the budget defence session where some Ministers could not defend the contents of their budget and others disclaim their Ministries' budgets. Furthermore, several expenditures were identified amounting to billions of Naira that ought to have been included in the budget but were missing (Centre for Social Justice, 2016). These revelations prompted the President to sack and redeploy some senior public officers in the budget office and gave an order to display the budget at the public domain for in-depth scrutiny. On the one hand, the National Assembly have been criticising the executive arm of government for presenting incorrect budget proposal and low budget performance (National Assembly, 2010; 2014; and 2016; Leadership Newspaper, 2016). On the other hand, the executive arm is claiming otherwise. At the end of the 2016 budget crisis, the Chairman of the budget Committee of the House of Representatives revealed that the leadership of the NASS were responsible for the budget padding.

operator[32] and the former as operator[33]. In addition, production sharing contracts and service contracts are employed by the Nigerian government to maximise rent seeking potentials. However, Multi National Oil Companies have dominated Nigerian oil industry due to their technical and financial advantage (see dependency theory in chapter five). The indigenous upstream companies mostly operate marginal oil fields due to their weak technical and financial base. In the downstream sector, independent oil companies both local and international partake in various aspects of petroleum activities (specifically, marketing and distribution of petroleum products). Moreover, several divisions of government agencies such as the Nigerian National Petroleum Corporation (NNPC) and Department of Petroleum Resources (DPR) are directly or otherwise involved in both upstream and downstream oil and gas operations.

4.5.2 Nigerian Oil and Gas Exports Destination

Nigeria exports its crude oil and gas to most of the countries in all the continents of the world (Nigerian National Petroleum Corporation, ASB, 2014). It is argued that most net energy importing countries prefer Nigerian oil and gas compared with other countries due to the following reasons: Firstly, Nigerian crude has high quality, low sulphur content and very popular in net energy importing countries and could easily process into petroleum products. Secondly, the country's geographical location, which has connections to the major international oil trade chokepoints such as Bab el-Mandab and Strait of Hormuz (Asian energy markets), Panama Canal (U.S and Southern America) and Danish Straits (Europe). Finally, the cost of oil production per barrel is relatively low compared to other oil and gas producing countries. For instance, the production cost per barrel in Nigeria is $30/bbl and $15/bbl for deep offshore and onshore respectively (Nigerian Extractive Industries Transparency Initiative, 2013). Conversely, it costs around $40 to produce one barrel of oil in Angola.

[32] This party usually participates in the Joint Venture by contributing what is called "cash call" annually in financing the oil and gas exploration.
[33] This party provides both the technical expertise and the cash of the exploration activities.

The current major destination of Nigerian oil and gas export is Europe, currently accounting for 46% of our total oil and gas exports (Nigerian National Petroleum Corporation (NNPC), 2014). Before the discovery and production of shale oil in US, Europe has been the second major destination of Nigerian oil and gas export with about 28% in 1997 (Nigerian National Petroleum Corporation, ASB, 1997). However, in 2007, Nigerian crude oil and gas exports to Europe declined to 15% (Nigerian National Petroleum Corporation ASB, 2007). Subsequently, while the oil and gas exports to U.S is showing dramatic decrease on the one hand, the export to Europe has increased tremendously to 43% in 2014 (Nigerian National Petroleum Corporation ASB, 2014). This development has made Europe to be the leading oil and gas export destination for Nigeria. However, this ranking of Europe as Nigerian major oil and gas exports destination may change in the near future. This is because Europe has made huge investment in renewable energy that is about to be matured. Moreover, it has been envisioned that by the year 2040, renewable energy will supply 50% of Europe's total energy demand (European Renewable Energy Council, 2004). Moreover, Europe has make strong commitment towards reduction of carbon related energy sources to attain energy security and environmental sustainability.

As mentioned earlier, the USA has seized to be the major destination of Nigerian both crude oil and gas due to discovery of shale oil and gas. The percentage of Nigerian oil and gas exports to the US has significantly reduced from 42% in 1997 to 3% in 2014 (Nigerian National Petroleum Corporation ASB, 1997; 2014). Mănescu and Nuño (2015) concludes that, the shale oil revolution has caused global supply shocks, which resulted to oil price crash that negatively affected oil and gas exports volume revenue of most net energy exporting countries. However, Salameh (2013) opined that, US shale oil and gas production would barely make any significant future impact on OPEC oil and gas supplies because there are not environmentally and economically viable. Similarly, the author argues that the expected supply from US shale oil would mainly compensate their decrease in conventional oil production; thereby making US to continue to be dependent on oil imports in the near future.

Similarly, the Asian Continents led by China and India are the second major destinations of Nigerian oil and gas exports, accounting for 19% of Nigerian total oil and gas exports (NNPC, ASB 2014). The percentage of oil and gas exports to Asia has been relatively the same since 1997, only with significant fluctuations in 2007, which declined to 13%. For instance, between 2002 and 2013, with the exception of 2007, Nigerian oil and gas exports were 23% and 20% respectively (Nigerian National Petroleum Corporation ASB, 2013).

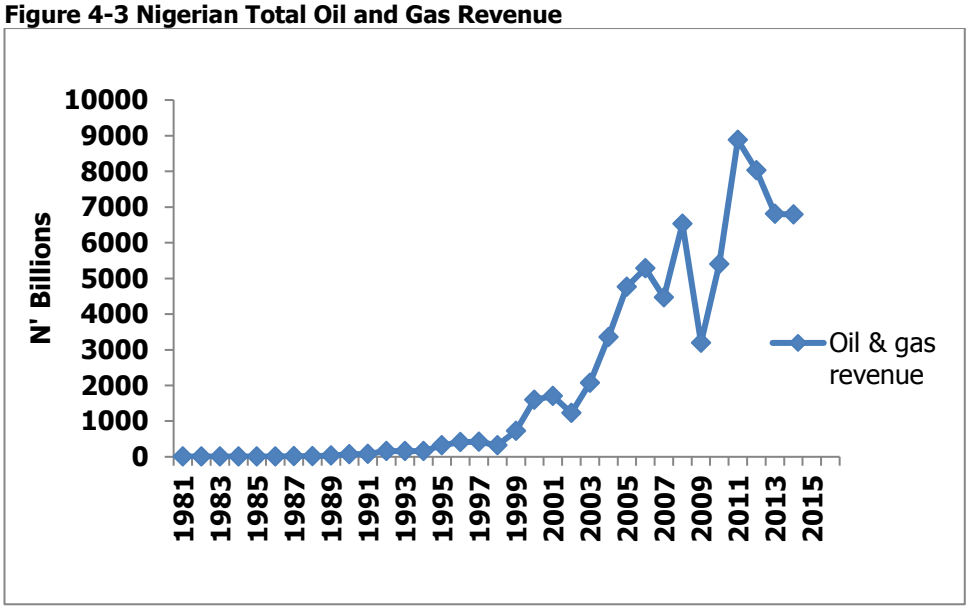
Also, African countries led by South Africa has been a destination for Nigerian oil and gas exports, accounting for 3% of total Nigerian oil and gas exports. Therefore, Asia and Africa could be the only continents that Nigeria may depend on for its oil and gas export destinations. As both continents have less commitment towards the development of renewable energy compared with developed and emerging countries. While other continents especially North America and Europe are transiting to shale oil and gas and renewable energy respectively, Asia and Africa may be a potential market for Nigerian oil and gas exports. However, other net energy exporting countries will also be willing to exports their oil and gas to these destinations.

When this happens, the international energy market will experience a supply glut and this will inevitably result to oil price crash (law of demand and supply). The reduction of oil price and export volume could cause a significant fall in oil and gas revenue of most net energy exporting countries including Nigeria. This may significantly affect the Nigerian annual budget, which is the cornerstone of the government's development path. Oil and gas revenue accruing to Nigeria comes from different sources, thus, it might be important to discuss these sources.

4.6 Nigeria's Oil and Gas Revenue Sources

The literature has shown the various categories of oil and gas revenue accruing to the net energy exporting countries. Nigeria as a net energy exporting country has benefited immensely from oil and gas revenue sources since the discovery of oil in the year 1956. Figure 4.3 below shows Nigerian total oil and gas revenue realised from 1981-2014.

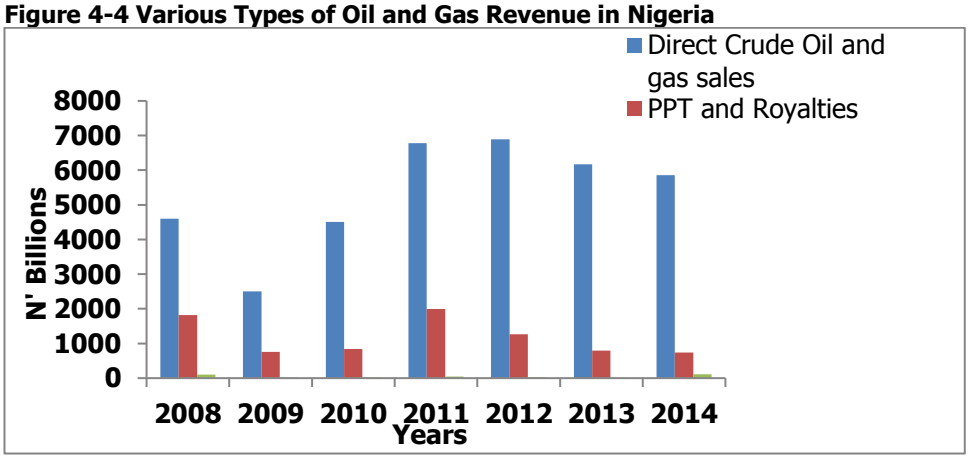
Figure 4-3 Nigerian Total Oil and Gas Revenue



Source: CBN, 2015

The total oil and gas revenue shown in Figure 4.3 comprises of direct oil and gas sales, petroleum profit tax (PPT), royalties, and bonuses. The summary of the various types of oil and gas revenue are shown in Figure 4.4 below, and subsequently explained.

Figure 4-4 Various Types of Oil and Gas Revenue in Nigeria



Source: CBN, 2015

4.6.1 Direct Crude Oil and Gas Sales Revenue

As shown in Figure 4.4, revenue realised from direct oil and gas exports sales constitutes the major share of Nigerian total oil and gas revenue. For instance, the inflows from direct crude oil and gas sales represent about 76.6%, 70.65% and 65.54% of the total oil and gas revenue for the year 2012, 2013 and 2014

respectively (Central Bank of Nigeria, 2016). Subsequently, the revenue from crude oil and gas sales accrues directly to the Federation Account.

The share of Nigerian direct oil and gas sales revenue has been continuously increasing, reaching a peak in 2012, accounting for 76.6% of total oil and gas revenue. However, it began to decline, reaching a lowest level in 2014, accounting for 65.54% of total oil and gas revenue. Moreover, a further decline in the projected contribution of the direct oil and gas sales are anticipated to be 42%, 43% and 40% in 2015, 2016 and 2017 respectively (Budget Office of the Federation, 2015). Apart from revenue from oil and gas exports, the Nigerian government receives other oil and gas export related incomes, which are discussed in the next subsections.

4.6.2 Petroleum Profit Tax and Royalties

Nigeria receives Petroleum Profit Tax (PPT) and Royalty payment from the Multinational Oil Companies (MNCOs) as stipulated under the Petroleum Profit Tax of 1959 as amended by the Petroleum Profit Tax Act (PPTA) of 2007. In addition, it is regulated under the Petroleum Act 1969, as amended in 1995. On the one hand, PPT is levied on the income of companies engaged in upstream petroleum operation. The rate is 85% for Joint Ventures (JVs) and 50% for Production Sharing Contracts (PSC) (PPTA, 2007). This major source of oil and gas revenue is associated with rents, royalties, margins and profit sharing components related to upstream operations. PPT constitutes a significant proportion of oil revenue sources apart from direct crude oil and gas sales.

Conversely, royalties are payment of any kind as a consideration for the right to use resources (petroleum, minerals), intellectual property of another or patent rights. In respect to petroleum taxes, royalties are levied on gross revenue less: evaporation losses, reinjected and production used for operation (Energy Sector Management Assistance Programme, 2004). The royalty as revenue depends on the rates, water depth, nature of the contractual agreement and as well as the location of the exploration. Tables 4.2 and 4.3 below give a summary of the royalty rates under PSC and JV as source of oil and gas revenue in Nigeria.

Specifically, the summary of the royalty rates under the Joint Venture (JV) contract for both oil and gas are presented in Table 4.2. Similarly, Table 4.3 provides the summary of the royalty rates applicable under the Production Sharing Contract (PSC). However, under the PSC arrangement, there is no royalty on gas production. Subsequently, signature bonuses are also other sources of oil and gas revenues, which are discussed immediately after Table 4.3 below.

Table 4-2 Royalty Rates Applicable to JV Contracts in Nigeria

	Royalty Rate % Onshore		Royalty Rate % Offshore	
Water Depth (Meters)	Oil	Gas	Oil	Gas
Up to 100	20.0	7.0	18.50	5.0
101-200	20.0	7.0	16.50	5.0
201-500	20.0	7.0	12.50	5.0
501-800	20.0	7.0	8.00	5.0
801-1000	20.0	7.0	4.00	5.0
Over 1000	20.0	7.0	0.00	5.0

Source: ESMAP, 2004

Table 4-3 Royalty Rates Applicable to PSCs in Nigeria

Water Depth (Meters)	Royalty Rate % Onshore	Royalty Rate % Offshore
0-200	10.0	10.0
200-500	10.0	12.0
500-800	10.0	8.0
800-1,000	10.0	4.0
Over 1,000	10.0	0.0

Source: ESMAP, 2004

4.6.3 Other Oil and Gas Revenue: Signature Bonuses

In accordance with the type of fiscal regime, the Nigerian government receives other oil and gas revenues in the form of signature and production bonuses. Signature bonuses are pre-discovery and production payments paid by the MNOCs, which arise because of production sharing contracts (PSC) and service contracts (Omorogbe, 2005; Kyari, 2012). Similarly, it is a one-off payment made upon completion of negotiations and signing of the contract between the host government and the MNOCs. On the other hand, production bonuses are paid to the federal government when production output from a given contract area reaches a specified threshold. One major distinction between a signature bonus

and production bonus is that the latter is a continued payment that is dependent on a production sliding scale. A summary of bonuses relevant to offshore and onshore fields in Nigeria is presented in Table 4.4.

Table 4-4 Bonuses Payable in Nigerian Upstream Sector

Bonus Type	**Off-shore**		**On-shore**
	Water Depth (<200m)	Water Depth (>200m)	
Signature Bonus:	$1 million	$5million	$1million
Production Bonuses: 10Mbd 50Mbd	 $2million $4million	 - $5million	 $1million $2million

Source: ESMAP, 2004

Based on Table 4.4, the Nigerian government generates oil and gas revenue in terms of bonuses from both offshore and onshore oil and gas production. However, the amount of the bonuses varies with water depth and type of the bonus. Thus, all generated revenue by the government in the form of bonuses, royalty, oil export revenue and the non-oil revenues accrue to an account called the federation account. The next subsection shall discuss the various accounts used in lodging the oil and gas revenue and the basis of revenue distribution.

4.7 Various Revenue Accounts and the Basis of Distribution

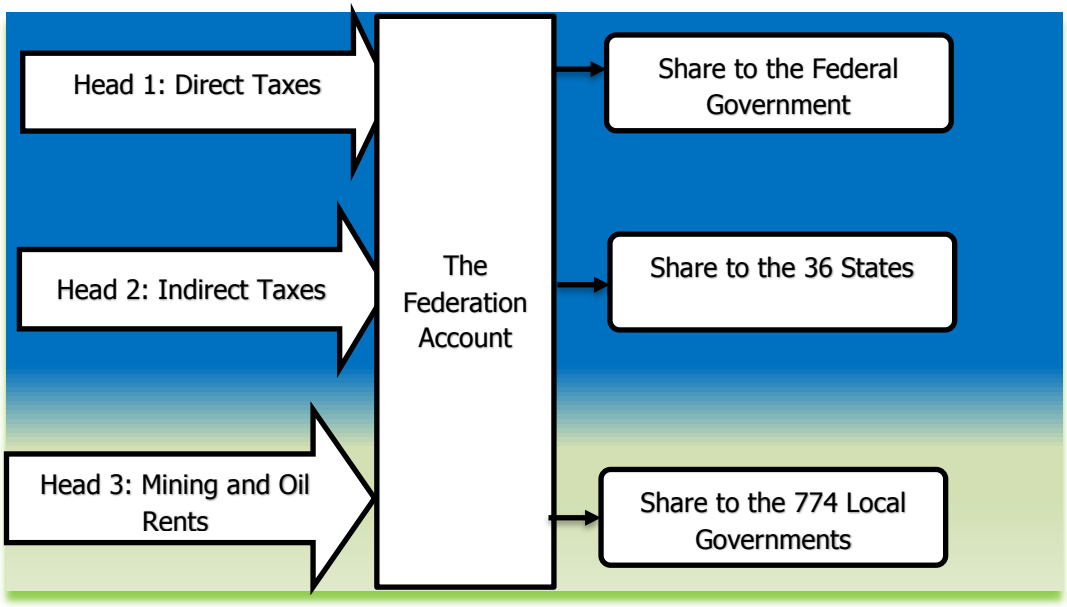
4.7.1 Federation Account

Section 162 (1) of the 1999 constitution of the Federal Republic of Nigeria as amended established the federation account which stipulates that into this account shall be paid all revenue[34] collected by the government of the federation. The sources of revenues payable to the Federation Account comprises of direct and indirect taxes as well as mining (royalty, fees, oil and export sales). Thus, oil and gas export revenue, royalty and bonuses arising from oil and gas production

[34] These includes the proceeds from the PAYE of the personnel of the Armed Forces of the Federation, the Nigeria Police Force, Foreign Service Officers and residents of the Federal Capital Territory, Abuja.

and export and other non-oil revenue are directly deposited into the Federation Account is shown in Figure 4.5.

Figure 4-5 Various Sources of Revenue that goes into the Federation Account



Source: Adams, 2013.

As shown in Figure 4.5, the Federation Account represent revenue pools within which allocations are made to the three tiers government: the federal, states[35] and local governments[36] base on terms and in a manner defined by law. Section 162(2) of the 1999 Constitution empowers the National Assembly to determine the formula for the distribution of funds in the Federation Account. Specifically, the above section states:

> "The President, upon the receipt of advice from the Revenue Mobilisation Allocation and Fiscal Commission, shall table before the National Assembly proposals for revenue allocation from the Federation Account, and in determining the formula, the National Assembly shall take into account, the allocation principles especially those of population, equality of States, internal revenue generation, land mass, terrain as well as population density.

Similarly, Section 149(2) provides that "any amount standing to the credit of the Federation Account shall be distributed among the federal and state

[35] Nigeria has 36 states plus the Federal Capital Territory (FCT), 37.
[36] There are 774 Local Government Areas

governments, and the local government councils in each state, on such terms and in such manner as may be prescribed by the National Assembly". The current revenue sharing formula is presented in Table 4.5 below.

Table 4-5 Nigerian Current Revenue Sharing Formulae

Beneficiary	% of share
Federal Government	48.5
State Governments	24.0
Local Governments	20.0
Special Funds	7.5

Source: Nigerian Constitution, 1999.

However, the actual oil and gas revenue accruing to the federation accounts may at times differ with the budgeted oil and gas revenue. This is because the budgeted revenue, as mentioned earlier, is based on budgeted oil benchmark price, budgeted production volume and exchange rate. At the end of the period, the actual oil and gas export revenue may vary with the budgeted oil and gas revenue. Because of the conservative approach employed in establishing the budgeted variable(s), the actual oil and gas revenue, most of the times, happen to be greater than the budgeted oil and gas revenue. This results to excess of actual over budgeted oil and gas revenue and vice-versa. When excesses are recorded, they are transferred to the then Excess Crude Savings Account (ECSA) and presently, to the Nigeria Sovereign Investment Authority (NSIA) which will be discussed in the next subsection.

4.7.2 Excess Crude Savings Account

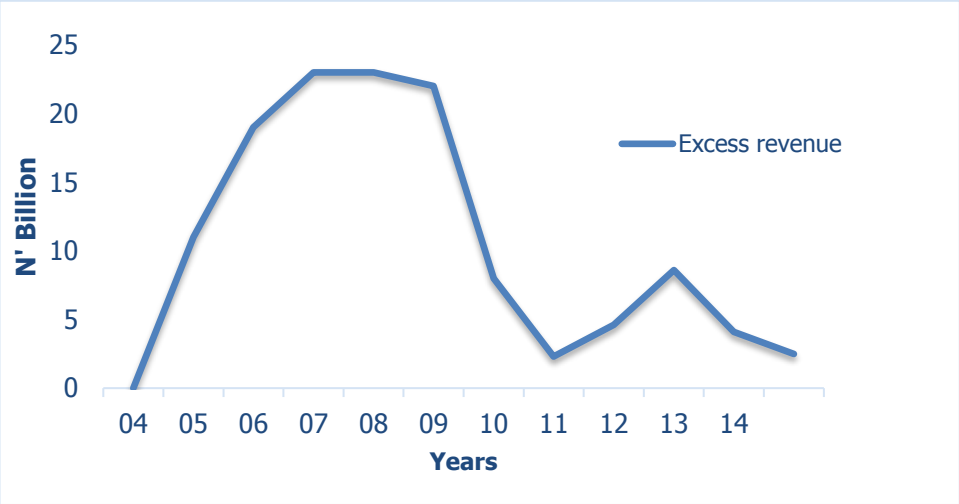
Excess Crude Savings Account (ECSA[37]) was established in 2004 by the president at that time, Olusegun Obasanjo, and it is synonymous with the Economic Stabilisation Fund established by President Shehu Shagari in 1982 (Adams, 2013). The International Monetary Fund (IMF) as a fiscal reforms package supported the establishment of ECSA (KPMG Africa Report, 2013). The purpose of this account is to provide buffer savings to smoothen government finance and the budget. The Fiscal Responsibility Act, 2007 has made clear provision on the

[37] It is made of two components namely: Foreign Excess Crude Savings Account (FECSA) and Domestic Excess Crude Savings Account (DECSA).

operations of the ECSA. It is designed that all revenue realised from selling oil and gas at a price higher than the budgeted be saved in the account. The Central Bank of Nigeria is statutorily mandated to invest the savings in the account on behalf of the three tiers of government. Thus, the Federal and State Governments jointly manage the ECSA. Moreover, the account was governed by the benchmark oil price rule.

Withdrawal in the account is permitted only when oil price falls lower than the bench marked threshold for three consecutive months. However, the three tiers of government may decide to share a part of the savings for executing capital projects based on the existing sharing formula (see Table 4.5). Similarly, from time to time, the government makes petroleum subsidy payments from the ECSA. However, the present government has removed the petroleum subsidy in view of the dwindling oil price and oil and gas exports volume. The summary of the ECSA from 2004-2014 is shown in Figure 4.6 below.

Figure 4-6 Balances of Nigerian Excess Crude Oil Account from 2004-2014



Source: National Bureau of Statistics, 2015.

From Table 4.6 above, it can be observed that the highest excess revenue that accrued to the account was $22 billion in 2008 (National Bureau of Statistics, 2010). However, in 2009, the balance reduced dramatically by 64%. The reduction is attributable to the landmark contribution of the account in providing stimulus package that saved the Nigerian economy against the global economic

crisis as at that period (World Bank Report, 2013). However, the account was converted into Nigeria Sovereign Investment Authority (NSIA)[38].

4.7.3 The Nigeria Sovereign Investment Authority

The Nigeria Sovereign Investment Authority (NSIA) came into existence in May 2011 by an Act of the Parliament and became operational in 2012. The Act empowered the NSIA to receive and manage the money previously paid into ECSA. The NSIA is composed of three distinct funds: future generations' funds, the Nigeria infrastructure fund and the stabilisation fund. The Fund primarily helps to reduce budget deficits, fund domestic infrastructures, and diversify the country's income so that it can positively respond to revenue shocks as well as provide for future generations. The NSIA is funded on a monthly basis, with the part of the oil and gas revenue above the budgeted revenue approved by the National Assembly. However, since the dramatic fall in oil price, there has been no savings into the funds.

Compared with other oil and gas producing countries, the NSIA appeared to be among the most recent. However, Ghana is yet to establish their SWF. Kuwait was the first net energy exporting country to establish the Sovereign Wealth Fund (SWF) in 1953. Subsequently, UAE, Saudi Arabia established their own in 1976 and 1978 respectively. Libya, with the highest oil and gas reserve in Africa established its Sovereign Wealth Fund (SWF) in 2006 (KPMG Africa Report, 2013). As at 2008, UAE has the world largest SWF accounting for 27% of the total SWF assets (Balin, 2009). Net energy exporting countries with the least SWF includes Azerbaijan, Nigeria, Iran and Angola. However, international observers have criticised SWF in several ways.

Balin (2009) argues that most of the SWF lack congruence with national fiscal policy objectives. Secondly, most economists are of the view that it is better to

[38] Law did not underpin the former ECSA but a mere political arrangement reached between the three tiers of government. Thus, the state governors declared the illegality of the account and headed to the supreme for verdict. The Supreme Court decided that the account is illegal and quoted that all revenue be paid to the federation account for onward distribution (Section 149(2) of the 1999 Constitution of the Federal Republic of Nigeria).

invest now and diversify a country's economic base to safeguard against future revenue shocks than to create an endowment fund to rebuild the economy after the shocks. Finally, there is a high level of secrecy and lack of accountability associated with managing SWFs globally. The next section will discuss oil and gas exports revenue and the Nigerian budget.

4.8 Oil Exports Revenue and Nigerian Budget

As explained earlier, Nigeria as an oil dependent economy has benefited enormously in terms of oil and gas exports revenue (El Anashasy and Bradley, 2012). On the one hand, substantial percentage of these oil revenues were used in financing Nigeria's annual budget. On the other hand, declining revenue arising from low oil and exports demand and price translates into budget deficit (Bruno and Sachs, 1982). However, empirical and theoretical studies have shown fluctuations in oil and gas exports revenues are caused mostly by oil price fluctuations.

This is evident following the dramatic collapse in oil price in early 2015. Global Business Report (2014) attributed the fall in price due to demand and supply imbalance. However, in terms of oil and gas exports, changes in quantities of oil and gas demanded have been relatively insignificant, this could be because of the homogeneity conventional energy has enjoyed over the years. However, with the concerted efforts made by net energy importing countries to attain energy security, economic and environmental sustainability via the development of renewable energy sources. Perhaps it could be difficult for oil and gas to maintain its position as a homogeneous product. This is expected to not only affect oil and gas export volume in net energy exporting countries but also Foreign Direct Investment (FDI) into their petroleum sector.

Nigerian oil and gas sector is the major sectors that attract FDI investment into Nigeria (Donwa, Mgbame and Ezeani, 2015), which influences oil and gas production and exports revenue. However, Nigeria has been experiencing a declining trend in FDI flow despite its natural resource base and large market size, (World Bank, 2014; United Nations Conference on Trade and Development,

2015). This suggests that when there is a decline in oil price, FDI, future oil and gas production, exports volume and revenue may be negatively affected. The decline in oil price, and FDI generally attributed to the gradual energy transition away from conventional energy sources by NEICs, has impaired global oil and gas consumption (Internal Energy Agency, 2016).

For instance, in 1973, conventional energy (fossil fuels) accounted for 62% of world total primary energy supply while non-fossil fuels contributed only 12% (International Energy Agency, 2012). Since then, the contribution of non-fossil fuels as an alternative energy has been rising steadily. For instance, between 1973 and 2010, the share of fossil fuel in the world total energy supply declined from 62% to 54% while that of non-fossil fuels rose from 12% to 13%. According to the International Energy Agency statistics (IEA, 2015), non-fossil fuels account for about 19% of the total global primary energy supply. However, it is expected to account for 25% and 70% by 2040 and 2100 respectively, making net energy importing countries much less dependent on imported energy from countries such as Nigeria (International Energy Agency, 2015; Organisation of the Petroleum Exporting Countries, 2014).

Thus, with anticipated dislodgment of oil and gas as the dominant global primary energy source may further results to oil and gas revenue uncertainties due to absence of sustainable revenue alternatives in Nigeria. The budget has been persistently in deficit, thereby financed with both internal and external loans. However, Nigeria has been continuously attempting to delink its economy from oil revenue dependence since the mid-eighties. The objective is to put the country on a sustainable revenue platform to safeguard the economy against external vulnerabilities and shock of oil related volatilities.

However, the aim is far from becoming a reality due to the global energy transition driven by energy security concerns, economic and environmental sustainability in net energy importing countries. Thus, the influence of oil and gas revenues in the Nigerian annual budget is distinctive and far reaching in scope (Ayadi, 2005). Hence, fluctuations in oil and gas revenue have serious

implications in setting and achieving macro-financial objectives of Nigerian government in terms of budget implementation and performance. It appears that public policy and decision makers in Nigeria have not proposed a robust strategic plan to mitigate this economic challenge arising from global energy transition. Therefore, this study intends to recommend strategic plan to public policy and decision makers in Nigeria on how to address the impact of the global energy transition. The next subsection gives the projected government revenue expected from oil and gas.

4.8.1 Projected Government Revenue from Oil and Gas

The executive arm of government in collaboration with the legislative branch develops the MTEF and Fiscal Strategy Paper to make revenue projections for three years. Table 4.6 below were extracted from the 2014-2016 MTEF/FSP.

Table 4-6 Nigerian Fiscal Frameworks 2014-2016 (Extract)

Years (Projection)	Oil Production/ Export (mb/d)[39]	Average Budgeted Oil Price Per Barrel US $	Average Exchange Rate 1$ to Naira	Gross Oil Revenue[40] (Billion N)	Gross Non-oil Revenue (Billion N)
2014	2,3883	74	160	6,814.43	3,288.58
2015	2,5007	75	160	7,137.740	3,488.651
2016	2,5497	76	160	7,213.038	3,743.284

Source: MTEF/FSP, 2013.

As shown in Table 4.6 above, the government is expecting to increase their generated revenue from oil and gas during the period 2014-2016. For example, it is projected that about 67% of Nigerian projected government revenue for 2015 will be realised from the oil and gas sector; while 65% for the 2016 fiscal year. However, these figures were reviewed and several adjustments are made to key parameters due to the recent developments in the global energy markets. The revised fiscal framework is shown in Table 4.7 below.

[39] Million barrels per day

[40] The gross oil revenue comprises of crude oil and gas exports sales, royalties, taxes, gas flared penalties, concessional penalties and other oil, and gas related revenues. This applies to Table 4.7 and 4.8.

Table 4-7 Nigerian Revised Fiscal Frameworks 2015-2017 (Extract)

Years (Projection)	Oil Production/ Exports (mb/d)	Average Budgeted Oil Price Per Barrel US $	Average Exchange Rate 1$ to Naira	Gross Oil Revenue (Trillion N)	Gross Non-Oil Revenue (Trillion N)
2015	2,278.20	52	190	6365.8	3539.07
2016	2,327.10	55	190	6,497.45	3,787.30
2017	2,406.70	55	190	6,847.52	4,018.04

Source: MTEF/FSP, 2014

Table 4.7 above provided the projected revenue from oil and gas for the period of 2015-2017. Thus, it is projected that about 64% of Nigerian projected government revenue for 2015 will be realised from the oil and gas sector; while this is the case for 60% in the 2016 and 2017 fiscal years. However, the dramatic fall in oil and gas price and exports volume in the last quarter of 2015 plunged the nation to severe financial crisis. The projections made in the 2015-2017 MTEF/FSP became unattainable. The net financial and economic impact caused by the oil and gas price and exports shock forced the government of the day to resort to borrowings in order to balance its short-term obligations (wages and salaries) (Daily trust Newspaper, 2015). However, upon commencement of the new government in May 2015, the current President and the NASS reviewed the MTEF/FSP 2016-2017 and reproduced the MTEF/FSP 2016-2018 in accordance with current economic realities, as shown in Table 4.8

Table 4-8 Nigerian Re-Revised Fiscal Frameworks 2016-2018 (Extract)

Years (Projection)	Oil Production/ Export (mb/d)	Average Budgeted Oil Price Per Barrel US $	Average Exchange Rate 1$ to Naira	Gross Oil Revenue (Trillion N)	Gross Non-Oil Revenue (Trillion N)
2016	2,200.00	38	197	6365.8	3539.07
2017	2,347.00	48	290	6,497.45	3,787.30
2018	2,469.00	56	290	6,847.52	4,018.04

Similarly, Table 4.8 above provided the projected revenue from oil and gas for the period of 2016-2018. Despite the assertion made by the Budget Office that the economic development in other countries are factored in the MTEF/FSP, the impact of the oil price is becoming much greater. It can be observed that the continued oil price and exports decline has caused over 70% reduction in oil and

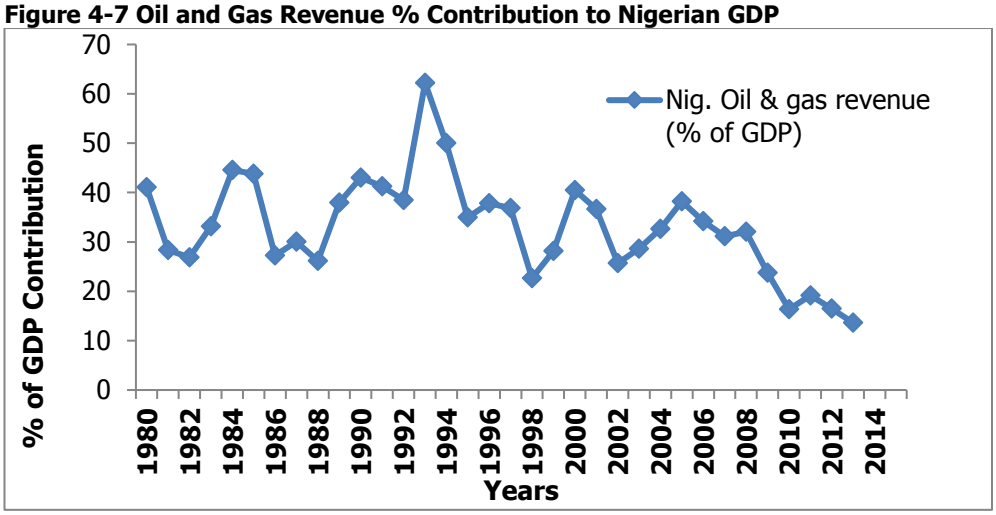
gas revenue. Based on economic and energy expert's projections, oil price and exports, driven by supply and demand side effects, will continue to fall. Thus, with the commitment made by NEICs to decarbonise their economy and increase renewable energy development over the course of this century, Nigeria may experience more reduction in oil and gas revenue in the future.

The former President Shehu Shagari in his message to the United Nations Nairobi Conference on New and Renewable Sources of Energy have foretold the present revenue crisis facing the nation in 1981 as:

> "…. for us developing countries……. now have an opportunity to take action before stumbling into a fossil fuel trap" (United Nations 1981 p.86).

This statement was made over three decades ago. Now, Nigeria is trapped by the dependence on oil revenue. The currently available statistics from the Central Bank of Nigeria (2015) shows that oil and gas revenue accounts for 67% of total government revenue used in financing the entire annual budget for the country. According to the Nigerian National Assembly report (2015), Nigeria has the lowest share of GDP contribution of non-oil and gas revenue in net energy exporting countries. This suggests the dominance of the oil revenue in the Nigerian revenue mix and the economy. However, recent World Bank statistics indicate that the Nigerian oil and gas revenue percentage of GDP has decreased considerably. Figure 4.7 below shows the oil and gas revenue contribution to Nigerian GDP.

Figure 4-7 Oil and Gas Revenue % Contribution to Nigerian GDP



Source: World Bank Indicators, 2015.

As shown in Figure 4.7, the oil and gas revenue contribution to Nigerian GDP has been declining since the year 2004. Presently, it accounts for only about 12%. However, in the year 1994, oil and gas revenue contribution to Nigerian GDP was over 62%. The fall in oil revenue due to the fluctuation in oil price, exports volume significantly affects both budgeted and actual revenue. Myers and Manning (2000) posits that most net energy exporting countries (NEECs) had been affected by oil price volatility, financial crisis and other related factors as a result of their high dependence on oil revenue. This is evident now, where Nigerian oil and gas revenue has drastically reduced, as shown in Figure 4.3. Similarly, this scenario was also evident during the 1997-1998 Asian financial crises where NEECs such as Nigeria faced a decline of about 50% in their oil revenues (Umbach, 2010). However, the negative impact of oil revenue dependence could not only be attributed to Nigeria alone, rather it is a mark synonymous with most resource-rich countries. As stated by Budina and Wijnbergen (2008), countries such as Nigeria are characterised by slow economic growth, de-industrialization; low savings, lagging human and physical capital accumulation, and stagnating or declining productivity despite numerous potentials that exist within their borders.

In the past, however, the Nigerian basic economic structure was consistent with that of non-resource dependent economies. Public policy and decision makers use the renewable based income as an impetus to sustain government activities

and the investment needed for growth and development. However, since the discovery of oil, Nigeria abandoned the non-oil and gas sector and glued to the exhaustible oil and gas revenue. With the persistent level of global energy transition from oil to other energy sources, substantial reliance on oil revenue has caused significant revenue fluctuation and gaps in Nigeria. To further understand the impact of the oil and gas revenue on the Nigerian annual budget, the next subsection is devoted to this issue.

4.8.2 Impact of Oil Revenue on Nigerian Budget

Ogbonna and Ebimobowei (2012) argue that despite the enormous revenue potentials that exist in the country, the decline in oil and gas revenue has caused significant effect on the total government revenue. The fluctuation in the oil and gas revenue has affected not only capital expenditure but also recurrent expenditures. This is largely attributed to the dramatic fall in oil price and reduction in oil and gas exports volume. More importantly, there is no buffer reserve to cushion the shock of the fluctuations in the key revenue variables. The previous Minister of Finance disclosed that the government has to borrow in order to execute day-to-day government activities including the payment of salaries. This has inevitably plunged the country back to the huge debt era where previous regimes succeeded in paying significant part of the debt in 2006. Economic and financial analysts argued that this development is unhealthy to Nigeria's economic growth and development. This may be due to Nigerian significant dependence on oil and gas revenue to finance its budget.

Numerous studies have shown that Nigeria runs a mono cultural economy with over dependence on crude oil and gas export revenue since 1970 (Aigbedion and Iyayi, 2007; Odularo, 2008; Ibrahim, 2008; Anthonsen et. al, 2012). According to Odularo (2008), oil and gas exports to developed net energy importing countries have positively contributed to the improvement in Nigerian total revenue on the one hand. However, the improvement in government revenue has ruined the non-oil and gas sectors on the other hand. As explained by Luqman and Lawal (2011) that Nigerian oil and gas resources had marginal

positive impact on socio-economic development of the citizens when compared to the actual oil and revenue realised. Similarly, Ibrahim (2008) and Anthonsen et al, (2012) argue that Nigerian oil and gas dependency had caused significant negative effects on transparency, service delivery and has undermines technological progress and crippled the revenue earning potential of the non-oil and gas sector of the economy.

On the one hand, oil price is declining at an alarming rate. On the other hand, Nigerian oil and gas exports to NEICs are reducing, largely due to global energy transition. For instance, the US has transited to non-conventional energy sources and that has significantly affected Nigerian oil and gas export and revenue (Central Bank of Nigeria, 2013). The European countries are transiting to renewable energy sources. Similarly, emerging and developing NEICs countries, supported by the developed countries through the Kyoto Protocol's Clean Development Mechanism, are keying in to the global agenda to invest in clean energy sources (Polidano et al., 2000). Thus, the transition from oil and gas to renewable energy and carbon emissions reduction may affect Nigerian budgeted and actual oil and gas export revenue.

This raises research question two below.

> **Q2:** What are the perceptions of public decision and policy makers in MDAs and other stakeholders about the impact of the global energy transition on Nigerian oil and gas revenue, budgets and plans to mitigate these impacts?

In regards to the above questions, the researcher has identified and selected public policy and decision makers and other stakeholders in Nigeria to undertake semi-structured interviews with them. The next section discusses some of the identified stakeholders that represent the government in the study interviews.

4.9 Stakeholders Representing Government in the Interviews

4.9.1 Chosen MDAs under the Executive Arm

As mentioned earlier in section 4.4, senior public policy and decision makers assigned with executing economic and financial policies of government were selected for the interviews. These interviewees were from different ministries, parastatals and agencies (MDAs) and their perceptions were sought in order to support the quantitative findings and solicit for further insights into the impact of the global energy transition and plans to mitigate these impacts (see chapter six and eight for details). Below gives detailed explanation of the statutory functions of each of these MDAs chosen as representative of the executive arm of government.

1. The Ministry of Finance is primarily responsible for the control and Management of public finance of Nigeria. Other functions of the Federal Ministry of Finance (MOF) include monitoring government revenue arising from oil and non-oil resources; managing revenue allocation matters; preparing annual estimates of revenue and expenditure for government; as well as formulating policies on fiscal and monetary matters amongst others. The researcher raised the interview questions that directly relate to the participant's routine functions, responsibilities and duties as specified in their organisation's statutory mandates.

2. The Budget Office of the Federation is under the Ministry of Finance and was established to provide budgetary functions, ensure budget and fiscal policies of government are implemented. The researcher selected participants from three departments namely: fiscal policy, revenue and budget monitoring and evaluation departments. These departments are responsible for the review of fiscal developments in the economy as well as study the trends and patterns of government revenue. Also, the estimation of all government revenue (oil and non-oil) and analysis of returns on oil production, lifting and sales of oil fall under the purview of the Budget Office of the Federation. Similarly, the interviewer administered the semi-structured interview questions that are linked to the functions and responsibilities of the participants in this office.

3. The National Planning Commission was specifically mandated to determine and advise the Nigerian government on matters relating to national development and overall management of the national economy. Moreover, the Commission is charged to undertake periodic review and appraisal of the human and material resources capabilities of Nigeria with a view to advancing their development and effective utilization. It is also expected for the commission to formulate and prepare long-term, medium-term and short-term national development plans and to co-ordinate such plans at the Federal, State and Local Government levels. Thus, the researcher directed the semi-structured interview questions that relates to the functions attached to participants in this organisation as explained above.

4. The Office of the Accountant General of the Federation (OAGF) is responsible for the overall management of all revenue receipt and payments of the Federal Republic of Nigeria. In addition, the Office undertakes the supervision of the accounts of Federal Ministries and Extra-Ministerial Departments as well as revenue monitoring and accounting. The OAGF is charged with the preparation of annual budgets, monitoring of budget performance and maintain the Nigerian sovereign wealth fund. Therefore, the study applied the relevant semi-structured interview questions to the participants from the above office that suits their functions and responsibility as enshrined in their organisational mandate.

5. The Nigerian National Petroleum Corporation (NNPC) is the state oil corporation with the mandate of undertaken both upstream and downstream oil and gas operations. In additions, the corporation represent the Nigerian government in any contractual dealings with oil companies as regards the oil and gas activities. The study selected the senior management level in crude oil marketing division and renewable energy division. The crude oil marketing division is charged with the mandate of selling Nigerian crude oil and gas both nationally and internationally. They relate with agents to negotiate the sale of Nigerian crude oil on behalf of the NNPC. On the other hand, renewable energy division is primarily charged with the responsibility of following the global trends of mitigating climate change and participate in the Clean Development

Mechanism (CDM) program of the Kyoto protocol. Moreover, the division is responsible for adopting national policy response to the global aspiration to curb carbon emissions in a sustainable manner that would guarantee economic empowerment to rural communities, reducing Nigerian dependence on oil and gas revenue and protecting the environment. The study administered semi-structured interview questions that relate to them.

6. Nigerian Investment Promotion Commission (NIPC) is the body, which governs and regulates Foreign Direct Investment (FDI) policies in Nigeria. The Nigerian petroleum sector has been the sector that attracts bulk of FDI flows into Nigeria. As a result, the study enquired from the senior staff and management using set of semi-structured interview questions that are related with their functions in their organisation. The next subsection discusses the committees selected under the legislative arm of government.

4.9.2 Chosen Committees Under the Legislative Arm

Similarly, the study identified and selected one member in each of the six identified Committees from the Senate and House of representatives to stand in as public policy makers under the legislative arm of government to partake in the interviews. The committees include: Senate and House of Representatives Committees on Finance, the Senate and House of Representative Committees on National Planning and Economic Development and lastly, the Senate and House Committees on upstream activities.

1. The Senate and House Committees on Budget and Finance are empowered by the standing rule of the senate and House of Representatives to oversee the revenue profile of government, the annual budgets estimate as well as to determine the general fiscal and monetary policy of government. Also, they are charged with the responsibilities of overseeing oil and non-oil revenue matters, harmonisation of the revenue bill as well as the annual budget estimate.

2. The Senate and House Committees on National Planning and Economic Development have a jurisdiction to undertake an oversight function on national economic intelligence, economic planning and economic policy; revenue mobilisation; macro fiscal and monetary policies of Government. The committees study international economic policies and gather economic intelligence for economic and financial planning. Also, the committees consider the appropriation of annual budget estimates of related Institutions.

3. The Senate and House Committees on Petroleum Upstream have statutory functions of overseeing the operations in upstream oil sector including the ministries and agencies responsible for the upstream operations.

4.10 Summary and Conclusion

This chapter gave a general background review of oil and gas revenue and budget financing in Nigeria. Similarly, the chapter reviewed budget and the framework of governmental budgeting in Nigeria. Moreover, the chapter discussed Nigerian budgetary process and the annual budgets. Despite the existence of budgetary processes and procedures in Nigeria, the annual budgets have not been isolated from the dominance of oil and gas revenue. Thereafter, the connection between oil and gas exports revenue with the Nigerian budgets were discussed. In addition, the chapter reviewed the various sources of oil and gas revenue that accrues to Nigeria. Moreover, the various government accounts that accommodate oil and gas revenue as well as how it is distributed were reviewed in this chapter. The overall impact of oil and gas revenue on Nigeria's budget and the likely effects of global energy transition on Nigerian projected oil and gas revenue were reviewed and discussed.

The review has revealed that amongst the net oil exporting countries, Nigeria appeared to be the top on oil and gas revenue dependence. Secondly, the review has revealed the degree of Nigerian dependency on oil and gas revenue in financing budgets over the years and in the future. Even though Nigeria has other potential sources of revenue that could compete favourable with the oil and gas resources, it has not yet been exploited. Thirdly, the chapter also revealed that

significant part of the anticipated revenue is expected to come from the oil and gas revenue. Thus, the government intends to finance its future budgets with the significant part of the anticipated revenue from oil and gas revenue.

Finally, the chapter revealed the degree of vulnerability, which the Nigerian dominant source of revenue faces in this era of transition away from oil and gas especially by the net energy importing countries. As some of the Nigerian major oil and gas exports destination such as the U.S.A has now become insignificant. Similarly, the present position of EU as the Nigerian major oil and gas exports destination may change when investment in their renewable energy becomes developed. Thus, the transition to renewable energy and carbon emission reduction as noted earlier has the potentials of reducing Nigerian oil revenue and it seems there is no apparent strategic plan for mitigating the impact on Nigerian oil and gas revenue and budgets. On this note, the study has identified senior government officials in various MDAs to represent the executive and legislative arms of government in the interviews to support the quantitative results and further seek their perceptions about the impact of the global energy transition on Nigerian oil and gas revenue, budgets and plans to mitigate these impacts. The next chapter discusses the research theoretical framework.

Chapter 5.
The Research Theoretical Framework

5.1 Introduction

The previous three chapters presented the reviewed literature on carbon emissions reduction, renewable energy and the impact of oil and gas revenue on Nigerian budgets. This chapter reviews and discusses the relevant theoretical frameworks underpinning the study. Consistent with the above, the chapter will develop the research framework and hypotheses from the theoretical propositions and the reviewed literature.

This chapter is designed and structured into five sections. Section 5.2 identifies and discusses dependency theory and explains how it fits into the debate of global energy transition in net energy importing countries (NEICs) in contrast to Nigeria, as a net energy exporting country (NEEC). Section 5.3 discusses a strategic issue analytical framework and links it to global energy transition. Also, the section explains how energy transition in NEICs is strategic to Nigeria as a NEEC. Similarly, section 5.4 presents the hypotheses developed from dependency theory and supported by the strategic issue analytical framework. Finally, section 5.4 provides the conclusion of the chapter.

5.2 Dependency Theory

Frank (1972; 1989) propounded dependency theory and contextualized it using a practical illustration of two distinctive countries: dominant and dependent. The former is considered as a categorical type of country, to which the dependent countries supply resources. However, Dos Santos (1970) simplified and expounded dependency theory into three forms. These are colonial dependency, financial-industrial dependency and new dependency. Colonial dependency explains the process whereby the colonial masters appropriate the resources of their colonies for their home countries. Financial dependency and the new dependency involve substantial investments in resource rich countries, for repatriating the natural resources to the dominant net energy importing countries (NEICs). The only difference between financial and new dependency is that while

the former involves the multi-national companies, the latter involved investment by the government of the NEICs mostly in the form of assistance and rendering of services.

Dos Santos (1970) further argues that dependency is a condition which depicts the economy of the dependent net energy exporting countries (NEECs) being influenced by changes of the dominant NEICs, which affect and limit the development possibilities of the former. However, according to Sunkel (1969) dependency theory can be defined as a situation whereby external influences (political, economic, and others) from the dominant NEICs have a significant impact in explaining the state of an economy of the dependent NEECs.

This economic inter-dependence between the dominant NEICs and dependent NEECs is underpinned by the core prepositions of the dependency theory. These core prepositions are (i) It is a set-up of international system comprising of dominant NEICs and dependent NEECs. (ii) The assumptions that those external forces (NEICs and Multi-National Companies) are of great influence to the economic activities within the net energy exporting countries (NEECs). (iii) Existence of dynamic relations between the NEICs and NEECs. The different forms of dependency theory and its characteristics explain the core prepositions as enumerated by numerous scholars such as Sunkel, (1969); Dos Santos, (1970) and Frank, (1989).

Within the above context, this study argues that the dominant countries are the developed and emerging net energy importing countries (NEICs), which rely substantially on oil and gas exports from net energy exporting countries (NEECs) such as Nigeria. According to Internal Energy Agency (IEA) statistics (2016), NEICs accounts for about 60% of the total global primary energy consumption. On the other hand, resource dependent countries are those nations, which depend heavily on the exports of a single commodity for foreign exchange earnings and the importation of a variety of goods from developed and emerging NEICs (Emeh, 2012). The World Bank Statistical Indicator (2016) shows that, oil revenue accounts for significant percentage of total government revenues and

GDP of most countries within the Organisation of the Petroleum Exporting Countries (OPEC). In addition, NEECs depends substantially on oil and gas exports to NEICs (Energy Sector Management Assistance Programme (ESMAP) (2004).

Consistent with the literature and understanding of the core preposition stated above, this study argues the appropriateness of dependency theory as a framework for underpinning Nigerian dependence on oil and gas export to NEICs. According to British Petroleum Statistical review (2016), Nigeria is the leading NEEC in Africa. Similarly, Nigeria is ranked first in terms of dependence on oil and gas revenue (ESMAP, 2004). According to current available statistics, oil and gas revenue accounted for 67% of Nigerian total revenue, 79.8% of foreign exchange earnings and 13.6% of GDP; while the non-oil and gas sector accounts for the remaining balances (Central Bank of Nigeria, 2015; National Bureau of Statistics, 2016Q1; World Bank, 2016). Moreover, according to the Budget Office of the Federation (2016), about 67% of Nigerian projected total government revenue for the 2016 and 2017 will be realised from oil and gas; while 65% for the 2018 fiscal year. This suggests that compared to other NEECs, it is likely that Nigeria may be affected adversely by the energy transition to renewable energy and carbon emissions reduction measures taken in the NEICs.

However, dependency theory is documented to have some limitations. The major limitation associated with dependency theory is that it emphasises the strength of one party (dominant countries) over the dependent countries in the economic interdependent relationships. Similarly, the theory tends to suggests that external factors emanating from the dominant countries are the major causes of socio-economic and political underdevelopment in the dependent countries and solutions to these problems lie with the latter countries to reduce their dependency on the former countries. Moreover, dependency theory overlooks the ability of the dependent countries to devise internal mechanisms to develop on their own without depending on external forces (Smith, 1979). However, the use of strategic issue analytical framework in this study has augmented the limitations of the dependency theory.

Aside from dependency theory and strategic analytical framework, other theories and frameworks such as trusteeship accounting theory and a sustainability analytical framework [theory] can be used to support studies of this nature. The idea of trusteeship accounting emanated from concerns about public assets[41] (Musgrave and Musgrave 1988; Mautz, 1988; Pollot, 1990 and 1992; Mc Greggor, 1999; Barton, 1999a and 1999b). The theory was propounded on the basis of accounting for publicly owned assets and provision of services to be treated as trusteeship assets, held and managed by governments on behalf of present and future citizens for the benefit of all (Barton, 1999a). This theory is more appropriate in explaining relationships between governments and its citizens. In this type of relationship, one party (governments) as a trustee of citizens, make sustainable socio-economic and environmental policies for the benefit of all.

Conversely, sustainability theory emerged from the broader sustainable development framework (World Commission on Environment and Development [WECD], 1987) due to the tragedy of the commons (Hardin, 1968; Meadows et al., 1974; Norton, 1992; Schlossberg and Zimmerman, 2003). In the early 1960s, the focus of sustainability has been on human economic development without considering the consequences of these actions on natural public assets (Meadows et al., 1972; Hardin, 1968). Primarily, sustainability theory became pronounced following the definition made by Brundtland in WECD report (1987 p.43) that the ability of the future generations to meet their own needs is not compromised by actions of the present generation.

According to Pearce and Atkinson (1993) and Neumayer (2003), sustainability could be in the form of ecological/environmental sustainability, natural assets sustainability, and economic sustainability. However, Johnston (2014) asserts that sustainability theory is relative, dynamic, contestable and normative. Sharpley (2000) considered sustainable development as a complex amalgam of

[41] These include infrastructure assets, heritage assets, community assets, environmental assets, natural assets and trust assets used for public purposes, which are to be treated equally in accounting (Mc Greggor, 1999).

economic, social, environmental as well as political pathways where each proponent of the various disciplines attempts to exert influence on the theory. Thus, the application of sustainable theory is characterized with ambiguity (Redclift, 1987), highly relative (Lele, 1991) and is apparently contradictory (Sharpley, 2000). Drawing from the characteristics above, neither is sustainability theory appropriate to explain this kind of study that focuses on inter-dependent relationship between Nigeria as dependent NEECs and the dominant NEICs. On this basis, dependency theory and a strategic analytical framework are proposed to underpin this study as suggested. The next section contextualises the core prepositions of the dependency theory within the context of Nigerian reliance on NEICs for its oil and gas exports.

5.3 Theorising Nigerian Reliance on Oil and Gas Exports

As one of the first core assumptions of dependency theory suggest, oil and gas trade are carried out internationally between countries. These countries comprise of dependent NEECs and the dominant NEICs. As explained in section 4.6.2, Nigeria as a NEEC undertakes oil and gas trade with several NEICs. Similarly, these NEICs exercise significant influence within the economic activities of Nigeria as a dependent NEEC. For years, NEICs and their oil companies have dominated the Nigerian oil and gas sector (Nigerian National Petroleum Corporation, 2015). This satisfies the second assumption of the dependency theory.

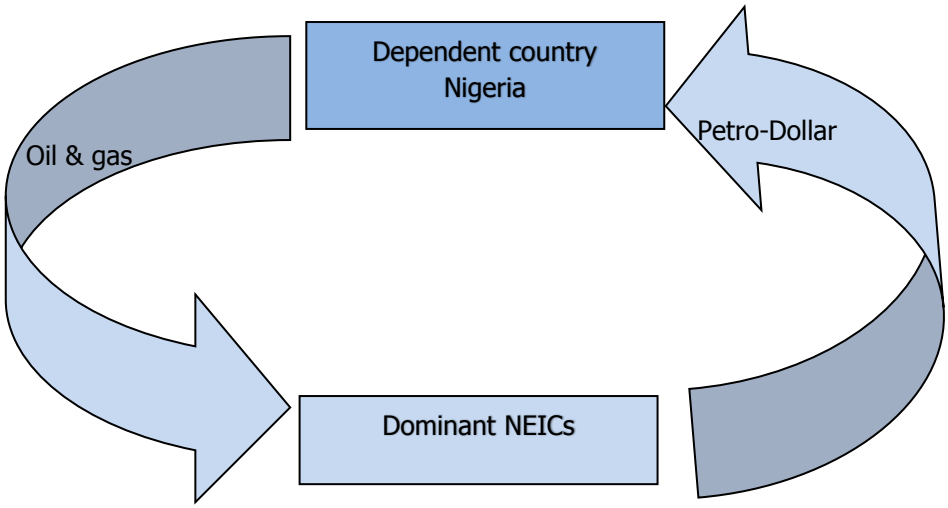
Thus, NEICs through their oil companies, undertake most of the upstream activities in the Nigerian oil and gas industry since after the discovery of oil in 1956 (Klieman, 2012). For instance, the dramatic changes of Nigerian petroleum policy in the late 1970s demonstrate the dependency on foreign expertise for its oil and gas exploration activities. In this period, the Nigerian government forgo its indigenisation policy and gave extra incentives to the Multi-National Oil Companies (MNOCs) to resume exploration activities (Omorogbe, 1987; Kyari, 2012). According to Nigerian National Petroleum Corporation Annual Statistical Bulletins Report (2014), a significant percentage of the upstream activities were executed by the MNOCs.

This suggests the control of the dominant countries in the Nigerian oil and gas industry for decades. Subsequently, the Nigerian share of the production output is exported to the global energy market for onward consumption by the dominant NEICs. However, the case is different in other net energy exporting countries. For instance, Brazil has a competent national oil company that undertakes oil operations in deep-sea waters. The Nigerian National Petroleum Corporation (NNPC), which was formed to drive indigenisation of the oil and gas sector, has over the years, not been able to achieve its objectives due to the lack of financial and technical advantage (Nwokeji, 2007).

Despite the inefficiency of NNPC, Nigeria exports its energy resources to different countries across the globe through JV and PSC contracts with MNOCs (NNPC ASB, 2015). Nigerian National Petroleum Corporation Annual Statistical Bulletins Report (2014), records that Nigeria exports its oil and gas to more than 37 different countries. From these countries, the EU accounts for 46% of Nigerian total oil and gas exports (Nigerian National Petroleum Corporation, 2014). As a result, Nigeria has benefited tremendously from direct crude oil and gas exports to Europe and as a result of this the Nigerian government uses this revenue to finance its annual budgets.

However, with the drive of the EU to attain macro environmental and economic sustainability through renewable energy sources, it appears that dependency on Nigerian oil and gas may change in the future. Until now, the U.S.A has been the dominant destination for Nigerian oil and gas exports. However, with the recent discovery of shale oil and gas, the US has almost ceased to be a Nigerian oil and gas exports destination. This signifies the justification of the existence of dynamic relations as one of the core assumptions of dependency theory. Figure 5.1 below depicts the interdependent economic relationship between Nigeria and NEICs.

Figure 5-1 Relationship Between Nigeria and Other Dominant NEICs



The energy transitions in the NEICs have a significant impact in explaining the state of the economy of a given dependent country such as Nigeria. Thus, Nigerian dependency on oil and gas exports to NEICs is viewed as a strategic issue, which may portend economic threat, and or opportunity to its oil and gas exports revenue in either the short or long run. In this regard, the strategic issue analytical framework comes into the picture.

5.4 Strategic Issue Analytical Framework

Theoretically, strategic issue is rooted within the strategic management disciplines that involve raising strategic questions, taking strategic decisions and making strategic plans (Dutton and Jackson, 1987; Dutton, Fahey and Narayanan, 1983). Mintzberg, Raisinghani and Theoret (1976) opined that the occurrence of perceived problems, opportunities and crises are the underlying stimulant of strategic issue. According to Dutton and Jackson (1987), what is classified as a strategic issue mostly emanates from an outside/external origin. Thus, Johnson, Bransford and Solomon (1973) made a descriptive analogy as thus: "Upon hearing a passage describing a person pounding a nail, people infer the presence of a hammer". In this regard, Heath (2002), asserted that strategic

issue management requires being vigilant for threats and opportunities that can affect achievement of organizational objectives.

In principle, when an issue is branded as strategic, it falls within two extreme strands of being either an opportunity or threat. When an issue is labelled as an opportunity, it is considered as positive, gainful and controllable. Thus, an opportunity presents a high chance of recording gain, however with a limited degree of control. When an external event is positively related with certain variables, it is likely that an increase is anticipated. However, a threat is synonymous with negativity, loss and uncontrollability. At times of threat, loss is anticipated and there is a limit to avert the occurrence of such loss. Similarly, Heath and Palenchar (2009) contend that strategic issue management (SIM) comprises of four actions: collecting and monitoring information, evaluating the information and categorizing the issue, prioritizing the issue, and evolving an action and implementation.

In analyzing strategic issue, there are two independent parties involved, the prospector and the defender (Miles and Snow, 1978). The former is assumed the party making a new invention. On the other hand, the latter party suffers the consequences that may occur due to the former's action. Therefore, the focus of the defender is to strategize and address the influence of the innovation. Hence, strategic issue is connected with the occurrence of certain developments, events and trends that vary within or without a geographical space. These developments, events and trends could be labelled as either critical and or inconsequential (Nutt, 1984). Some scholars opined that the theory enables decision makers to take decisions that hinge on opportunity or threat (Christensen et al., 1982). Thus, the responsibility of evaluating external events, developments and issues lies with the decision makers of an organisation (Dutton, Fahey and Narayanan, 1983; Judge and Fowler, 1996).

Most of the literature reviewed indicates that the concept of strategic issue is widely used within the context of organizational level (micro perspective) (Dutton, Fahey and Narayanan, 1983; Thomas, McDaniel and Dooris 1989; Judge

and Fowler, 1996; Jackson, 1988; Health, 2002; Health and Palenchar, 2009). Within the framework of organizational theory, strategic issue represents the responsiveness of decision makers in an organization to scan their external environment and identify long and short-term potentials and challenges. It operates in such a way that decision makers assess the external environment to determine areas of strength and opportunities to capitalize on them for the good of the organization. Similarly, they assess the constraints and threats facing the organization in order to overcome the challenges.

Thus, capacities and capabilities of public decision managers play a significant role towards understanding the matrix of the external environment in order to make plans to reap the available opportunities and address the emerging threats (Paget, 1952). In consistence with Heath (2002), application of a strategic issue framework requires public policy and decision makers to be vigilant for opportunities and threats that can influence the society. According to Dutton, Fahey and Narayanan (1983), labelling of an issue as a threat or opportunity is dependent on the professional views of public policy and decision makers that have an understanding of the implication of the external developments.

In this perspective, the perception of public policy and decision makers on what constitutes a threat and/or opportunity depends on geographical locations and the prevailing circumstance existing within that environment. However, the world is becoming a global village, as most countries are interdependent; hence, development in any country or countries may affect others. Hence, what may be considered as an opportunity by public decision makers in a particular country could be seen as a threat by public decision makers in a different country. In this way, strategic issue analytical framework could be applied within the context of national, regional and global perspective.

5.5 Linking Strategic Issue to Global Energy Transition

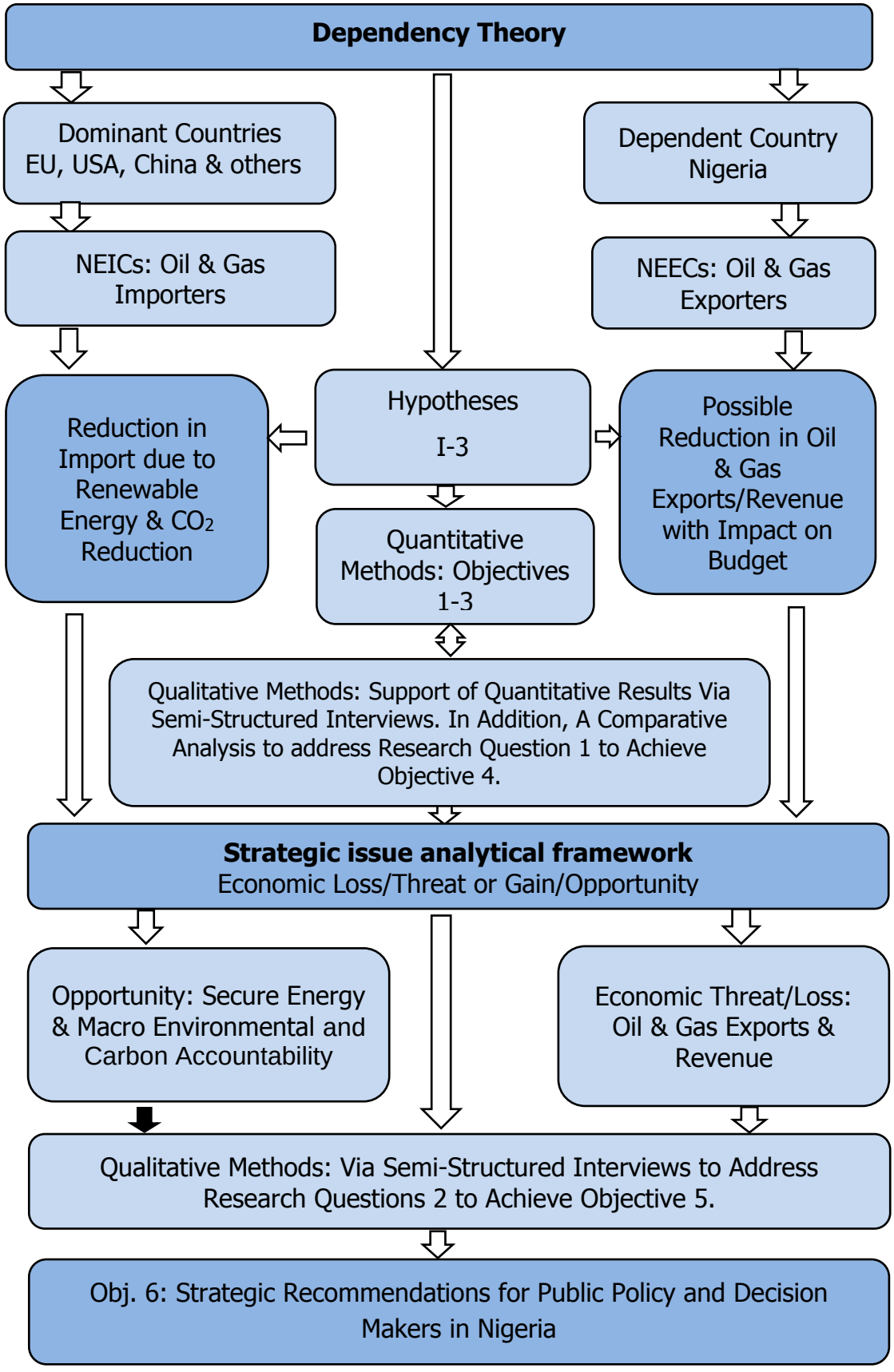
As discussed in chapter two and three, net energy importing countries (NEICs) have seen opportunities in transiting from conventional energy to the consumption of energy from renewable energy sources. This development was considered a strategic issue to attain energy security, economic and macro environmental accountability. However, net energy exporting countries (NEECs) such as OPEC member countries are seeing these developments as a threat to their oil and gas export volumes and revenues to finance their national budgets. In this perspective, the global energy transition is viewed differently by countries, where some countries see it as an opportunity; others consider it as a threat.

This study contextualizes that the prospectors are the NEICs since most of them are sourcing new forms of energy in order to reduce the influence of conventional energy sources in their energy mix. Specifically, these countries have made a commitment to reduce dependence on foreign energy associated with carbon emission, GDP and financial loss. On the other hand, the defenders are the OPEC member countries that appear to have raised concerns about the NEICs action on their oil and gas export revenue.

In this context, the global energy transition is considered as a strategic issue for OPEC member countries. Nigeria as a member of OPEC and oil and gas exports revenue dependent may be affected by the energy transition of the NEICs. Consequently, the study recognised renewable energy transition and carbon emissions reduction in NEICs as a strategic issue to Nigeria because of its potential impact Nigerian oil and gas exports volume, revenue and budgets. Hence, the strategic issue analysis was applied to seek professional views of Nigerian public decision and policy makers and other stakeholders that have an understanding of the implications of the energy transition on Nigeria. Consequently, based on conceptual understanding of the findings, and implications, the study made a strategic recommendation to decision and policy makers in Nigeria. Figure 5.2 below shows the theoretical research framework of the study.

5.6 Research Framework and Derivation of Hypotheses

Figure 5-2 Theoretical Research Framework



The NEICs pursue strategic policies to reduce the consumption of conventional energy sources in order to attain energy security, environmental and carbon accountability. This objective is expected to be realised via the consumption of energy from renewable energy sources and carbon emission reduction.

According to del Rio and Burguillio (2008) "territories base their sustainable development process on the use of local resource endowments" (p.1334). Despite Nigeria's net energy importing countries having divergent characteristics in terms of natural resources endowment, economic and demographic structure, they share common objectives of achieving macro environmental and carbon accountability. Hence, these countries pursue the development and consumption of renewable energy sources, which are natural resources that are mostly found within the borders of their respective countries. Similarly, renewable energy is considered non-depleting and environmentally friendly.

In contrast with renewable energy, conventional energy sources are exhaustible, associated with carbon emissions and usually being imported from countries such as Nigeria. Hence, substituting conventional energy consumption with renewable energy is critical to achieve their national objectives. On the one hand, both renewable energy consumption and carbon emissions reduction in NEICs may have the potential of decreasing their dependence on conventional energy sources. This is because renewable energy is a substitute for conventional energy on the one hand. Similarly, conventional energy is the major cause of carbon emissions; any attempt to reduce carbon emissions may affect global consumption of conventional energy sources.

On the other hand, it may affect the volume of Nigerian oil and gas exports to NEICs thereby affecting oil and gas exports revenue and budget financing. In this way, global energy transition is regarded a strategic issue to Nigeria as a NEEC. Consistent with the dependency theory and strategic issue analytical framework underpinning Nigerian dependence on oil and gas exports to NEICs, the study hypothesized as follows.

H_0 1: Carbon emission reduction in developed NEICs has no influence on Nigerian oil and gas exports.

H_a 1: Carbon emission reduction in developed NEICs has influence on Nigerian oil and gas exports.

H_O2: Renewable energy consumption in developed NEICs has no influence on Nigerian oil and gas exports.

H_a2: Renewable energy consumption in developed NEICs has influence on Nigerian oil and gas exports.

As mentioned in chapter six, Nigeria also exports its oil and gas to emerging NEICs. In this regard, the study intends to ascertain the impact of renewable energy consumption in emerging NEICs on Nigerian oil and gas exports. This explains the rationale for the generation of the last hypothesis as stated below:

H_O 2: Renewable energy consumption in emerging NEICs has no influence on Nigerian oil and gas exports.

H_a 2: Renewable energy consumption in emerging NEICs has influence on Nigerian oil and gas exports.

The above three testable hypotheses were derived from the research literature and are related with specific objectives (1-3) of the study. The key variables that are embedded in these hypotheses include Nigerian oil and gas exports to these countries as the dependent variable. While renewable energy consumption in developed and emerging NEICs, carbon emissions in developed NEICs as the key independent variables.

Hypothesis one was employed to examine the effect of carbon emission reduction in developed NEICs on Nigerian oil and gas exports and achieve objective one. The empirical results obtained from the tests of hypotheses two, three, are used to assess the overall impact of the renewable energy consumption in both developed and emerging NEICs on Nigerian oil, and gas exports demand to achieve objectives two and three. In addition, research question one is raised to

make a qualitative comparative analysis between the extents of the impact of renewable energy consumption in developed and emerging NEICs on Nigerian oil and gas exports and achieve objective four. Similarly, a semi-structured interview was undertaken in order to support the quantitative findings and solicits for further insights into the impact of global energy transition on Nigerian oil and gas revenue, budgets and plans to mitigate these impacts. The insights generated from public and other stakeholders would address research question two and achieve objective five. Finally, objective six is to make strategic recommendations for public decision and policy makers in Nigeria on how to address the impact of the global energy transition.

5.7 Summary and Conclusion

This chapter has reviewed literature on dependency theory and strategic issue analytical framework. In the process of the review, the chapter explains how dependency theory and strategic issue analytical framework underpinned the study.

Firstly, the review of the dependency theory identified the parties involved in the interdependent relationship and the nature and propositions underpinning these interdependent relationships. Similarly, it was established that dependency theory can be used to underpin energy transition in NEICs on the one hand and Nigerian oil and gas exports on the other hand.

Secondly, the chapter revealed how strategic issue analytical framework fits into the global energy transition debate, which is considered as a strategic issue for both NEICs and Nigeria as NEECs. The review specifically highlights renewable energy transition and carbon emissions reduction in NEICs as a strategic issue to Nigeria because of its potential impact on Nigerian oil and gas exports volume to these NEICs on the one hand. On the other hand, it pinpointed on how strategic is the energy transition to NEICs.

Thirdly, the chapter established that both dependency theory and strategic issue analytical framework fits into the debate of the energy transition in NEICs on the one hand and the Nigerian oil and gas exports on the other hand.

Fourthly, the review of literature in the chapter established that dependency theory has some limitations. However, these limitations have been augmented by using strategic issue analytical framework. Similarly, the review revealed that other theories and frameworks could be used support studies of this nature. These are trusteeship accounting theory and a sustainability analytical framework [theory]. However, the reasons for not adopting these theories were discussed in the chapter.

Lastly, the chapter revealed the developed research theoretical framework, which linked the derived research hypotheses to each of the research objectives. The next chapter discusses the research methodology and methods.

Chapter 6.
Research Methodology and Methods

6.1 Introduction

The prior chapter discussed the theoretical framework, which underpins this study. This chapter reviews the research methodology and methods in social science. In terms of the methodology, the research philosophies and paradigms underpinning social science research will also be discussed. Consequently, the chapter will identify the relevant research philosophy, research paradigm and the research approach to this PhD project. In addition, the chapter intends to adopt a research methodology and method suitable for the study based on the philosophical assumptions and paradigm identified. Moreover, the chapter identifies and discusses data collection procedures and the research and sample population for both secondary and primary data. Subsequently, the nature and sources of secondary and primary data to be used and analysed will be identified. Overall, the chapter outlines the research methodology and approach used for the study in order to achieve the study aim and objectives.

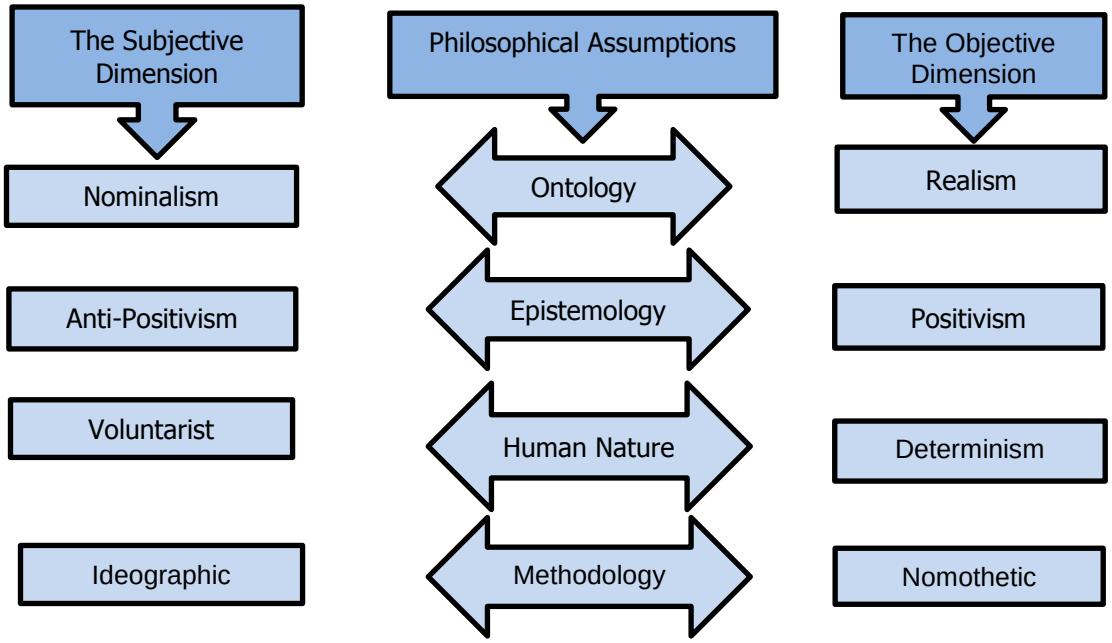
6.2 The Philosophies Under Social Science Research

In broader terms, research has been defined as "a systematic and methodological process of inquiry and investigation with a view to increasing knowledge" (Collis and Hussey, 2013, p.2). According to Burrell and Morgan (1979) framework, social science research is underpinned by different sets of meta-theoretical assumptions about the nature of social science and the nature of society. Social science is viewed as the study of how people behave and the impact their actions would made on the world around them (Burrell and Morgan, 1979; Blaikie, 2010; Collis and Hussey, 2014). This suggests that the study of social science necessitates the researcher to understand the ways of reasoning and belief of people. To do that, the researcher has to make some philosophical assumptions. These mete-theoretical assumptions are the two extreme standpoints: the subjective-objective dimension.

The subjective-objective dimensions of social science research provide the bases on how the world is viewed by the four sets of philosophical assumptions and these are: ontology, epistemology, human nature and methodology. The first three sets of philosophical assumptions play a significant role in determining the latter. In other words, the type of methodology to be adopted in undertaking a particular research is shaped by the ontology, epistemological and the nature of the researcher.

According to Burrell and Morgan (1979), the subjective dimension is considered to be ontologically nominalist, epistemologically anti-objectivist. It also considers human nature as a voluntarist. On the other hand, the objective dimension has the attributes of realism, objectivism and determinism as ontological, epistemological and human nature respectively. Figure 1 below gives the diagrammatic view of the four sets of philosophical assumptions based on the subjective-objective dimension to social science research, as suggested by Burrell and Morgan (1979).

Figure 6-1 The subjective-Objective Dimension to Social Science Research



Source: Burrell and Morgan, 1979: p.3

Ontological assumptions attempt to define what constitute a valid knowledge. In other words, it defines the nature and elements that supposed to be existent in order to recognize a social reality. According to Blaikie (2010), ontological assumptions are based on three distinctive viewpoints: the idealist, realist and cautious realist. The proponents that recognize knowledge to have emanated from the perception of human experience and mind construct are identified as the idealist. However, in the context of Burrell and Morgan (1979), they are considered as nominalism ontology, which falls within the subjective-dimension. On the other hand, the objective-dimension is of the view that the knowledge of the social reality is derived from either independent of the human consciousness or dependent of human mindset. This explains the ontological assumptions of realism, which considers human being as a product of the society that has no influence over the social reality. In determining what constitute a valid knowledge, the realist believe that it is the only through hypothesis testing that causal explanation about the social reality can be made.

However, Kuhn (1970) argues that valid knowledge of social reality is derived from both human intellect and those things defined by reality, which are independent to human perception. Similarly, Blaikie (2010) states as thus:

"The world is not a universe of facts that exist independently of the observer; theoretical statements do not describe reality, they depend on assumptions embedded in theoretical constructs and common-sense thinking. Truth is based not on evidence but on the consensus that could be expected in an ideal speech situation" (p.180).

These suggest that a researcher may by moving along the continuum to understand reality from different perspectives either from subjective or objective extreme ends. This movement is termed as pluralism of reality, which appreciates both the objective and subjective and intersubjective reality and their interrelations (Johnson and Christensen, 2010). In this context, a researcher moves back and forth in understanding reality. The universe is seen as evolving rather than static. External forces do not determine humans; rather through

intelligence, humans are capable of shaping experience (Maxcy, 2003, p.63). Similarly, Laughlin (1995) recognizes the existence of material reality distinct from our interpretations does not dismiss inevitable bias in perceptive understanding. He terms this as middle range ontological assumption. Closely associated with ontological assumptions are epistemological assumptions.

The epistemological assumption defines the way within which knowledge of the world reality can be obtained and judged. It states the methodology and methods to be adopted in producing reliable, legitimate and sufficient knowledge. However, the nature of the knowledge to be generated is underpinned by the ontological assumptions. According to Blaikie (2010) for instance, the epistemologies of the positivism paradigm attempt to generate valid social knowledge via scientific procedures. On the other hand, generating social reality from the perspective of interpretivists is underpinned by human experience, reasons and intuition.

Blaikie (2010) has identified three broad classifications of epistemological assumption, which outline procedures for obtaining a valid knowledge. These are: constructionism, empiricism and falsificationism. The constructionism relates to the belief that social reality emanates from human ideas, which are presented from personal understanding. Contrary to constructionism, the empiricism and falsificationism opined that human ideas have to be subjected to scientific test to be a valid knowledge. In other words, the presentation of ideas using scientific concepts and theories help in eliminating elements of human biasness in order to infuse accuracy. Constructionism disagrees with the view of both falsificationism and empiricism. The proponents of constructionism believe that social reality is a matter of mind construct; it is neither discovered through scientific method nor produced from reasoning. But rather, the researcher tries to create and not to discover the object based on his personal perspective. However, the use of scientific methods, quantitative data and variable provides adequate information that may be deemed vital for understanding the problem under investigation (Blaikie, 2010: 168). However, radical critiques have criticised

the objective science (objective dimension) as being anti-feminist (Keller, 1985; Rose, 1983). This suggests that science itself is not immune to subjectivity of the researcher as claimed by Burrell and Morgan (1979), and Collis and Hussey (2009).

Based on the above, moving along the continuum of the two extreme ends of positivism and anti-positivism epistemological divides is preferred in order to generate a valid knowledge. Hence, the pragmatism epistemological assumptions are introduced (Johnston and Christensen, 2010). Similarly, the pragmatic epistemological assumption of Johnston and Christensen (2010) is consistent with the middle range epistemological assumption of Laughlin (1995) who argues that in an attempt to obtain knowledge, generalisations about reality are possible, although not guaranteed to exist, yet these will always be skeletal requiring empirical details in order to be meaningful (Laughlin, 1995).

The epistemological assumption of pragmatism is mixture of universal and community standards or specific needs based standards pragmatic justification implying that what works for whom in a specific context (Johnston and Christensen, 2010). In this way, the importance of subjective meaning and theorisation of empirical observations are recognised without surrendering to rigid methodological adherence (Modell, Morris and Scapens, 2007). However, it is argued that this epistemological thought is too vague as a ground for justification of mixed methods (Maxcy, 2003). The next philosophical assumption after epistemology is the human nature.

The philosophical assumption about the human nature as stated by Burrell and Morgan (1979) could be either voluntarist or determinist. This human nature defines how human beings generally interact with their environment. In the perspective of Burrell and Morgan (1979:2) human nature, explain whether the environment has any significant influence in determining man perception and his intellectual ability or vice-versa. It determines whether human beings and their experiences are products of the environment or they dictate and control the environment. However, human beings naturally view social reality and respond

to situation either in mechanistic or deterministic fashion from the perspective of their environment. Similar to ontological and epistemological assumptions, moving along the continuums of the subjective – objective perspectives on human nature assumption could be applied.

It is revealed that human nature is dynamic, complex, and partially predictable (Johnston and Christensen, 2010). Human nature and behaviour are influenced by multiple factors such as the environment, nature, freewill and chance and both must be taken into consideration in social science studies. This perspective recognizes multiple factors that could influence human nature; thus, human nature rather than being purely voluntarism or deterministic, is combination of both. Ontological, epistemological and human nature assumptions as outlined above are reported as having implications on choosing a methodology for conducting research (Burrell and Morgan, 1979); below is an outline of the methodological debate.

The methodological assumption dictates the ways and means in which a researcher designs to undertake a study in order to obtain knowledge about the social reality (Hassard, 1991; Jonker and Pennink, 2010). However, Ryan, Scapens and Theobald (2002) argued that, adopting a research strategy depends on the philosophical assumptions by the researcher. As explained earlier, these philosophical assumptions are mere personal construct coined to suit researcher's ways of reasoning and belief that are in most cases not totally objective (Hopper and Powell, 1985). Thus, research methodology is the reflection of the philosophical assumptions of researcher's paradigm in order to achieve the research aim and objectives. Blaikie (2010) considers research strategies to mean research methodology.

According to Burrell and Morgan (1979), researcher's methodological assumption could be either ideographic or nomothetic depending on the philosophical assumptions adopted. Within the ideographic assumption, it stresses on generating knowledge from data collected during fieldwork while nomotheitic methodological assumption emphasises on testing hypotheses and theory with

data. Thus, social science research could be undertaken following both confirmatory methods associated with quantitative research and exploratory method associated with qualitative method. Therefore, choosing either the subjective or objective divide or moving along these divides such as pragmatism could result in adopting different methodologies of conducting research even on the same phenomenon.

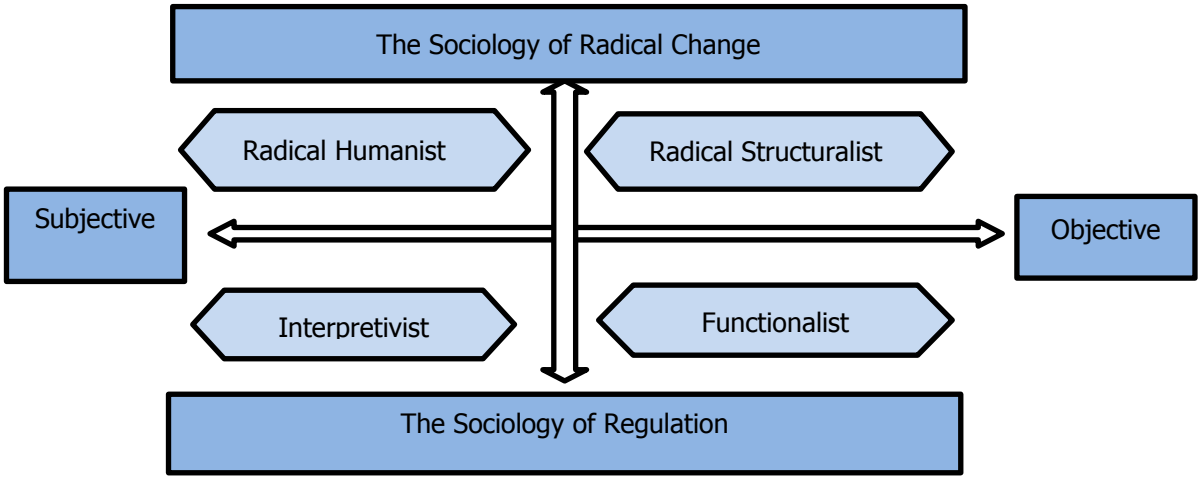
However, in order to keep pace with social dynamism, social science researches are motivated to move away from the traditional strict adherence of either being quantitative (objective) or qualitative (subjective) (Johnson and Christensen, 2010). This is referred to as the mixed method of research designed to achieve the objective of providing complex and full understanding of investigated phenomenon from multiple perspectives. This is consistent with the argument that although the two methods are substantively distinctive, they are compatible (Bryman, 2004; 2015). Agreeing with their views, Blaikie (2010) states that mixed methods are becoming popular because of the growing recognition of paradigmatic pluralism in social science research. In addition, Saunders, Lewis and Thornhill (2012) states that combination of methods; philosophies and paradigms are considered as pragmatism in the research literature. The next section presents sociological paradigms embedded within the social science research.

6.3 The Paradigms Under Social Science

According to Burrell and Morgan (1979) framework, the four sociological paradigms, namely; interpretive, functionalist, radical humanist and radical structuralist were derived from subjective-objective dimension and the regulation-radical change dimension. These two dimensions were built from science and the society. Research paradigms are the theoretical and philosophical perspectives that guide the conduct of social research. Each paradigm is underpinned by philosophical assumptions that serve as mental window within which the world is viewed and understood. According to Blaikie (2010), these paradigms offer multiple perspective of linking ideas, social experience and social

reality. Burrell and Morgan (1979) argue that the paradigms are symbol that depict the views of social reality in a particular spectrum. Figure 6.2 below gives the diagrammatic view of the four paradigms.

Figure 6-2 Four Paradigms in Social Science Research



Source: Burrell and Morgan, 1979: p.22

The four paradigms provide a medium of viewing social world reality mainly from the subjective-objective dimension and the regulation-radical change dimension that fit all social science research. The first paradigm to be discussed shall be the interpretive paradigm. The interpretive paradigm is underpinned by subjective dimension that considers valid knowledge emanating from the idealist and uses the constructionism perspective in its acquisition (Burrell and Morgan, 1979; Blaikie, 2010). However, the positivist perspective is grounded within the realist ontology and empiricism epistemology. Contrary to positivist approach, the interpretivist believes that social problem could best be described at the level of personal experience than status of being an observer.

Similarly, the interpretive paradigm is firmly rooted in the assumptions that human mind plays significant part in constructing and determining valid knowledge. It seeks to explain social reality at the hierarchy of subjective perspective. The nominalist, anti-positivist, voluntarism and ideographic philosophical assumptions underpin this paradigm. These philosophies are rooted in the subjective theoretical assumptions of social science and within the

sociology of regulation, which advocate for consensus building, unity of purpose and realisation of national objectives. This suggests that the sociology of radical change has no basis in the interpretive paradigm.

The second paradigm identified by Burrell and Morgan (1979) is functionalist paradigm. Functionalist paradigm approaches social problems from the objective dimension. Objective approach is underpinned by scientific viewpoints that consider knowledge as hard, real and external in characteristics. Moreover, it is underpinned by positivist philosophical assumption that is ontologically realist and empiricist in epistemological perspective. The realist considers that valid knowledge emanates within the corridors of what can be observed and measured in real terms. Thus, whatever that is measured could be controlled. However, the interpretivists have criticized the positivist of been deficient in the knowledge explaining human actions including their own (Blaikie, 2010). However, the nature of the knowledge generated by them is scientific and real. Merton (1968: 78) state that "functionalist paradigm involves the viewpoint of the observer, not necessarily that of the participant". Thus, functionalist paradigm is underpinned by core assumption of realist, positivist, and determinist as well as nomothetic. However, the paradigm is rooted in the sociology of regulation. Meaning, they are indoctrinated with the maintenance of the status quo rather than embracing change.

The third category is the radical humanist paradigm. This paradigm has common perspective with that of the interpretive in terms of philosophical assumptions as both views the social problem from the subjective dimension. Thus, subjective dimension is grounded in the knowledge of mind and societal construct rather than scientific observation. Therefore, radical humanist and interpretive paradigm are regarded as the key components that are underpinned by the subjective philosophical assumptions. Both radical humanist and interpretive paradigm believed that reality is socially created and socially sustained (Burrel and Morgan, 1979). On the one hand, the radical humanist is inclined towards the sociology of radical change, but within the subjective framework. Unlike the functionalist, which believes, that radical change of society primarily lies within the objective

dimension. On the other hand, the interpretive paradigm believes that society is a combination of different individuals and characteristics that are voluntarist in nature. As such, stability, consensus and integration could only be achieved through the sociology of regulation and not sociology of radical change.

However, the radical humanist are of the view that humans by nature are determinist, thus, the adoption of interpretive paradigm would only maintain the status quo. Hence, they believe that sociology of the radical change could be achieved within subjective dimension and not necessarily using the objective standpoint. Thus, radical humanist is rooted in the sociology of radical change which seeks to digress from the status quo which is contrary to the interpretive sociological that is incline to the sociology of regulation.

The last paradigm under the Burrell and Morgan (1979) is the radical structuralist. This paradigm firmly believes in the objective perspective as earlier explained under the functionalist paradigm. In other words, radical structuralist paradigm is considered to be ontologically realist and epistemologically objectivist. Moreover, it considers humans by nature as determinist and not voluntarist. However, unlike the functionalist that is confined in maintaining the status quo, the radical structuralist is situated within the sociology of radical change similar with that of the radical humanist paradigm.

Contrary to the radical humanist paradigm, the radical structuralist accommodates the role of different social forces in analysing and explaining social change. It is governed by the belief that occasionally, contemporary societies are confronted with political and economic crises (Burrel and Morgan, 1979). Burrel and Morgan (1979) further argued that these challenges could best be solved through the sociology of radical change and not regulation. Thus, radical structuralist paradigm is underpinned by the sociology of radical change, which seeks to reform society, emancipate people through exploring their untapped potentials. In contrast, the functionalist paradigm is rooted in the sociology of regulation, which advocate for the maintenance of the status quo that prevents human and societies from attaining independent fulfilment.

Given the above explanation, there seems to be cross-connection between the subjective-objective and the regulation-radical change dimensions, which resulted to the four basic paradigms that aid in constructing social reality in social science. The important aspect of these paradigms is that they provide the platform of accommodating one's perception on social reality. It also provides direction to the area of the research and a means of contrasting the differences and similarities with other studies to determine the depth and biasness' of the research area. Also, these four paradigms give the theoretical and intellectual boundary for determining the way in which the world is viewed and analysed. This brings to the components that underpinned the sociology of regulation and radical dimension.

Figure 6-3 Sociology of Regulation and Radical Dimension

Sociology of Regulation is concerned with:	Sociology of Radical Change is concerned with:
• Status quo • Social order • Consensus • Social integration and cohesion • Solidarity • Need satisfaction • Actuality	• Radical Change • Structural conflict • Modes of domination • Contraction • Emancipation • Deprivation • Potentiality

Source: Burrell and Morgan, 1979: p.18

Overall, the interpretive and functionalism paradigm are approaches within the context of sociology of regulation that is concerned with maintenance of the status quo. On the other hand, radical humanist and radical structuralist paradigms fall within the boundary of sociology of radical change that is rooted to achieve radical transformation. However, radical humanist and interpretive paradigm believes in the subjective dimension of philosophy. Hence, the ideographic methodological approach fit for these paradigms, which are underpinned by the subjective philosophical assumptions.

On the contrary, the nomothetic methodological approach is used for studies that have objective philosophical underpinning such as functionalist and radical

structuralist paradigm. Relatively, each of these paradigm have element of commonality even though they differ greatly in some instances-philosophy, approaches and sociology of society. However, they represent branches of world-views, which analyse contesting standpoints of social reality that is underpinned by philosophical assumptions, approaches and sociology of society.

Despite the significant contribution of Burrell and Morgan (1979) framework to the social science research (Laughling, 1995; Chua, 1986; Ryan, Scapens and Theobald, 2002; Saunders, Lewis and Thornhill, 2012), it has been a subject of severe criticism by several scholars in the discipline (Willmott, 1993; Hopper and Powell, 1985). The framework of Burrell and Morgan (1979) were criticised for stating that the paradigms are contradictory and thus be considered as mutually exclusive; adopting one has inevitably forbade using others (p.25).

This statement made by Burrell and Morgan (1979) were labelled been narrow which appeared not to represent the dynamic and multi-faceted nature of social ideas, social experience and social reality (Willmott, 1993). Thus, the partition of the subjective-objective dimensions may have denied proponents of mixed methods research in using the framework (Willmott, 1993). For this reason, Gioia and Pitrie (1990) advocated that the social science paradigms should be elastic, porous and interconnected and be considered as continuums. It is on this basis that researchers seeking to combine subjective-objective in their studies consider the Burrell and Morgan framework irrelevant. Despite the above criticism, the Burrell and Morgan framework is considered as the philosophical and theoretical foundation of social science research (Chua, 1986). Other social science disciplines such as accounting used the Burrell and Morgan framework in building their taxonomy of research (Hopper and Powell, 1985; Hassan, 2012). As a social science research, the research philosophy and paradigm adopted for this study are discussed in the next section.

6.4 The Research Philosophy and Paradigm of the Study

The preceding sections (6.2 and 6.3) have identified and discussed the broad philosophies and approaches underpinning the conduct of social science research. This section states the philosophical assumptions and the paradigms that guide the researcher. The philosophical assumption underpinning this study is discussed as follows.

6.4.1 Research Philosophy

It is argued that the nature of the social phenomenon to be explored determines the appropriate research approach, including philosophical assumptions to be adopted (Morgan and Smirrcich, 1980; Hassan, 2012) and methodological choice (Gill and Johnson, 2010). Therefore, the purpose of this study specifies its philosophical assumptions, which in turn determine its methodology (Hussey and Hussey, 1997). Therefore, it is of significance to state the aim of this study, which is to empirically evaluate the impact of global energy transition on Nigerian oil and gas exports. In addition, to undertake a semi-structured interview in order to support the quantitative findings and solicits for further insights into the impact of global energy transition on Nigerian oil and gas revenue, budgets and plans to mitigate these impacts.

The energy transition away from conventional energy sources to renewable energy is more pronounced in net energy importing countries (NEICs) than net energy exporting countries (NEECs). Consequently, this PhD study examines the impact of renewable energy consumption in developed NEICs and emerging NEICs on Nigerian oil and gas exports. Similarly, the study examines the impact of carbon emission reduction in developed NEICs on Nigerian oil and gas exports. To achieve this, the objective philosophical dimension is used in order to evaluate quantitatively the impact of renewable energy consumption and carbon emission reduction in NEICs on Nigerian oil and gas exports. Subsequently, the subjective philosophical dimension is used in order to support the quantitative findings and solicit for further insights into the impact of global energy transition on Nigerian oil and gas revenue, budgets and plans to mitigate these impacts. Thus, semi-

structured interview was conducted with public decision makers and other stakeholders in Nigeria. The combination of the objective-subjective philosophical dimensions of social science via quantitative measurements and qualitative data from semi-structured interviews may give a robust understanding of the quantitative results and the impact of global energy transition on Nigerian oil and gas exports, revenue and budgets.

Consequently, the philosophical assumptions of the study are as follows. Ontologically, this study believes in the existence of pluralism of reality, which appreciates objective, subjective and intersubjective realities and their interrelations (Johnson and Christensen, 2010). Thus, the researcher moves back and forth in understanding reality (Maxcy, 2003). In this study, the researcher has obtained the quantitative measurement of the impact of renewable energy consumption and carbon emission reduction in NEICs on Nigerian oil and gas exports demand. The quantitative approach is a research method associated with positivist who believes in objective reality. On the other hand, the supportive qualitative analysis via semi-structured interviews is a research method associated with interpretivists that believe in subjective reality (Collis and Hussey, 2014).

Therefore, in an attempt to achieve the study aim and objectives, the study is moving back and forth within the realms of objective and subjective reality and the interrelations between them to answer raised hypotheses and research questions (Johnston and Christensen, 2010). This position is consistent with Laughlin (1995) who advocates for the middle of the range approach between the objective and subjective dichotomy or moving along back and forth between realism and idealist on the objective-subjective dichotomy developed by Blaikie (2010). The ontological assumption of this study is summarily termed as the pluralism, which appreciates both the objective and subjective and intersubjective reality and their interrelations (Johnson and Christensen, 2010). Closely following ontological assumption is epistemological assumption.

Based on the ontological stand, the study selected pragmatic epistemological assumption, which defines what works in specific contexts and the use of universal standards and specific needs standards in order to answer the hypotheses and research questions (Johnston and Christensen, 2010). Thus, the importance of theory laden empirical observations and subjective meaning in generating valid knowledge are recognized (Johnson and Onwuegbuzie, 2004). This could be argued as moving along the continuum instead of being at either of the two extreme ends of positivism and anti-positivism epistemological divides.

Conversely, the pragmatic epistemological assumption of Johnston and Christensen (2010) is consistent with the middle range epistemological assumption of Laughlin (1995). He argued that in an attempt to obtain knowledge generalisations about reality are possible, although not guaranteed to exist, yet these will always be skeletal requiring empirical details in order to be meaningful (Laughlin, 1995). Therefore, in an attempt to evaluate the impact of renewable energy consumption and carbon emission reduction measures in major net energy importing countries on Nigerian oil and gas exports demand using quantitative data as capable of revealing causal relationships between constituents of the social world (Collis and Hussey, 2014). Similarly, qualitative data obtained from the semi-structured interviews with decision and policy makers and other stakeholders in Nigerian justifies the anti-positivist/interpretivist ontological dimension. Thus, both quantitative and qualitative findings are important in arriving at valid knowledge in this study. Assumptions on human nature are also acknowledged as important in undertaking social science research.

On human nature, this study chose the position that stresses human nature as being dynamic, complex, and partially predictable (Johnston and Christensen, 2010). In this regard, human nature and behaviour are influenced by multiple factors such as the environment, nature, freewill and chance and all these should be taken into consideration in social science studies. Therefore, human nature and behaviour are neither mechanistically determined (determinism) by the environment nor totally free willed (voluntarism); rather, combination of both

produces human nature and behaviour. Within the context of this study, the perceptions of public decision makers and other stakeholders has been sought on the subject matter. Being humans, the views expressed was done under free-willed. However, the tendencies for environmental influences may not be discarded. Based on the chosen ontological, epistemological, and human nature assumptions, the methodological choice is hereby presented underneath.

On the one hand of the methodological continuum, is nomothetic approach to social science which values established systematic protocols, techniques as well as hypothesis testing and theories with data as a basis of understanding the social reality as suggested by Burrell and Morgan, (1979). On the other hand, ideographic approach, which emphasizes that in order to understand the social world, first-hand information, should be obtained about the investigated subject matter. This study is underpinned by both philosophies (mixture of ideographic and nomothetic assumptions) in undertaking research of this nature.

Thus, quantitative time-series data from secondary sources, which is analysed using ARDL-bound testing approach, represents nomothetic approach. Conversely, the semi-structured interviews conducted with public decision makers and other stakeholders is an attempt to get first-hand information from important actors in Nigeria in order to further understand the problems under investigation. Therefore, in trying to empirically evaluate the impact of global energy transition on Nigerian oil and gas exports on one hand, and supporting the quantitative findings by providing further insights into these impacts via semi-structured interviews on the other hand, the study used a mixture of both ideographic and nomothetic methodological approaches. From this perspective, the methodology of the research could be seen as following the pragmatic approach. The research paradigm underpinning this study is hereby discussed in the next section.

6.4.2 Research Paradigm

Based on the above proceedings, this study adopted pragmatic paradigm, which involves the mixture of positivism and interpretivism paradigms in a single

research (Rorty, 1999; Feilzer, 2010; Johnston and Christensen, 2010; Saunders, Lewis and Thornhill, 2012; Goldkuhl, 2012; Biddle and Schafft, 2015). Bature (2014) and Pansiri (2005) described pragmatic paradigm as the foundation of mixed method research. This chosen approach is consistent with the pluralism ontological assumptions and pragmatism epistemological stand previously adopted. Collis and Hussey (2014) states that research question(s) should determine the adoption of a particular paradigm. Based on this, the pragmatic paradigm is the most appropriate medium through which the study research questions could be answered.

However, either positivism or interpretivism paradigms can also be adopted as a research approach. Positivism paradigm is underpinned by the belief that social reality is best understood using deductive process and scientific protocols. On the other hand, interpretivism paradigm involves "an inductive process with a view to providing interpretive understanding of social phenomena within a particular context" (Collis and Hussey, 2009, p. 57). Currently, the combination of paradigms, quantitative and qualitative research techniques, methods, approaches, into a single study are encouraged because it produces better outcome (Sale, Lohfeld and Brazil 2002; Johnson and Onwuegbuzie, 2004; Creswell, 2013; Bryman, 2015). Miles and Huberman (1994:4) in Kyari (2013: 143) states as thus:

> "In epistemological debates it is tempting to operate at the poles. But in the actual practice of empirical research, we believe that all of us ... are closer to the centre with multiple overlaps" ... an increasing number of researchers now see the world with more pragmatic, ecumenical eyes".

By adopting philosophical position of pragmatism, the researcher is not only being independent with the problem investigated but became part of it to understand the problem from the insider perspective. It is centred on the belief that theories, programs or actions that proved to work for particular group of people, should be viewed as the ones valid for those people. This is consistent with the central idea of pragmatist that knowledge arises out of actions, situations, and consequences, thus, are concerned with what works (Creswell, 2013). Therefore,

the approach focus on desired ends, thus, research was conducted based on what will help the researcher answer raised research questions. Its ontological assumptions are pluralism, appreciation of objective, subjective and inter-subjective reality and their interrelations. The next section presents the appropriate methodology and methods selected to undertake this study.

6.5 Research Methods

The study has adopted triangulation and mixed methods as the research methodology and methods respectively.

6.5.1 Triangulation

Triangulation[42] is defined as the 'process of verification that increases validity by incorporating several viewpoints and methods. In the social sciences, it refers to the combination of two or more theories, data sources, methods or investigators in one study of a single phenomenon to converge on a single construct, and can be employed in both quantitative (validation) and qualitative (inquiry) studies' (Yeasmin, 2012, p. 156). This is consistent with Collis and Hussey (2014) who defined it as "the use of multiple sources of data, different research methods and/or more than one researcher to investigate the same phenomenon in a study" (p. 85).

Yesmin and Rahman (2012) and Collis and Hussey (2014) stress that a researcher should choose a methodology that corresponds with the philosophical assumptions and paradigms of the study. Relying on the above, the study chose triangulation because it corresponds with the adopted philosophical assumptions and paradigms of the problem under investigation. However, as revealed in the

[42] Theoretical triangulation means using more than one theoretical position to interpret data. Data triangulation entails retrieving data from different sources to form one body of data. Methodological triangulation is the use of more than one research method or data collection technique; and investigator triangulation refers to the use of more than one investigator in the field to collect and interpret data on the same phenomenon being investigated (Bryman, 2015; Yeasmin and Rahman, 2012; Denzin, 1978). It is established that depending on the purpose of the study, more than one type of triangulation can be used in the same study (Yeasmin and Rahman, 2012).

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literature, there are various kinds of methodology used in undertaking social science research. These are experimental studies; surveys; cross-sectional studies and longitudinal studies. Others are hermeneutics; ethnography; participative enquiry; action research; case studies; grounded theory; feminist, gender and ethnicity studies.

It is argued that much of research strands in social sciences are founded on using single research method, which may be having certain limitations (Yeasmin and Rahman, 2012). However, the use of multiple methods is seen as capable of enhancing confidence (Yeasmin and Rahman, 2012; Bryman, 2015) and precision in the ensuing findings (Denzin, 1978; Bryman, 2004, 2015). Similarly, it is argued that findings from two or more independent measurement processes greatly reduce uncertainties of interpretation (Sechrest, et al., 1966). Thus, literature strands are arguing for the use of multiple methods so that the deficiencies of one method could be overcome by the other (Yeasmin and Rahman, 2012). This could be supported by documented evidence that by combining different theories, data, methods and observers, the weakness or inherent biases in using only one of these could be overcome (Yeasmin and Rahman, 2012). In this way, researchers become more confident of their results; uncover different dimensions of investigated phenomenon; by its comprehensiveness, theoretical triangulation could serve as a critical test for competing theories and could lead to synthesis of theories (Jick, 1979). Thus, this study adopted the mixed methods, data and combined a theory and analytical framework as explained in section 6.5.2, 6.5.3 and chapter five respectively. Thus, after selecting an appropriate methodology, the next section presents the research methods for the study.

6.5.2 Mixed Methods Research

This is a research method in which the quantitative[43] and qualitative[44] research methods, approaches or other research paradigms are mixed in a single research study or set of related studies (Bature, 2014; Biddle and Schafft, 2015; Macmanamny, et al., 2015). The combination of quantitative and qualitative research techniques, methods, approaches, data, concepts or languages into a single study is generally referred to as mixed methods (Brannen, 1992; Trochim, 1999; Johnson and Onwuegbuzie, 2004; Creswell, 2013). This method of research is also termed as multi-methods (Brannen, 1992), multi strategy (Bryman, 2004, 2015), or mixed-methodology (Tashakkori and Teddlie, 1998).

Similarly, other scholars had equally stress that research could be quantitative in its approach, but with qualitative contents (Trochim, 1999; Collis and Hussey, 2009; Jankowicz, 2011). This suggests that quantitative or qualitative aspects of the research could be undertaken concurrently or sequentially. However, the appropriateness of the mixture depends on research questions, situational and practical issues facing the researcher (Johnson and Christensen, 2010). Pragmatism paradigm is capable of allowing researchers the freewill to mix different paradigms useful in solving research problems. This is achieved by discarding the philosophical debate about reality and nature of knowledge, as suggested by Burrell and Morgan (1979). This results in the offsetting of the weakness of one paradigm by the strength of the other (Collis and Hussey, 2014).

This pluralist approach offers the researcher alternatives to the dichotomous choice between (post) positivism and constructivism (Creswell and Clark, 2007; Morgan, 2007; Biesta, 2010; Feilzer, 2010; Hannes and Lockwood, 2011). Similarly, it is argued as an attempt to "cross the divide between the quantitative

[43] Quantitative approach is another form of research methods, which identify and quantify variables to determine cause-effect, and tests hypotheses and theory (s) with data (Johnson and Christensen, 2010; Sullivan and Sergeant, 2011). It is a scientific method thus denies researchers the freedom, choice and peoples' ability to interpret their experiences.

[44] Qualitative approach is the direct opposite of quantitative approach.

and qualitative and positivist and non-positivist" (Curran and Blackburn, 2000, p. 123). It is argued that this type of research has complementary strength and has no overlapping weakness (Johnson and Turner, 2003). This is based on the presumption that by combining two or more research methods having different strength and weakness, there is less likelihood of missing something important or making mistakes (Lincoln and Guba, 1985).

Its ontological assumptions are pluralism, appreciation of objective, subjective and inter-subjective reality and their interrelations. Epistemologically, the approach belief in pragmatism. It views human thought and behaviour as being dynamic, complex, and partially predictable which is however, influenced by multiple factors such as environment, freewill, nature, and fortuity. The objective of this research method is to provide complex and full understanding from multiple perspectives (Johnson and Christensen, 2010). The next section discusses the methods of collecting the relevant data.

6.5.3 Data Collection Methods

Data collection method is a technique for collecting data (Collis and Hussey, 2014). Data collection methods largely depend on the type of data to be used and the nature of research question(s) to be answered (Blaikie, 2010; Hassan, 2012). Generally, data can be categorised into two main types: primary data and secondary data. Secondary data are collected from data bank of organisations, institutions, governments and non-governmental organisations stored for public use. In this PhD project, the secondary data for all the variables has been collected in the form of annual time-series from various sources. Detailed discussions on the nature of the secondary data are made in subsection 6.6

On the other hand, primary data are the type of data collected through field survey in the form of questionnaires, observations and interviews. Interview (s) is "a method for collecting primary data in which a sample of interviewees are asked questions to find out what they think, do or feel" (Collis and Hussey, 2009 p.194). The methods are argued as a major type of techniques of collecting data through questioning and are acknowledged as some of the most effective ways

of data collection (Easterby-Smith, Thorpe and Lowe, 2002). It is established that the most common classification of interviews are structured[45], unstructured[46] and semi-structured[47] (Burns, 2000; Collis and Hussey, 2009).

This study focuses on semi-structured interview located within the structured and unstructured continuum. Semi-structured interview is a technique used to collect qualitative data by creating a situation (the interview) which allows respondent time and scope to say their views and opinions on the subject being investigated (Collis and Hussey, 2014). The objective is to understand respondent's point of view on the subject rather than generalizing about behaviour (Hardon, Hodgkin, and Fresle, 2004). The method is focused in terms of the topics to be covered, yet flexible, as it is possible to direct into areas that appears to provide rich data and or additional useful information (Lancaster, 2005). Consistent to this, it is argued that although some questions may be pre-determined, the interviewer can ask additional questions in order to obtain relevant detailed information (Collis and Hussey, 2014).

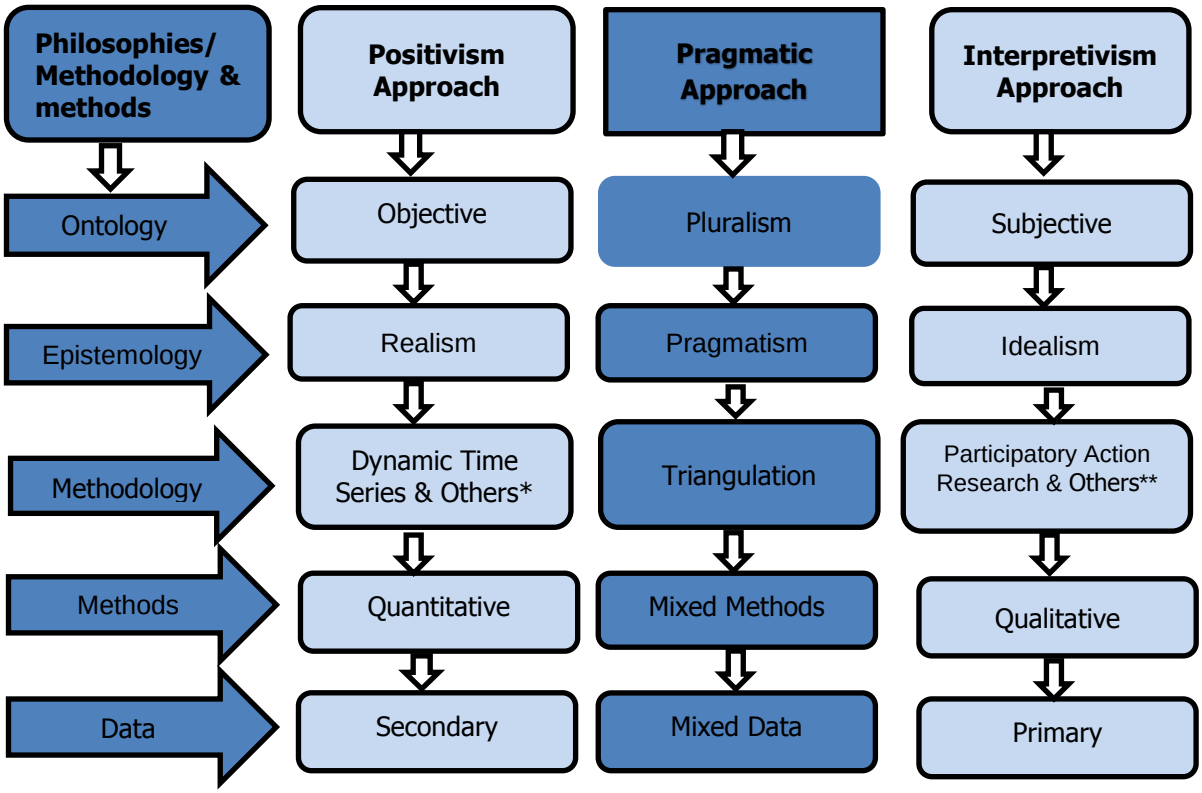
The method has the strength of being suitable for exploring sensitive areas such as attitudes, values, beliefs, motives and allows for multiplicity of questions to be asked (Barriball and While, 1994). Moreover, the method pools the attributes of both structured and unstructured interview methods, thus assists the researcher to be in control of the interview proceedings by making the participants stick to the research questions in order to achieve the research agenda. Similarly, non-verbal indicators in the course of the interview could be used to adjudge truthfulness (Farnsworth, 2010). However, some of the established weaknesses of this method, as opined by Hardon, Hodgkin, and Fresle, (2004) are that it is time consuming, expensive and dependent on the skills of the interviewer.

[45] Structured interview is aimed at gathering data from large samples, ensure consistency of response and is therefore associated with quantitative research (Collis and Hussey, 2009).
[46] Un-structured interview also referred to as qualitative, loose, non-directive, open ended encounters between the researcher and the participants directed toward understanding participants' perspective on the subject of discourse.
[47] This has been explained in details in the succeeding paragraphs.

Furthermore, the expected rigour in data handling and confidentiality of the obtained qualitative information may be difficult to handle and analyse.

Based on the preceding discussions, participants were allowed to comment on the quantitative findings and freely shed further light into the impact of global energy transition on Nigeria. Therefore, in this PhD project, in order to obtain in-depth knowledge on the perception of public decision and policy makers and other stakeholders, semi-structured interview is considered most suitable. Information about study population for primary data is discussed in details in section 6.7. Overall, the research approach, methodology and methods in social science including the one adopted for this study, as highlighted can be summarised below.

Figure 6-4 Summary of Research Approaches in Social Sciences



Notes: According to Collins and Hussey (2014), * Experimental research, surveys; cross-sectional studies; and longitudinal studies are documented as methodologies associated with positivism**.** On the other hand, ** Grounded theory; hermeneutics; ethnography; participative enquiry; action research; case studies; feminist, gender and ethnicity studies are recognized as studies associated with interpretive research approach/paradigm.

The research population and sample population for the study are subsequently discussed.

6.5.4 The Population of the Study

The initial task in sampling is to ascertain and explain specifically the members of population to be sampled (Burns, 2000). According to Collins and Hussey (2009), research population represents the total collection of all properties, including objects and individuals to be studied. In other words, research population stand to highlight the general common characteristics of the population within which a researcher can observe to undertake his study. However, due to constraints of time and resources, it is difficult to study the entire population. The researcher must make selection from the research population. The selected population is generally recognised as the sample. Therefore, a sample is subsets that represent the entire population of study. It is expected that the results obtained from the sample could be applied on the research population. This study has two research populations: the study populations for secondary and primary data[48]. The next subsection discusses the study population for the secondary data.

6.6 Study Population for the Secondary Data

According to the Nigerian National Petroleum Corporation (NNPC ASB) reports (2014), Nigeria exports its crude oil and gas to all the six continents of the world but confined to thirty six (36) countries[49]. Table 6.1 below provides the various countries that were considered to be the research population as regards the secondary data.

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[48] The study population for the primary data is discussed in details in section 6.7.

[49] According to the current NNPC Report (2014), Nigeria exports its oil and gas to the following regions (countries). North America (Canada and USA); South America (Argentina, Brazil, Uruguay and Peru); Europe (Denmark, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Poland, Spain, Sweden, Switzerland, Turkey, UK, Scotland, Malta, Bulgaria and Croatia); Ocean Pacific (Australia); Asia (Singapore, India, Indonesia, Taiwan, China, Malaysia and Thailand); lastly, Africa (Ghana, Cote D'ivore, Cameroun, Senegal, South Africa, Togo, and Benin Republic).

Table 6-1 The Secondary Data Study Population

	Nigerian Oil and Gas Exports Regions	Number of Countries as in 2014	Percentage of Nigerian Oil and Gas Exports				
			2014	2013	2010	2005	2000
1.	Europe	17	47	44	20	17	24
2.	North America	2	4	12	41	51	46
3.	South America	4	12	12	9	6	6
4.	Oceania Pacific/Australia	1	1	1	1	0	0
5.	Asia	7	25	20	17	18	18
6.	Africa	6	11	11	12	8	6
	Total	36	100	100	100	100	100

Source: NNPC ASB, 2014.

As shown in Table 2 above, Nigeria exports its crude oil and gas to six regions of the world. However, the researcher employed stratified random sampling (SRM[50]) to select NEICs in those regions countries that Nigeria exports at least 2% and above of its total oil and gas to represent the population for the secondary data. In addition, availability of data was part of the reason for their selection. However, where data of all the variables for each country is available, other methods under the probability sampling may be used to minimise the inherent subjectivity in stratified random sampling. As shown in Table 6.1 above, Nigeria exported 51%, 41% and 4% of its total oil and gas to North America during the year 2005, 2010 and 2014 respectively. However, USA was selected because Nigeria exported 45%, 36% and 3% of its total oil and gas within these periods (Table 6.1). Similarly, out of the 17 EU member countries that Nigeria exports its oil and gas, 14 were selected based on the above criteria. Thus, USA and 14 EU member countries are labelled as developed NEICs, which accounted for 49% of Nigerian total oil and gas exports for these periods (Table 6.2).

[50] This is a probability sampling technique associated with quantitative research, which gives equal opportunities of selecting each units from the population based on defined criteria. In this study, the criteria used are (1) NEICs that Nigeria exports at least 2% and above (2) Availability of data in other variables.

On the other hand, Nigerian oil and gas exports to the Asian region accounted for 18%, 17% and 25% for the year 2005, 2010 and 2014 respectively (Table 6.1). However, China and India were selected in the region due to the percentage of their oil and gas imports from Nigeria was at least 2% and above during these periods. The duo accounts for 15%, 16% and 19% of Nigerian total oil and gas exports volume to Asian region during the year 2010, 2013 and 2014 respectively (Table 6.1). Similarly, only Brazil and South Africa were selected to represent South America and the African continents (Table 6.1). Nigeria exports 8%, 9% and 10% of its total oil and gas to Brazil during the year 2010, 2013, and 2014 respectively. On the other hand, South Africa accounts for 3%, 2%, and 3% during the year 2010, 2013 and 2014 respectively. These four countries (China, India, Brazil and South Africa) represent the emerging NEICs and they account for 32% of Nigerian total oil and gas exports for these periods. The countries selected are shown in Table 6.2 below, which represents the sample for the secondary of the study.

Table 6-2 Population Sample for Secondary Data

	Nig. Oil Export Regions	**Nig. Oil & Gas Export Countries Selected**	**Number of Export Countries**	**Percentage of Nigerian Oil & Gas Exports**				
				2014	2013	2010	2005	2000
1.	Europe	European Countries	14	46	43	20	18	24
2.	North America	USA	1	3	10	36	45	44
3.	South America	Brazil	1	10	9	8	5	3
4.	Asia	China & India	2	19	16	15	12	13
5.	Africa	South Africa	1	3	2	3	2	1
	Sub-Total		**19**	**81**	**79**	**82**	**82**	**85**
6.		Other countries not selected	18	19	21	18	18	15
	Total		37	100	100	100	100	100

Source: NNPC ASB, 2014.

As presented in Table 6.2 above, the significant percentage of the study population selected is envisaged to represent the behaviour of the research population (Brooks, 2008). Nigeria exports averagely about 80% of its total oil

and gas to these countries over the selected period of 1980 to 2014. However, Nigeria exports 82%, 79% and 81% of its total oil and gas to these selected countries combined in the year 2010, 2013 and 2014 respectively. Other countries not selected account for the remaining 20 percent. Therefore, it is optimistic that the selected 19 NEICs (categorised into developed NEICs and emerging NEICs) and the period from 1980 to 2014 have adequately represented the overall population. Also, the sample size conforms to the study of Narayan, (2002) which argues that small observations gives better statistical results compared with larger sample size. The nature of the secondary data is discussed in the next subsection.

6.6.1 Nature and Sources of Secondary Data

In order to test the postulated hypotheses, the study has collected macro-economic secondary data from different sources, national and international data bank. The collected data on all the variables are in the form of annual time series for the period 1980 to 2014 for Nigeria, developed NEICs (I4 EU member countries and USA) and emerging NEICs (China, India, Brazil and South Africa), as mentioned in Table 6.2 above. Table 6.3 below provides the variables and their sources.

Table 6-3 Variables and Data Sources

Variables	Description	Sources
NOE	Nigerian oil and gas exports to developed NEICs and emerging NEICs	IEA and NNPC
REDE	Renewable energy consumption in developed NEICs	EIA
REEE	Renewable energy consumption in emerging NEICs	EIA
CEDE	Carbon emissions from petroleum in developed NEICs	EIA
GDPDE	GDP per capita in developed NEICs	World Bank
GDPE	GDP per capita in emerging NEICs	World Bank
OPD	Oil price in US Dollars	CBN

6.6.2 Specification of the Variables

The main variables in an econometric analysis may be categorised into two: the dependent[51] and independent[52] variables. According to Gujarati (2003) and Allen and Fildes (2001), the values of other variables (independent) are the determinant of the values of one variable (dependent). This implies that outcome of regressand variable depends on the values of the regressors. The dependent variable is usually denoted by Y and the independent variables by$X_1,\ X_2, X_3 \ldots\ldots X_n$.The variables of the study will be discussed as stated in the next subsections.

6.6.2.1 Dependent Variable

1. Nigerian Oil and Gas Exports

The data on Nigerian oil and gas exports volume to various countries and regions are available on an annual basis and were used as the dependent variable. However, developed NEICs (14 EU and USA) imports from Nigeria measured in barrels[53] are used as Nigerian oil and gas exports to these countries. Using export volume as against the revenue can be justified from policy and methodological perspectives as follows. Export volume is a more stable measure of the Nigeria's capacity to produce oil and gas as an energy resources. Oil and gas revenue is subject to volatilities in the international oil price, which tend to inflate/deflate the total revenue from oil and gas sales. Therefore, this is not a good indicator for policy formulation, implementation and analysis. From these reasons, it evident that using exports volume makes the findings of the study more relevant for policy formulation, implementation and analysis.

Thus, Nigerian oil and gas exports to NEICs are predicated on several factors. However, the key factors identified and used in this study are found within the

[51] This is also called y, explained, regressand, endogenous, controlled or left hand side variable.
[52] Other terms for it includes: x, right-hand side, explanatory, regressor, exogenous or control variables.
[53] The available data from International Energy Agency was in thousands tonnes of oil equivalents. It was converted to barrels of oil equivalent (boe) by multiplying by 7142.857.

scope of macroeconomic and fiscal variables which was used in several studies (Szklo and Schaeffer, 2006; Chien and Hu, 2008; Akella et al., 2009; Sadosky 2009a; Jorgenson, 2012; Tugcu, Ozturk and Aslan 2012; Payne, 2012; Von Eije, von Eije, and Westerman 2012; York, 2012; Smith, 2014).

More specifically, oil price, GDP per capita, renewable energy consumption and carbon emission level in NEICs are used as key determinant of Nigerian oil and gas exports to NEICs. Since Nigeria is a net energy exporter, it is expected that a higher consumption of renewable energy and stringent efforts to reduce carbon emission level in NEICs may affect Nigerian oil and gas exports volume. Therefore, consumption of renewable and carbon emission level is expected to be negatively related to Nigerian oil and gas exports demand. Similarly, the low demand and consumption of the oil and gas by the NEICs may press down the oil price. Ultimately, this may affect Nigerian oil and gas exports volume, oil price and consequently reduces Nigerian oil and gas revenue.

6.6.2.2 Independent Variables

The independent variables were selected based on the literature reviewed of previous empirical studies (Chien and Hu, 2008; Tugcu, Ozturk and Aslan 2012; Payne, 2012; Von Eije, von Eije, and Westerman 2012; McCollum, et al., 2014). As mentioned earlier, the independent variables of this study are four: renewable energy, carbon emissions, real GDP per capita and oil price. The heading below discusses the independent variables.

1. **Renewable Energy Consumption**

The total renewable energy consumption comprises of solar, wind, geothermal, tidal and wave. Others are biomass, waste and hydroelectricity. Biofuels is excluded due to lack of sufficient data. This key independent variable is measured in billion kilowatt/hrs. Macro Environmental and carbon accountability as well as economic sustainability are the main factors influencing renewable energy consumption in NEICs. However, there are others factors driving renewable energy consumption such as level of technology and government policies. For instance, within the context of developed NEICs, government provides incentive

towards renewable energy consumption and development. These supports are in the form of subsidy on consumption and tax exemption on outputs. On the other hand, emerging NEICs are faced with financial and technical constraints towards the development of renewable energy. Thus, it is envisaged that, renewable energy consumption as a substitute to conventional energy by NEICs may affect Nigerian oil and gas exports. Also, it is expected that the level of effect between developed NEICs and emerging NEICs on Nigerian oil and gas exports may differ significantly.

2. Carbon Emissions

Demand theory also implies that an oil and gas exports to NEICs is affected by other factors such as environmental policies, macro carbon accountability measures to reduce carbon emission level. According to International Energy (IEA) Statistics (2015), hydrocarbons utilization significantly contributes to carbon emissions, accounting for 53.4% of total global carbon emission by fuels. Similarly, the literature suggests that when countries attained economic growth, they become more concerned about environmental and carbon accountability; they commit more resources to reduce carbon emission. As measures to reduce carbon emission by these countries may lead to low consumption of oil and gas and this may affect Nigerian oil and gas exports to these countries. Thus, the study used the carbon emissions of these NEICs as one of the key variables and it is expected that to have a negative sign. Similarly, carbon emissions are expressed in metric tons of carbon and were sourced from the USA Energy Information Administration, US Department of Energy.

3. Oil Price

The current trading currency in the international energy market is the US Dollars. Thus, oil price per barrel is denominated based on US Dollar. Oil price is postulated to have an ambiguous impact on Nigerian oil and gas export. An increase in oil price will increase Nigerian oil and gas exports and conversely, reduce NEICs demand of Nigerian oil and gas exports. On the one hand, as the oil price decreases, there will be less oil revenue accruing to Nigeria and vice-versa, as argued by (Bruno and Sachs, 1982; Harberger, 1983; Ayadi, 2005;

Huntington, 2010). On the other hand, when oil price increases, NEICs may be transiting away from conventional energy sources to renewable energy to avert oil price shock and GDP loss on their economy, as argued these authors (Awerbuch and Sauter, 2006; Chang,Ting-Huan, 2009; Sadorsky, 2009b).

It is expected that an increase in oil price cause more renewable energy consumption in NEICs, which predictably reduces Nigerian oil and gas exports. This is because as oil price increases on one hand, the NEICs are subsidizing the price of renewable energy on the other hand. NEICs may prefer consuming renewable energy that is environmentally friendly and provide economic savings than consuming Nigerian oil and gas. When demand for oil and gas fall and supply increases, it may result to oil price crash. Thus, oil price is expected to be either negatively or positively related with Nigerian oil and gas exports demand.

4. Real GDP Per Capita

Data on GDP Per capita, measured in constant US Dollars is sourced from the World Bank. The literature reveals that the level of income is one of the key determinants of energy consumption, as found by (Soytas and Sari, 2003; Wolde-Rufael, 2004; Zhang and Cheng 2009; Chang,Ting-Huan, 2009; Sadorsky, 2009b). Use of GDP per capita captures purchasing power and aggregate demand in the respective NEICs, which determines consumption of energy. Moreover, most renewable energy policies are implemented through taxes and subsidies, which are better, reflected by per capita GDP and directly affect it, as against the aggregate GDP. In addition, one of the most important determinants of energy demand/consumption is population. Therefore, using GDP per capita has captured this aspect of energy demand, thereby reduces the omitted variables bias in the models and parameter estimates. Based on the foregoing, the use of per capita has no limitations; it rather has some advantages. Hence, the GDP per capita of NEICs was used to represents level of income is considered as a determinant of Nigerian oil and gas exports to NEICs. When GDP per capita is high, energy intensity may tend to be high; this increases oil and gas exports of countries such as Nigeria. However, when GDP per capita is low, energy intensity may tend to be low; this reduces Nigerian oil and gas exports demand.

Similarly, when oil price is high, NEICs may make efforts to reduce the effect of oil price shock in order safeguard financial loss. Hence, for the purpose of economic sustainability, may be willing to run its economic activities on renewable energy to sustain its GDP per capita. Thus, for many of NEICs, reducing conventional energy consumption is to safeguard financial, GDP and asset loss arising from the imported energy (Chang, 2009). Hence, GDP per capita of NEICs is predicted to have negative effect on Nigerian oil and gas exports. The next section discusses the data transformation and aggregation method used.

6.6.3 Data Transformation and Aggregation

The data for all the variables were transformed into log form in order to normalise the distribution of the data and unify the different units of measurements thereby easing the interpretation of results (Gujarati, 2009; Wooldridge, 2015). Moreover, it takes care of heteroscedasticity; removes non-linearity to some extent and no information is lost by taking the natural logarithm of the variables (Taylor and Peel, 2000; Vogelvang, 2005; Huisman, 2009). In relation to data aggregation, there exist numerous methods of aggregation (Lin and Sung, 1983; White, 1985; Tremblay, 1989; Gonzalez and Moral, 1995; Padilla, 1988; and Saayman and Saayman, 2008). For instance, the study by Padilla (1988) and Gonzalez and Moral (1995) used the weighted geometric average to aggregate their respective data. Also, Saayman and Saayman (2008) estimated elasticity of demand for tourism in Dubai and used fixed weights to aggregate the data set for the respective countries. However, Nosier (2012) opined that there is no general method of aggregation available in the literature; each study can adopt any methods that suit the circumstances of the study.

This study aggregated[54] the annual data for each of the independent variables (except oil price) in each models. For instance, the annual data for renewable energy for the fifteen developed NEICs were aggregated to arrive at the total for each year. This was repeated for all the remaining independent variables, except

[54] This is referring to aggregation of the annual data for each of the independent variables relating to the net importing countries.

oil prices. Following this, the total figure for each of the independent variables except oil prices for the emerging NEICs was arrived. The aggregated totals, which had been reached through the previous steps, were then tabled for each of the independent variables and combined with the dependent variables to run each of the three models. The next section discusses the method for secondary data analysis.

6.6.4 Method of Secondary Data Analysis

Several methods were found in the literature on studies of this kind on different countries over certain periods, as discussed in chapter two and three. Similarly, Autoregressive Distributed Lag (ARDL) Bounds testing integration technique is also used in demand modelling (Bentzen and Engsted 1993; Dargay and Gately, 1997; Gately and Huntington, 2002; Narayan, 2002; Hunt and Ninomiya, 2005; Chitnis and Hunt, 2012). For instance, Chitnis and Hunt (2012) estimated the UK transport and housing expenditure using the structural time series model. Similarly, Hunt and Ninomiya (2005) forecasted energy demand for Japan. Moreover, Narayan, 2002 used the Bonds testing approach to co-integration to examine tourism demand for Fiji.

ARDL model is a dynamic time series analysis where both the dependent and independent variables are lagged (Brooks, 2008). The lagging takes control of the time paths effect of the independent variables on the time paths of the dependent variable (Brooks, 2008; 2014). In other words, the dynamic model helps in capturing the lagged effects of the regressors on the regressed variables and reduces the effect of serial correlations. However, there are other method[55] of executing co-integration test (Engle and Granger, (1987); Johansen (1988) and Johansen and Juselius approaches (1990). For instance, Johansen (1988)

[55] There are other methods used in conducting co-integration test. The most popular one are two: Johansen (1991) maximum likelihood approach and the Phillips and Hansen (1990, PH) fully modified OLS procedure. Other methods are also being used. The two-step method of Engle and Granger (1987), the leads and lags estimation procedure proposed by Saikkonnen (1991). In addition, the stochastic common trends approach of Stock and Watson (1993) and the canonical method by Park (1992).

methods of co-integration require many independent variables and on the other hand, Engle and Granger (1987) cannot accommodate more than two independent variables in the model. Moreover, both Johansen (1998) and Engle and Granger (1987) methods require large samples. Also, these methods are considered to be conventional approaches which require the integration of the variable has to be in order I (1) (Duasa, 2007). As a result, the above co-integration technique was considered as rigid within the body of econometric literature (Pesaran and Shin, 1998). On the other hand, the ARDL technique appears to be flexible as it accommodates all classes of order of integration either I (1) or I (0) (Akpan, 2011; Akpan and Akpan, 2012; Naiya and Manap, 2013).

Moreover, the ARDL methodology is believed to have several advantages over other conventional methodologies. As mentioned earlier, its adaptability: it can be applied independent of whether the basic regressors are absolutely I (0), (I), or mutually cointegrated. Secondly, the methodology can be applied to studies that utilize small sample size (Tang and Nair, 2002; Duasa, 2007; Narayan, 2007), for example, the present study. As exhibited by Pesaran and Shin (1999), the small sample properties of the ARDL methodology gives preferable result over that of the Johansen and Juselius (1990) cointegration method. Whereas, fully-modified OLS procedure gives poor and biased estimates in small sample size (Banerjee, Dolado and Mestre 1998) which may result in making invalid inferences (Philips and Loretan, 1991). Lastly, the method makes estimation possible when most of the variables are endogenous (Alam and Quazi, 2003).

This study employs the ARDL-Bound testing used by Pesaran and Shin, (1998); Duasa, (2007) and Narayan, (2002) to estimate the determinants of Nigerian oil and gas exports. As mentioned in section 6.4.1, one part of this PhD is primarily interested about the impact of renewable energy consumption and carbon emission reduction in NEICs on Nigerian oil and gas exports demand. However, the effect of the key independent variables (renewable energy consumption and carbon emissions level) may not be immediate especially during one period, but with a lag over several periods. Therefore, ARDL-Bound testing techniques appears to be most appropriate for this part of the study, as it involves evaluating

both the short and long-run impacts of renewable energy consumption and carbon emission reduction in NEICs on Nigerian oil and gas exports demand. Also, the study has a small sample size of 24 years and the underlying variables are co-integrated in the order of I (0) and I (1). Other methods of co-integration techniques such as the Johansen and Engle-Granger methods could not be used due to their limitations as explained above. The estimation procedures are discussed in the next subsection.

6.6.4.1 Estimation Technique and Procedure

The ARDL time series analysis is characterised with basic procedure that is expected to be followed during the process of its application. This procedure ensures statistically efficient empirical model. The first step in conducting ARDL is to investigate the unit properties of the variable via unit root tests to know their stationarity. The study undertakes two-unit root tests: (i) Augmented Dickey Fuller (ADF) (ii) Phillips-Perron (PP) to ascertain the level of integration of the variables. The aim is to confirm that the variables are not I (2) to avoid spurious results. Consequently, the ARDL–Bonds testing approach is employed to examine the long-run co-integration relationship between the dependent and independent variables. Thus, the ARDL procedure to co-integration requires the estimation of the model and subsequently conduct the bounds testing using the F-statistics. Using Narayan (2002) approach, the three models[56] of the study are stated as thus:

$$\Delta \ln(NOE)_t = \alpha_0 + \lambda_1 \ln(CEDE)_{t-1} + \lambda_2 \ln(GDPEE)_{t-1} + \lambda_3 \ln(OPD)_{t-1} + \lambda_5 \ln(NOE)_{t-1} + \sum_{i=1}^{p} \beta_1 \Delta \ln(CEDE)_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta \ln(GDPEE)_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta(OPD)_{t-i} + \sum_{i=0}^{p} \beta_5 \Delta \ln(NOE)_{t-i} + \mu \ldots\ldots(1)$$

[56] Models 1 and 2 were about Nigerian oil and gas exports to developed NEICs. On the one hand, model 1 selected carbon emissions of these NEICs as one of the key independent variable and on the other hand, model 2 specified renewable energy consumption of these NEICs as one of the major independent variable. Similarly, model 3 was about Nigerian oil and gas exports to emerging NEICs and renewable energy consumption of these NEICs represented one of the major independent variables.

$$\Delta \ln(NOE)_t = \alpha_0 + \lambda_1 \ln(REDE)_{t-1} + \lambda_2 \ln(GDPDE)_{t-1} + \lambda_3 \ln(OPD)_{t-1} + \lambda_5 \ln(NOE)_{t-1} + \sum_{i=1}^{p} \beta_1 \Delta \ln(REDE)_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta \ln(GDPDE)_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta(OPD)_{t-i} + \sum_{i=0}^{p} \beta_5 \Delta \ln(NOE)_{t-i} + \mu \text{.....(1)}$$

$$\Delta \ln(NOE)_t = \alpha_0 + \lambda_1 \ln(REEE)_{t-1} + \lambda_2 \ln(GDPE)_{t-1} + \lambda_3 \ln(OPD)_{t-1} + \lambda_5 \ln(NOE)_{t-1} + \sum_{i=1}^{p} \beta_1 \Delta \ln(RECEE)_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta \ln(GDPE)_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta(OPD)_{t-i} + \sum_{i=0}^{p} \beta_5 \Delta \ln(NOE)_{t-i} + \mu \text{.....(3)}$$

Where p is the optimal lag length, NOE is Nigerian Oil and Gas Exports demand; CEDE is Petroleum Based Carbon Emissions in developed NEICs; GDPDE and GDPEE stand for GDP per capita in both developed NEICs and emerging NEICs respectively; OPD is the Oil Price in US Dollars. Others are REDE and REEE, which, represents Renewable Energy Consumption in both developed and emerging NEICs respectively and lastly, μ_t is the disturbance term. All the variables are in natural logarithm form. The F-test is conducted to ascertain if the variables are co-integrated that is if they have long run relationship. The null hypotheses for all the models: H_0: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 0$ are tested against the alternative hypotheses H_1: $\lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq 0$.

Similarly, the computed F-statistic is assessed using the critical values introduced by Pesaran et al., 2001). These critical values are of two types; the lower bound critical values and the upper bounds values. The former expect all the variables to be I(0) while the latter assume that all the variables to I(1). The decision rule is as thus: if the calculated F-statistic is less than the lower bound value, then H_0 cannot be rejected. Subsequently, we infer that there is no long run relationship between the variables.

Conversely, when the calculated F-statistic is greater than the upper bound value, then we reject the H_0 and conclude that there is a long run relationship between the variables of this study. However, when the calculated value lays amid the two extreme limits, then our outcome is considered inconclusive. Overall, for a long run relationship to exist between the dependent and independent variables, the calculated F-statistics must be greater than both the lower and upper bound. In the event that long run relationship between the variables is established, and

then a long-run equation is estimated for each of the three the models separately as follows:

$$\ln(NOE)_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \ln(CEDE)_{t-i} + \sum_{i=0}^{p} \beta_2 \ln(GDPDE)_{t-i} + \sum_{i=0}^{p} \beta_3 \ln(OPD)_{t-i} + \upsilon_t \ldots.(4)$$

$$\ln(NOE)_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \ln(REDE)_{t-i} + \sum_{i=0}^{p} \beta_2 \ln(GDPDE)_{t-i} + \sum_{i=0}^{p} \beta_3 \ln(OPD)_{t-i} + +\upsilon_t \ldots(5)$$

$$\ln(NOE)_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \ln(REEE)_{t-i} + \sum_{i=0}^{p} \beta_2 \ln(GDPE)_{t-i} + \sum_{i=0}^{p} \beta_3 \ln(OPD)_{t-i} + \upsilon_t \ldots..(6)$$

In order to estimate the short run coefficients, an error correction model (ECM) will be undertaken. The ARDL specification of the ECM for the three models are specified as thus:

$$\Delta \ln(NOE)_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta \ln(NOE)_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta \ln(CEDE)_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta \ln(GDPDE)_{t-i} +$$

$$\sum_{i=0}^{p} \beta_4 \Delta \ln(OPD)_{t-i} + \varphi ECT_{t-1} + \eta_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(7)$$

$$\Delta \ln(NOE)_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta \ln(NOE)_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta \ln(REDE)_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta \ln(GDPDE)_{t-i} +$$

$$\sum_{i=0}^{p} \beta_4 \Delta \ln(OPD)_{t-i} + \varphi ECT_{t-1} + \eta_t \quad . \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(8)$$

$$\Delta \ln(NOE)_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta \ln(NOE)_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta \ln(REEE)_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta \ln(GDPE)_{t-i} +$$

$$\sum_{i=0}^{p} \beta_4 \Delta \ln(OPD)_{t-i} + \varphi ECT_{t-1} + \eta_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(9)$$

At this point, it is important to consider the selection of optimal lag length at all the phases of analysis delineated above. Consequently, two main lag length selection criteria are utilized. These are the Schwarz Bayesian Criterion (SBC) and Akaike Information Criterion (AIC). The SBC repetitively select parsimonious model; this means it selects the minimum likely lag length. In contrast, the AIC selects the maximum lag length. However, the SBC-based models are considered to have minor forecast error than the AIC (Jalil and Ma, 2008). Consequently, in

order to fulfil the requirement of parsimony and evade enormous forecast error; the SBC-based models are given preference over the AIC-based lag length selection criteria (Pesaran and Shin, 1999).

Moreover, various diagnostic tests are employed to ensure the goodness of fit of the models and to qualify the results be relevant for policy formulation and recommendation. Thus, serial correlation test, normality test, stability test and heteroskedasticity test are conducted. Similarly, as suggested by Pesaran and Pesaran (2015), the cumulative sum of recursive residuals (CUSUM) and the cumulative sum square of recursive residuals (CUSUMSQ) tests are carried out to test for structural stability. The next section discusses the qualitative part, which deals with the primary data.

6.7 Study Population for the Primary Data

The researcher identified and selected four different groups to be the population for the primary data based on purposive sampling techniques[57]. These are: (1) the executive arm of government[58], (2) the academicians, (3) civil society groups and (4) the legislative arm of government[59]. These identified four different groups are selected in order to help address the research question two raised in chapter four. For the first group, which represents the executive arm of government, three senior staffs at the top management level from each of the six ministries, department and agencies (MDAs) were selected to participate in the interviews. The MDAs incudes: Ministry of Finance (MOF), National Planning Commission

[57] This is a non-probability sampling techniques associated with qualitative or mixed methods research where a researcher uses his personal discretion to select the units to get his research questions answered by the particular characteristics of the interviewees.

[58] Constitutionally, the executive arm of government is represented by the Office of the President, which directly empowers the President, or indirectly through the Vice-President and Ministers of government of the Federation or officers in the public service of the Federation to execute policies and programme of government.

[59] NASS statutorily are empowered to make laws and oversee the activities of the executive arm of government on any matter stated in the exclusive legislative list such as the economy, account and finance, trade and others. The substances of these powers are meant to provide peace, check, balances, and good governance.

(NPC), Budget Office of the Federation (BOF), Office of the Accountant General of the Federation (OAGF), Nigerian National Petroleum Corporation (NNPC) and Nigerian Investment Promotion Council (NIPC). These senior public officers were empowered by law to make plans, take public decisions and execute economic, financial policies and programmes of government at various capacities in the aforementioned MDAs. The MDAs of federal government that were chosen to represent the executive arm of government were discussed in details in chapter four.

Similarly, group two represents academics from universities, which were identified and selected as a category of study population for this study. Specifically, three senior lecturers of accounting, finance and economics in the faculty of management sciences were selected to participant in the interviews. This group of participants are known to possess in-depth knowledge in their respective disciplines. They are up to date in matters of finance, economy and governance and could provide new knowledge and understanding within the field.

Group three are civil societies made up of two senior independent researchers and two public financial and economic analysts were identified and selected as the study population for this study. These groups of participants are representative of the civil society that usually express independent opinion, which may differ with officials, and representatives of government. Independent researchers undertake research specifically on socio-economic and political matters thus, not under the payroll of government but offer consultancy services to their clients. On the other hand, public commentators and analyst are persons or group of persons that observe socio-economic and political events and make their opinion known to the public. Both senior independent researchers and public analyst carry out investigations on matters of public interest with a view of enlighten the public or call the attention of individuals, society and government to address these issues. Mostly, they are professionals in their own right and enjoy tremendous goodwill from the public.

Lastly, group four is the legislative arm of government and represented by the Senate[60] and the House of representatives[61] members elected to represent the people. These groups of elected officials formed the National Assembly (NASS). Statutorily, the NASS makes laws and oversee the activities of the executives on any matter stated in the exclusive legislative list[62] -economy, account and finance, trade and others. The substances of these powers are meant to provide stability, check, balances, and good governance. Hence, the study identified and selected one member in each of the six identified Committees[63] from the Senate and House of representatives to stand in as public policy makers.

Table 6-4 Summary of the Study Population for the Interviews

Group 1: Executive Arm	
Budget Office of the Federation (BOF)	3
Nigerian Investment Promotion Commission (NIPC)	3
The Nigerian National Petroleum Corporation (NNPC)	3
National Planning Commission (NPC)	3
Ministry of Finance (MOF)	3
Office of the Accountant General of the Federation (OAGF)	3
Sub-total	**18**
Group 2: Academicians	
University of Maiduguri	1
University of Abuja	1
Federal University Dutse	1
Sub-total	**3**
Group 3: Civil Society Group (CSG)	
Public Analyst	2
Independent Researcher	2
Sub-total	**4**
Group 4: Legislative Arm	
Senate and House of Representatives Committees on Finance	2
Senate and House of Representative Committees on National Planning and Economic Development	2
Senate and House Committees on Oil & Gas Upstream Activities	2
Sub-total	**6**
Total	**31**

[60] Each of the 36 states in Nigeria is represented by 3 senators and plus one from the Federal Capital Territory making a total of 109.
[61] The House of representative is made of 360 members elected from the 36 States, each State having handful of members depending on the population and number of local Government Councils.
[62] The Nigerian Constitution, 1999 has outlined in the second schedule 68 items as exclusive legislative list for the NASS.
[63] These Committees are: Senate and House of Representatives Committees on Finance, the Senate and House of Representative Committees on National Planning and Economic Development and lastly, the Senate and House Committees on upstream activities, which were discussed in details in chapter four.

6.7.1 Sample and Sampling Technique for the Primary Data

According to Webster (1985), sample is "a finite part of a statistical population whose properties are studied to gain information about the whole" (p.1100). In connection to qualitative enquiry, Patton (2002) suggested that there are no pre-determined standards for sample size. However, Sandelowski (1995) and Kyari (2013) opined that the selection of a sample size in qualitative research depends on the circumstances of the researcher and thus his/her judgemental discretion comes into play.

As mentioned earlier in section 6.7, the researcher selected and interviewed the 20 participants based on purposive sampling techniques. The interviewees who cut across three groups are shown in Table 6.5 below. Similarly, the participants comprise of 15 males and 5 females. The 20 participants interviewed from the three groups constitute 65% of the entire population thus representing the sample population for the primary data. Group one have fifteen (15) participants. These participants are senior and management staff from six selected MDAs, representing the Executive Arm of Government as against the 18 identified. The reason for interviewing 15 government officials was due to unavailability and inaccessibility, as effort to increase the number proved difficult due to their tight schedule at the time of researchers visit. As regards the academicians, the researcher interviewed two senior lectures from accounting and economics departments from two different universities instead of the three. Similarly, the researcher interviewed three from the civil society group (two senior public analysts and one senior independent researcher) that are knowledgeable in finance and economic as against the four. The limited number of academicians and civil society group was due to time and resource constraints.

As stated earlier, the study interviewed 20 participants as against the 31 identified. The remaining 11 participants which constitutes 25% comprises of group one (three participants); group two and three (one participants each); and group four (entire six Committees of the Senate and House of Representatives). Thus, group four accounted for significant proportion of those not interviewed. This is because the researcher could not get access to the members of the

National Assembly. The 20 participants interviewed from the three groups represent the sample population for the primary data as showed in Table 6.5 below.

Table 6-5 Summaries of the Interview Participants

Group 1: Executive Arm	
Budget Office of the Federation (BOF)	3
Nigerian Investment Promotion Commission (NIPC)	3
The Nigerian National Petroleum Corporation (NNPC)	3
National Planning Commission (NPC)	3
Ministry of Finance (MOF)	1
Office of the Accountant General of the Federation (OAGF)	2
Sub-total	**15**
Group 2: Academicians	
University of Maiduguri	1
University of Abuja	1
Federal University Dutse	-
Sub-total	**2**
Group 3: Civil Society Group (CSG)	
Public Analyst from Civil Society Legislative Advocacy Centre (CISLAC)	2
Independent Researcher	1
Sub-total	**3**
Total	**20**

The next section discusses the interview procedures and method of interview analysis.

6.8 Procedures for the Interviews and Method of Analysis

6.8.1 Procedure for the Interviews

Prior to conducting the interview, an ethical approval form was filled and approved by the University. Therefore, interviews were conducted in strict compliance of the approved ethical form. Similarly, the researcher explains to participants the purpose of undertaking the research and assured observance of utmost confidentiality by making their identity anonymous. Also, their permission to record the proceedings of the interviews were requested and some participants granted while others declined. The interviews were conducted in their places of work. The researcher used voice recorder to records the proceedings of the interviews. In addition, field notes were used to write salient points expressed by

the interviewees while recording. However, some participants that were not keen on voice recordings, the researcher recorded the proceeding in writing.

The tape-recorded interviews were manually transcribed. The researcher used manual method as an alternative to statistical packages due to volume and number of participants, which happens to be small although adequate to address the issue, been investigated. However, where bulky and complex data are involved, statistical packages that are specifically designed to handle such type of data such as Nvivo, SPSS and Amos may be used. In this study, the transcripts and the field notes formed the basis of data analysis.

6.8.2 Method of Interview Analysis

Data analysis encompasses the process of systematically organising data to ease presentation and understanding to end-users (Bodgen and Bilken, 1982). However, the process of data analysis in qualitative approach remains poorly described (Collins and Hussey, 2009). According to Miles and Huberman (1994) and Saunders, Lewis and Thornhill (2012), organisation and presentation of data consist of three main processes: data reduction, data codification and drawing conclusions. In this regard, the interviews data was reduced, important ideas taken and codified to arrive at the ultimate version, as suggested by Bodgen and Bilken, (1982), Miles and Huberman (1994), Saunders, Lewis and Thornhill (2012) and Bature, (2014). This provided for the basis of drawing conclusion and subsequently verified within the context of reviewed literature and theory used. In terms of the codification, the participants were assigned codes in order to make their identity anonymous. The interview questions were carefully directed to participants based on their organisations, work schedule, expertise and in some few instances availability. Table 6.6 below gives the summary of the participant's codes and their respective positions and organisations.

Table 6-6 Interview Participants and their Codes

Participants Code	Position	Organisation	Nature of Organisation
Group One			
R1, R2 and R3	Managerial	BOF	Government Agency
R4, R5 and R6	Managerial	NIPC	Government Agency
R7, R8 and R9	Managerial	NNPC	National Oil Company
R10, R11 and R12	Managerial	NPC	Government Agency
R13	Managerial	MOF	Government Agency
R14 and R15	Managerial	OAGOF	Government Agency
Group Two			
R16	Academicians	UNIMAID	Academic Institution
R17	Academicians	University of Abuja	Academic Institution
Group Three			
R18	Public Analyst	CISLAC	Civil Society Group
R19	Public Analyst	CISLAC	Civil Society Group
R20	Researcher	Civil Society	Civil Society Group

Note: BOF=Budget Office of the Federation; NIPC=Nigerian Investment Promotion Commission; NNPC=Nigerian National Petroleum Corporation; NNPC=National Planning Commission; MOF= Ministry of Finance; OAGF=Office of the Accountant General of the Federation; UNIMAID=University of Maiduguri; CISLAC= Civil Society Legislative Advocacy Centre.

6.9 Summary and Conclusion

This chapter has reviewed research methodology and methods in social science. The review revealed the philosophical assumptions and paradigms underpinning social science research. On this basis, the pragmatic paradigm (mixture of both subjective and objective philosophical approaches of social science research) was adopted as philosophical stands for this research project. Consequently, triangulation and mixed method as the methodology and research methods respectively. Consistent with research approach adopted, the study collected mixed types of data, secondary and primary. The secondary data in the form of macro-economic annual time series data collected for all the variables in different sources, which were analysed using Auto Regressive Distributive Lag (ARDL) Bounds testing approach of co-integration. Similarly, the primary data collected via semi-structured interviews from various MDAs, universities and civil society organisations were analysed manually. A statistical based package that handle bulky and complex data such as Nvivo, SPSS and Amos may be use as an alternative method. However, the manual method was used due to the volume of data collected, which only supported and provided further insights into the quantitative results. The next chapter shall present the analysis of the quantitative data and findings. The next chapter shall present the analysis of the quantitative data and findings.

Chapter 7.
Presentation of Quantitative Data, Analysis and Findings

7.1 Introduction

The previous chapter presented and discussed the research methodology and methods. This chapter is focused on the presentation of the quantitative results, their analysis and findings. The qualitative data in the form of supportive interview responses for the quantitative results and opinions of stakeholders will be analysed and discussed in the next chapter. The quantitative analyses have been done carried out on the bases of three developed models. The first model deals with the impact of impact of carbon emissions reduction in developed net energy importing countries (NEICs) on Nigerian oil and gas exports (NOEs). The second model focuses on the impact of renewable energy consumption in developed NEICs on NOEs. Lastly, model three deals with the impact of renewable energy consumption in emerging NEICs on NOEs. Each of these models was constructed in order to provide answers to the raised hypotheses and research objectives in sections 1.3 and 1.4 irrespectively. Before arriving at the main empirical results, the secondary datasets have been subjected to rigorous econometric and statistical screening to ensure fitness and robustness.

The chapter is structured as follows: Section 7.2 presents the summary of the descriptive statistics for the datasets. Section 7.3 focuses on the empirical results, analysis and findings for model one. The next section provides the results, analysis and findings for model two, while section 7.5 presents the data, empirical results and analysis of the last model. The last section (7.6) provides the interim summary of key findings.

7.2 Summary of the Descriptive Statistics for the Datasets

The summary of the descriptive statistics for the datasets is presented in Table 7.1 below. First, we look at the mean and median, which measures central tendency. On the one hand, the mean, signifies the average value a variable possesses, over the period and through countries. While the median indicates the

position of the middle of the distribution. As shown in Table 7.1, both the mean and the median appear to be the same, which implies that the distribution is symmetrical. However, when they are not, the distribution is considered skewed[64]. Secondly, a measure of the dispersion is required, using the standard deviation. This represents the deviation of the actual values from the mean value. The differences between the actual values from the mean values for each variable suggest variability of Nigerian oil and gas exports to these countries and variability among the NEICs in the sample. Further confirming this scenario is the range, which is the difference between the maximum and minimum values. The range is normal for all the variables, except in the case of oil price. Overall, the data is consistent, as both the mean and median are within the scope of the maximum and minimum values.

Table 7-1 Summary of the Descriptive Statistics for the Datasets

Variables	Mean	Median	Maximum	Minimum	Std. Dev.	Obs.
LNOE to D NEICs	8.645	8.671	8.782	8.512	0.074	35
LNOE to E NEICs	8.793	8.829	8.940	8.533	0.119	35
OPD	1.329	1.342	2.201	-0.259	0.873	35
REDE	2.942	2.938	3.183	2.811	0.099	35
REEE	2.763	2.745	3.176	2.372	0.243	35
CEDE	3.586	3.595	3.649	3.509	0.045	35
GDPDE	5.656	5.667	5.763	5.509	0.087	35
GDPE	4.060	4.026	4.232	3.978	0.081	35

LNOE to D NEICs=NOE to developed NEICs, LNOE to E NEICs=NOE to emerging NEICs

In addition to the descriptive statistics of the variables, the tests of unit root and determination of long run relationship, which are the major concern of the ARDL model, are conducted as discussed in the next sections.

[64] If the distribution is skewed to the right, the mean will be greater; if it is skewed to the left, the median will be greater.

7.3 Examining Impact of Carbon Emissions Cut in Developed NEICs on NOEs

As explained in the literature review (chapter 2), developed NEICs are the largest energy consumer, accounting for over 60% of total global energy use. However, most of these countries have introduced measures towards reducing oil and gas consumption and achieving energy and climate security. According to the NNPC ASB reports (2014), the developed NEICs are the major Nigerian oil and gas exports destination. These countries accounts for about 50% of Nigerian annual oil and gas exports. Thus, model 1 investigated the impact of carbon emission reduction in developed NEICs on NOEs. Equation 1 was used and is re-written below as:

$$\Delta \ln(NOE)_t = \alpha_0 + \lambda_1 \ln(CEDE)_{t-1} + \lambda_2 \ln(GDPDE)_{t-1} + \lambda_3 \ln(OPD)_{t-1} + \lambda_5 \ln(NOE)_{t-1} + \sum_{i=1}^{p} \beta_1 \Delta \ln(CEDE)_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta \ln(GDPDE)_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta(OPD)_{t-i} + \sum_{i=0}^{p} \beta_5 \Delta \ln(NOE)_{t-i} + \mu \ldots\ldots(1)$$

Before estimating this model, Augmented Dickey-Fuller (ADF) and Philips Perron (PP) unit root tests were conducted to avoid spurious results and invalid inferences. These tests were conducted at different specifications (constant and constant and trend), as presented in Table 7.2 and Table 7.3

7.3.1 ADF and PP Unit Root Tests

The results obtained for both tests, ADF and PP unit root tests at levels indicated that the variables have unit root and are therefore non-stationary (see Table 7.2).

Table 7-2 ADF and PP Tests Results on Log Levels of Variables

	ADF Statistic		PP Statistic		
Variables	Constant	Constant & Trend	Constant	Constant & Trend	Stationary Status
LNOE	-3.04**	-2.64	-3.16**	-2.84	Non stationary
LCEDE	-1.59	-1.402	-1.40	-1.33	Non stationary
LGDPE	-1.21	-2.57	-0.56	-2.26	Non stationary
LOPD	-0.21	-1.80	-0.16	-1.63	Non stationary

Notes: Lag lengths are selected based on Schwarz Bayesian Criterion; the test statistics are compared with critical values from Mckinnon (1996); ***, ** and * denote statistical significant, i.e. rejection of the null hypothesis at 1%, 5% and 10% levels of significance respectively.

The above unit roots results showed that the model is not fit for different types of econometric modelling, hence, there is a need for differencing the data series. However, the rules provide the data to be differenced only once. Consequently, when the data series were differenced, all the data series became stationary at first difference (see Table 7.3).

Table 7-3 ADF and PP Tests Results on First Differences of Log Variables

	ADF Statistic		PP Statistic		
Variables	Constant	Constant & Trend	Constant	Constant & Trend	Stationary Status
LNOE	-4.63***	-4.89***	-7.41***	-7.34***	I(1)
LCEDE	-4.63***	-4.89***	-4.63***	-7.58***	I(1)
LDPE	-4.26***	-4.22**	-4.20***	-4.70***	I(1)
LOPD	-5.84***	-6.46***	-5.85***	-8.24***	I(1)

Notes: Lag lengths are selected based on Schwarz Bayesian Criterion; the test statistics are compared with critical values from Mckinnon (1996); ***, ** and * denote statistical significant, i.e. rejection of the null hypothesis at 1%, 5% and 10% levels of significance respectively.

Therefore, the null hypothesis, which say that the variables are not stationary, is rejected based on MacKinnon (1996) critical values, which confirms the suitability of the transformed data for econometric modelling. Following Pesaran, Shin and Smith (2001), we proceed to undertake the next protocol, which is the bound test of cointegration to determine the long-run relationship between the variables.

7.3.2 Bound Tests

The bound test was conducted base on Joint F-test to test for joint significance of the variables. Specifically, the hypothesis in equation (1): H_0: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 0$ (no long-run relationship) is tested against the alternative H_1: $\lambda_1 = \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq 0$. The F-statistic value is (see Appendix B (1)) compared with the critical values obtained from Narayan (2004b: p.26), under appendix A1 case II: restricted intercept and no trend (see Table 7.4 and appendix E1).

Table 7-4 Bound Tests Critical Values

Level of significance	I(0)	I(1)
1%	4.522	**5.816***
5%	3.16	4.218
10%	2.626	3.55

Source: Narayan, 2004b

The bound test results show that the F-static calculated (8.925) (see Appendix B (1)) is greater than both the upper and lower critical bounds at 1% (see Table 7.4). Hence, we conclude that there is co-integration relationship between the variables and the null hypothesis of no long-run relationship among the variables is rejected forthwith. This suggests that there is a long-run relationship between NOEs to developed NEICs and the independent variables used in the model. It further indicates that Nigerian oil and gas exports demand can be influenced by oil price, GDP per capita and carbon emissions reduction in developed NEICs in the future. By implication, the bound results posit that Nigerian oil and gas revenue in the future is dependent on the fluctuations of these independent variables.

Accordingly, the underlying ARDL model 1 is estimated using the orders (p, q, r, s) which represents (1, 1, 2, 1) for the variables (see Appendix A1). Schwarz Bayesian Criterion (SBC) underpins the selection of these orders. The SBC chooses the minimum optimum lag length (Pesaran and Shin, 1999). The lag selection criterion used is the SBC, which chooses the smallest optimal lag, as shown in Table 7.5 below. This indicates that the model has an insignificant forecast error as suggested by (Pesaran and Shin, 1999). The software used for the analysis, i.e E-views automatically select the optimal lag length. However, prior to the estimation of the model, the researcher specifies the maximum lag of 2 especially for an annual data in order to conserve degrees of freedom (Pesaran and Shin, 1999; Narayan, 2004b: p.11[65]).

[65] This also applies to all the remaining models.

Table 7-5 Underlying ARDL Model 1 Results

Autoregressive Distributed Lag Estimates		
ARDL(1,1,2,1) selected based on Schwarz Bayesian Criterion		
Dependent variable is LNOE		
32 observations used for estimation from 1983 to 2014		
Regressor	Coefficient	T-Ratio[Prob]
LNOE(-1)	0.45183	3.1309[0.00]
LCEDE	2.4132	1.6465[0.11]
LCEDE(-1)	-5.8569	-4.2744[0.00]
LOPD	-0.070635	-0.5351[0.59]
LOPD(-1)	0.19761	1.5199[0.14]
LOPD(-2)	-0.34688	-2.7153[.012]
LGDPDE	-0.72252	-2.3400[0.03]
LGDPDE(-1)	0.85494	2.8960[0.01]
C	16.4548	4.4096[0.00]
R-Squared 0.82831	**R-Bar-Squared 0 .76859**	

7.3.3 Diagnostics Tests

In addition to the underlying ARDL model 1, bound tests and unit root tests, the study employed several diagnostic tests to this model (see C (1) and D 1 (a & b). These diagnostic test results, confirmed that the coefficients are unbiased and the model is correctly specified, with a reported R^2 of 0.83. This means that 83% of the variation of Nigerian oil and gas export demand to developed NEICs is jointly explained by the explanatory variables. This outcome was expected following the assumption that carbon emissions reduction in developed NEICs and other independent variables are expected hypothesised to have an influence on Nigerian oil and gas exports. Therefore, it is concluded that the model is structurally and statistically sound and robust for policy formulation. The short and long run results for model 1 are presented below.

7.3.4 Short and Long-Run Empirical Results

Firstly, the estimated empirical results of the short-run coefficients are presented in Table 7.6.

Table 7-6 Estimated Short Run Dynamics and the Error Correction Term

Regressor	Coefficient	T-Ratio[Prob]
DLCEDE	2.4132	1.6465[0.112]
DLOPD	-0.0706	-0.5351[0.597]
DLOPD1	-0.3469	2.7153[0.012]
DLGDPE	-0.7225	-2.3400[0.027]
DC	16.4548	4.4096[0.000]
ECM(-1)	-0.5482	-3.7985[0.001]

Table 7.6 above exhibited the dynamic short-run causality among the relevant variables. The EC term (ECt-1) which measures the speed of adjustment towards long-run equilibrium, is one period lag of the residual. Thus, the ECt-1 has appeared with the correct sign (negative) and statistically significant at 1% level. The result means that when the relationship among the variables diverges due to some shocks, the whole system can re-attain long-run equilibrium at a speed of 54%. In other words, a deviation from long-run equilibrium in this period is adjusted by 54% in the succeeding years. This is a strong indication that the speed of the convergence to equilibrium is high. Moreover, the short run coefficients indicate causal relationship between NOEs to developed NEICs and the independent variables (oil price, carbon emission and GDP per capita in developed NEICs). It means that all the independent variables cause NOEs to developed NEICs in the short-run.

Similarly, the coefficient of the CEDE (petroleum based carbon emissions in developed NEICs) reveals a positive sign (2.41%), although not statistically significant. This suggests that a change in CEDE causes an increase in NOEs. On one hand, the short-run results revealed that a 1% change in GDPDE (GDP per capita in developed NEICs) leads to a 0.72% fall in NOEs. This suggest that a decline in economic activities and efforts to sustain economy in developed NEICs affects Nigerian oil and gas exports. This will lead to a decrease in Nigerian oil and gas exports revenue. In comparison with GDPDE, the one period lag oil price

exhibited the expected negative sign and is statistically significant (P-Value= 0.012) at 1%. The one period lag coefficient shows that, a change in oil price causes 0.346% decrease in NOEs. However, a 1% change in current oil price causes a 0.0706% decrease in NOEs; but not statistically significant. Thus, the one period lag of oil price coefficient indicates that about 35% of Nigerian oil and gas exports to developed NEICs will reduce. This will no doubt affect revenue realised from oil and gas exports to these countries. The long-run results are presented in Table 7.7 and subsequently analysed.

Table 7-7 Estimated Long Run Coefficients

Regressor	Coefficient	T-Ratio[Prob]
LCEDE	-6.2820	-2.9552[0.01]
LOPD	-0.4012	-1.7897[0.08]
LGDPDE	0.2416	1.2351[0.23]
C	30.0175	4.8551[0.00]

Table 7.7 above showed the long run results. It is observed that both CEDE (carbon emission level in developed NEICs) and oil price exhibit negative relationship with NOEs and, statistically significant at 1%. Thus, CEDE level elasticity of NOEs to developed NEICs is elastic (>1), which indicates that 1% change in CEDE level lead to 6.28% decrease in NOEs. This suggests that for every reduction in fuel based carbon emissions in developed NEICs, Nigerian oil and gas exports reduces by 0.0628. In comparison with CEDE, oil price exhibited the expected negative sign and is statistically significant at 10%. The oil price elasticity of Nigerian oil and gas exports to developed NEICs indicates that a 1% change in oil price influences a fall in Nigerian oil and gas exports by 0.40%.

Therefore, it implies that revenue to be generated from oil and gas exports to developed NEICs will be affected by their carbon emissions reduction and reduction in oil price, which invariably, affects total government revenue. GDP per capita exhibited a mixed outcome. On one hand, the long-run coefficient of GDPDE (GDP per capita in developed NEICs exhibited a positive sign; with a 1% change in GDPDE causing a 0.24 increase in NOEs to developed NEICs, however not statistically significant. On the other hand, the short-run results reveals that a 1% change in GDPE to 0.72% fall in NOEs and statistically significant (P-

Value=0.027) at 1%. This also suggest that Nigerian oil and gas exports to developed NEICs is affected by the decrease in economic activities in these countries.

In comparison of the long and short-run results for CEDE, the former is negatively related with NOEs and statistically significant at 1% (Table 7.7). However, the latter is positively related, however, not statistically significant (Table 7.6). This indicates that, reduction in carbon emission level in developed NEICs has negative influence on Nigeria oil and gas exports in the long run. Based on this key finding, it suggests that reduction in fuel based carbon emissions in developed NEICs will lead to significant decrease in Nigerian oil and gas exports to developed NEICs.

Based on the above findings, we can reject the null hypothesis (1) which states that:

> **H_0 1:** Carbon emission reduction in developed NEICs have no influence on Nigerian oil and gas exports

Based on the findings above, it suggests that carbon emissions reduction in developed NEICs has a detrimental effect on NOEs as about 49% of Nigerian oil and gas exports goes to these countries. This suggests that Nigerian oil and gas exports to developed NEICs are threatened by their quest to achieve macro environmental and carbon accountability. This has serious implications on future Nigerian oil and gas exports revenue considering the contribution of this revenue source to our total revenue, which helps in financing the national budget.

In this regards and based on the results presented and analysed, the following implications could be deduced. The author argued that the peak of carbon based energy and economy is reached and will soon start to decline. The gradual phasing out of oil and gas, driven by environmental and climate change considerations, will results to significant reduction in Nigerian oil and gas exports thereby affecting government revenue. Several developed NEICs have adopted various forms of targets and developed support policies to substitute oil and gas

as the dominant source of global energy with low-carbon energy sources such as renewable energy sources. This will continue to exert downward pressure on global oil price and consumption thereby affecting Nigerian oil and gas exports to NEICs.

Similarly, the gradual displacement of oil and gas due to environmental considerations in developed NEICs would reduce FDI flow into Nigerian petroleum industry resulting in a decrease in Nigerian oil and gas reserves. Since the Nigerian upstream petroleum activities are largely dominated by MNOCs from developed NEICs, they may decide to pull out substantial portions of their investments due to oil price fall and quest for legitimacy from their citizens. This is consistent with the assumption that the dominant NEICs via their MNOCs exercise great economic influence within the dependent nations as explained in our theoretical framework under dependency theory.

Another major implication of this result is that Nigeria has to reduce its reliance on oil and gas exports particularly to developed NEICs and focus on emerging NEICs where they have flexible environmental policies and legislations in the long term. As a lasting solution, the government needs to develop internal markets by improving and modernising existing infrastructure. Similarly, the governments need to channel the energy resources towards the development of the non-oil sector and forgo dependence on oil and gas exports revenue to finance the budgets. This would certainly lessen our dependence on NEICs for economic survival as explained in the assumption of our theoretical framework. Interview findings supporting this quantitative result, which establish that carbon emissions reduction in developed NEICs has influence on NOEs, will be presented in section 8.2.1 of the next chapter. The next section presents the quantitative results of the second model.

7.4 Examining Impact of REC in Developed NEICs on NOEs

This model (2) using equation 2 investigated the impact of renewable energy consumption in developed NEICs on NOEs. Equation 2 is restated below.

$$\Delta \ln(NOE)_t = \alpha_0 + \lambda_1 \ln(REDE)_{t-1} + \lambda_2 \ln(GDPDE)_{t-1} + \lambda_3 \ln(OPD)_{t-1} + \lambda_5 \ln(NOE)_{t-1} + \sum_{i=1}^{p} \beta_1 \Delta \ln(REDE)_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta \ln(GDPDE)_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta(OPD)_{t-i} + \sum_{i=0}^{p} \beta_5 \Delta \ln(NOE)_{t-i} + \mu \ldots\ldots(2)$$

To avoid spurious results and invalid inferences, the study conducted the Augmented Dickey-Fuller (ADF) and Philips Perron (PP) unit root tests. These unit root tests were conducted using different specifications (constant and constant and trend) to ascertain the level of integration of the variables and to provide the basis and satisfy the ARDL-Bounds testing rules. Below are the ADF and PP tests results.

7.4.1 ADF and PP Unit Root Tests

The results obtained from both tests, ADF and PP unit root tests at levels indicate that the variables have unit root and are therefore non-stationary (Table 7.8). However, the data series became stationary at first difference, as shown in Table 7. 9.

Table 7-8 ADF and PP Tests Results on Log Levels of Variables

	ADF Statistic		PP Statistic		
Variables	Constant	Constant & Trend	Constant	Constant & Trend	Stationary Status
LNOE	-2.24	-0.66	-2.47	-1.96	Non stationary
LREDE	2.45	-0.50	6.07	0.30	Non stationary
LOPD	-1.86	-0.78	-1.87	-0.84	Non stationary
LGDPDE	-1.92	-0.64	-1.85	0.15	Non stationary

Notes: Lag lengths are selected based on Schwarz Bayesian Criterion; the test statistics are compared with critical values from Mckinnon (1996); ***, ** and * denote statistical significant, i.e. rejection of the null hypothesis at 1%, 5% and 10% levels of significance respectively.

Table 7-9 ADF and PP Tests Results on First Differences of Log Variables

	ADF Statistic		PP Statistic		
Variables	Constant	Constant & Trend	Constant	Constant & Trend	Stationary Status
LNOE	-7.41***	-7.54**	-7.42***	-7.57***	I(1)
LREDE	-6.08***	-7.13**	-6.09***	-8.04***	I(1)
LOPD	-4.94***	-5.35***	-4.94***	-5.65***	I(1)
LGDPDE	-3.19**	-3.74**	-3.18**	-3.54**	I(1)

Notes: Lag lengths are selected based on Schwarz Bayesian Criterion; the test statistics are compared with critical values from Mckinnon (1996); ***, ** and * denote statistical significant, i.e. rejection of the null hypothesis at 1%, 5% and 10% levels of significance respectively.

Therefore, the null hypothesis, which states that the variables are not stationary, is rejected[66] and this confirms that variables are stationary at first difference. This further suggests that the statistical properties of the data such as the mean, variance and auto-correlations with other variables are constant overtime and possess the power to make accurate predictions. Hence, we conclude that unit root is eliminated and the transformed data can be used for different types of econometric modelling. The second step after the unit root tests is the bound test of co-integration to determine the long run relationship between the dependent and independent variables (Pesaran, Shin and Smith, 2001).

7.4.2 Bound Tests

The bound test was conducted to establish the existence of long-run relationships among the variables of the study testing H_0: $\lambda_1=\lambda_2= \lambda_3= \lambda_4= 0$ (no long-run relationship) for model 2 against the alternative H_1: $\lambda_1\neq \lambda_2\neq \lambda_3\neq \lambda_4\neq 0$. The F-statistic value is (Appendix **B** (2)) compared with the critical values obtained from Narayan (2004b; p.27), under appendix A2, case II: restricted intercept and no trend at 5% level (see Table 7.10 and appendix E2).

Table 7-10 Bond Tests Critical Values

Level of significance	I(0)	I(1)
1%	4.522	5.792
5%	3.16	**4.194***
10%	2.626	3.55

Source: Narayan, 2004b

The results of the bound tests established that the F-static calculated (5.348) (see Appendix B (2)) is greater than both the upper and lower critical bounds at 5% (see Table 7.10 and appendix E2). Hence, we conclude that there is co-integration relationship between the variables in the model. Therefore, the null hypothesis of no long-run relationship among the variables is rejected. These suggest that there is long-run relationship between Nigerian oil and gas exports on one hand and oil price, developed NEICs renewable energy consumption and GDP per capita on the other hand. Subsequently, the underlying ARDL model is

[66] The rejection of the null hypothesis is based on MacKinnon (1996) critical values.

hereby estimated using the orders (p, q, r, s) and presented in Table 7.11 below and the full results are in Appendix (Table A (2)).

Table 7-11: Underlying ARDL Model 2 Summary Results

Autoregressive Distributed Lag Estimates		
ARDL(1,0,0,1) selected based on Schwarz Bayesian Criterion		
Dependent variable is LNOE		
32 observations used for estimation from 1983 to 2014		
Regressor	Coefficient	T-Ratio[Prob]
LNOE(-1)	0.35893	1.9937[0.05]
LGDPDE	-1.8942	1.8582[0.07]
LOPD	0.010549	.13678[0.89]
LREDE	-0.25567	-.40525[0.04]
LREDE(-1)	1.5515	2.1649[0.04]
C	23.5367	1.8376[0.07]
R-Squared	0.70965	R-Bar-Squared 0.63997

These orders stand for ARDL (1, 0, 0, 1) for the variables which are selected based on Schwarz Bayesian Criterion (SBC). The SBC selects the optimum minimum likely lag length. In contrast with the SBC, the Akaike information criterion (AIC) selects the maximum lag length. However, the underlying model (see Table 7.11 above) selected the minimum of 3 lags based on SBC. This indicates that the model has an insignificant forecast error as suggested by (Pesaran and Shin, 1999).

7.4.3 Diagnostics Tests

The diagnostics results (see Appendix C (2) and D2 (a) & D3 (b)) have shown that model 2 is structurally and statistically sound. The serial correlation LM test (see Appendix C1 (1)) suggests that there is no serial correlation in the in error term. Secondly, the Breuch-Godfrey test indicates that there is no sign of heterokesdacity in the error terms (see Appendix C (2)). Thirdly, the RESET test proves that the model is normal and correctly specified (see Appendix C (2)). Fourthly the plots of the cumulative sum of recursive residuals (CUSUM) and the cumulative sum squares of recursive residuals, which tests structural stability, depicts that the estimated parameters are stable over the sample period of the

study (Appendix D2 (a) and D2 (b). Lastly, the model results show an R^2 (71%) (see Table 7.11), which means our model explains over 71% of the variability of the selected independent variables with the dependent variables. From the foregoing, the model is correctly specified in terms of the selected variables and functionality. Hence, it is concluded that the results are valid and the model is robust for policy formulation. Finally, the short and long run empirical result for model 2 is presented in the next section.

7.4.4 Short and Long-run Empirical Results

After establishing the existence of long-run relationship between the variables (bounds tests), the empirical results of the estimated short and long run coefficients for model 2 are presented below.

Table 7-12 Estimated Short Run Dynamics and the Error Correction Term

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
DLGDPDE	-1.8942	1.0194	-1.8582[0.074]
DLOPD	0.0106	0.0771	0.1368[0.892]
DLREDE	-0.2557	0.6309	-0.4053[0.046]
DC	23.5367	12.8086	1.8376[0.078]
ECM(-1)	-0.6411	0.18003	-3.5608[0.001]

As shown in Table 7.12 above, the short-run results established the dynamic short-run causality among the relevant variables in the model. Thus, the ecm (-1) coefficient is negative and statistically significant, which means 64% of all deviations from the long-run equilibrium is adjusted in one year (see Table 7.12). Moreover, the short run coefficients indicate causal relationship between Nigerian oil and gas exports to developed NEICs and the explanatory variables consisting of oil price, renewable energy consumption (dLREDE) and GDP per capita (dLGDPDE) of developed NEICs. It means that all the independent variables influence Nigerian oil and gas exports.

From the foregoing, GDP per capita of developed NEICs has a negative relationship with the dependent variable (NOEs) and statistically significant at 10%. A 1% rise in GDP per capita of developed NEICs causes 1.89% decrease in

NOEs demand, other factors held constant. The coefficient of oil price shows a positive relationship with NOEs, although not statistically significant. Furthermore, the coefficient of renewable energy consumption in developed NEICs shows a negative sign and is statistically significant at 5%. This shows that a change in renewable energy consumption in developed NEICs influences 0.26% decrease in Nigerian oil and gas exports, other factors held constant. Table 7.13 shows the estimated long-run results.

Table 7-13 The Estimated Long Run Coefficients

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LGDPDE	-2.9548	1.4273	2.0702[0.04]
LOPD	0.0165	0.1193	0.1379[0.89]
LREDE	2.0213	0.4762	4.2449[0.00]
C	36.7146	16.8866	2.1742[0.03]

In contrast, Table 7.13 provides for the long-run results, which shows that all the variables have positive relationship with Nigeria oil and gas exports except GDP per capita of developed countries (LGDPDE). Similarly, renewable energy consumption and GDP per capita of developed NEICs are statistically significant at 1% and 5% respectively except oil price. On one hand, GDP per capita in developed NEICs has a negative relationship (-2.95%) on Nigerian oil and gas exports (NOEs) and statistically significant (PV=0.05). This indicates that a decrease in GDP in developed NEICs by 1% decreases NOEs by 2.95%, holding other factors constant. Although change in oil price causes a marginal increase of 0.01% on Nigerian oil and gas exports, however, it is not statistically significant.

On the other hand, REDE has a positive relationship (2.02%) on NOEs and is statistically significant at 1%, holding other factors constant. This indicates that for every unit of renewable energy consumed in developed NEICs, there is an increase in NOEs by 2.02%. The conclusion from the long-run results is that, consumption of renewable energy in developed net energy importing countries has positive influence on Nigerian oil and gas exports.

Comparing the short and long run results, it is observed that GDP in developed NEICs has a negative and significant short-run influence on NOEs, with a coefficient of -1.89 and a P-Value of 0.074. Also, GDP per capita in developed NEICs has a negative and significant long-run impact on NOEs, with a coefficient of (-2.95) and P-Value= (0.049). This suggests that the efforts made by developed NEICs to reduce reliance on imported energy sources to sustain their economy has an impact on Nigerian oil and gas exports. Overall, we can see that a decrease in GDP per capita of developed NEICs has a significant short and long-term influence on NOEs to these countries.

For the impact of renewable energy consumption in developed NEICs on NOEs, on the one hand, the long-run results indicate that the consumption of renewable energy in developed NEICs positively influences NOEs. On the other hand, the short-run results indicate that the consumption of renewable energy in developed NEICs negatively influences NOEs. Consequent to the quantitative results (both long and short-run) presented, the study arrived at key findings that the consumption of renewable energy in developed NEICs has influence on NOEs.

At this point, we can reject the H_0 2: stated below:

> **H_0 2:** Renewable energy consumption in developed NEICs has no influence on Nigerian oil and gas exports

Therefore, it can be argued that the fluctuation in oil and gas exports revenue is due to changes in Nigerian oil and gas exports to developed countries as their renewable energy consumption increases in the short-run. However, the fluctuation in oil and gas export and subsequent impact on revenue is because of the failure of public decision and policy makers to have practical and robust plans to cushion the influence of oil and gas exports on total revenue. As a result, Nigeria is currently in financial problem thereby making it difficult for the government to discharge their short-term obligations.

On the other hand, an increase in NOEs demand by developed NEICs increases Nigerian oil and gas revenue in the long run. Unlike the case of Nigeria, developed

NEICs prioritise less oil and gas importation; however, their renewable consumption positively influences Nigerian oil and gas exports. Consequently, the increase in oil and gas exports volume to developed NEICs may translate to more oil and gas exports revenue for Nigeria. Nigeria being an oil revenue dependent country, it may positively affect its oil and gas exports revenue.

In this context, the dependency theory fits in explaining the relationship between Nigeria as an oil revenue dependent country on the one hand, and the developed NEICs as the dominant countries that rely on Nigerian oil and gas exports on the other hand. As a result of this mutual relationship, developed NEICs actions to consume renewable energy has significantly influence Nigerian oil and gas exports in the short run, thereby affecting oil and gas revenue accruing to Nigeria. However, in the long-run, the reverse is the case. Therefore, Nigerian government can continue to depend on developed countries for its oil and gas exports in the long run. Thus, this finding is inconsistent with the dynamism assumptions of dependency theory, as explained in chapter five. The finding implies that developed NEICs would continue to depend on Nigerian oil and gas exports demand. This suggests that the 49% of Nigerian oil and gas exports to developed NEICs (14 EU countries and USA), which constitutes the largest share, is unlikely to change in the long-term.

Consequently, the major policy implications of these findings is the need to strengthen cooperation between Nigeria and developed NEICs in the long term. While doing so, there is a need for Nigeria to explore non-oil revenue sources such as agriculture and solid minerals to substitute current loss from oil and gas exports revenue and compliments future oil revenue flows. In addition, the ability of government to generate sufficient revenues through taxes engages the populace, ensuring transparency and good governance. This will guarantee sustainable revenue streams to finance government budget and speed up economic development. The supportive qualitative responses to the above quantitative findings are presented in the next chapter, section 8.2.2 and 8.2.3 for short and long run respectively. The next section presents the quantitative results of the last model.

7.5 Examining Impact of REC in Emerging NEICs on NOEs

As mentioned in chapter six, Nigerian oil and gas exports to emerging NEICs constitute 32% of its total oil and gas exports. In this regard, model 3 investigated the impact of renewable energy consumption in these emerging NEICs on Nigerian oil and gas exports using equation 3. This is re-represented as:

$$\Delta \ln(NOE)_t = \alpha_0 + \lambda_1 \ln(REEE)_{t-1} + \lambda_2 \ln(GDPE)_{t-1} + \lambda_3 \ln(OPD)_{t-1} + \lambda_5 \ln(NOE)_{t-1} + \sum_{i=1}^{p} \beta_1 \Delta \ln(REEE)_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta \ln(GDPE)_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta(OPD)_{t-i} + \sum_{i=0}^{p} \beta_5 \Delta \ln(NOE)_{t-i} + \mu \ldots\ldots(3)$$

7.5.1 ADF and PP Unit Root Tests

In a similar manner, the captioned tests were conducted using constant and constant and trend specifications to determine the degree of integration of the variables, and meet the ARDL-Bounds testing procedures. These tests are conducted to avoid spurious and invalid inferences from the results. The results obtained for both ADF and PP unit root tests at levels indicated that the variables have unit root and are therefore non-stationary (Table 7.14). Consequently, the data series became stationary at first difference, as presented in Table 7.15.

Table 7-14 ADF and PP Tests Statistic on Log Levels of Variables

	ADF Statistic		PP Statistic		
Variables	Constant	Constant & trend	Constant	Constant & trend	Stationary Status
LNOE	-1.43	O.03	-1.58	-4.22**	Non stationary
LREEE	-0.10	-1.90	0.16	-1.54	Non stationary
LOPD	-1.86	-0.78	-1.87	-0.84	Non stationary
LGDPE	1.05	-1.46	2.06	-1.45	Non stationary

Notes: Lag lengths are selected based on Schwarz Bayesian Criterion; the test statistics are compared with critical values from Mckinnon (1996); ***, ** and * denote statistical significant, i.e. rejection of the null hypothesis at 1%, 5% and 10% levels of significance respectively.

Table 7-15 ADF and PP Tests Statistic on First Differences of Log Variables

Variables	ADF Statistic		PP Statistic		
	Constant	Constant &Trend	Constant	Constant & Trend	**Stationary Status**
LNOE	-5.75***	-4.09**	-8.30***	-10.95***	I(1)
LREEE	-3.73***	-3.66**	-3.73***	-3.66**	I(1)
LOPD	-4.94***	-5.35***	-4.94***	-5.65***	I(1)
LGDPE	-3.26**	-4.21**	-3.17**	-4.20**	I(1)

Notes: Lag lengths are selected based on Schwarz Bayesian Criterion; the test statistics are compared with critical values from Mckinnon (1996); ***, ** and * denote statistical significant, i.e. rejection of the null hypothesis at 1%, 5% and 10% levels of significance respectively.

Based on the Table 7.15 results, we rejected the null hypothesis, which asserts that the variables are not stationary using the MacKinnon (1996) critical values. Therefore, it is confirming that variables are stationary and mutually integrated at first difference. Furthermore, it indicates that the results can be used for econometric modelling. The bound test of co-integration to determine the long run relationship between the dependent and independent variables as suggested by Pesaran, Shin and Smith (2001) is the next test to be employed.

7.5.2 Bound Tests

The bound tests were conducted using the Joint F-test in order to determine the joint significance of the variables in model ((3): H_0: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 0$ (no long-run relationship) against the alternative hypothesis H_1: $\lambda_1 = \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq 0$. The result reveals that the F-static calculated (4.196) (see Appendix B (3)) are greater than both the upper and lower critical bounds compared with the critical values obtained from Narayan (2004b; p.28), under appendix A3, case II: restricted intercept and no trend at 10% level (see Table 7.16 below and appendix E3).

Table 7-16 Bond Tests Critical Values

Level of significance	I(0)	I(1)
1%	4.522	5.792
5%	3.16	4.218
10%	2.626	**3.532***

Source: Narayan, 2004b

In this regards, the null hypothesis, which states the existence of no long-run relationship among the variables, is hereby rejected. On this note, it indicates

that all the independent variables (oil price, GDP per capita and renewable energy consumption in emerging NEICs) could predict the volume of Nigerian oil and gas exports to emerging NEICs in the future. Similarly, it means that the independent variables are capable of determining the oil and gas exports revenue that will accrue to the Nigerian government in the future. Table 7.17[67] below presents the underlying estimated ARDL model summary results for the model three.

Table 7-17 Underlying ARDL Model 3 Summary Results

Autoregressive Distributed Lag Estimates		
ARDL(2,0,0,0) selected based on Schwarz Bayesian Criterion		
Dependent variable is LNOE		
32 observations used for estimation from 1983 to 2014		
Regressor	Coefficient	T-Ratio[Prob]
LNOE(-1)	0.39625	2.0076[0.05]
LNOE(-2)	-.41948	-2.3818[0.02]
LGDPE	-1.22333	-2.1079[0.04]
LREEE	0.61963	1.9349[0.06]
LOPD	0.06409	1.7651[0.09]
C	27.4430	3.9450[0.00]
R-Squared and R-Bar-Squared	0.91628	0.89619

As shown in the Table, the orders (p, q, r, s) stand for ARDL (2, 0, 0, 0) for the variables, which are carefully chosen based on Schwarz Bayesian Criterion (SBC). The SBC selects the minimum optimum lag length. In contrast with the SBC, the Akaike information criterion (AIC) selects the significant maximum lag length. Therefore, the selection of the lags based on the SBC by the underlying model (see Table 7.17) indicates that the model has an insignificant forecast error as suggested by (Pesaran and Shin, 1999).

7.5.3 Diagnostics Tests

Several diagnostic tests were undertaken in order to examine the strength of the model. It was further established that model 3 is structurally and statistically sound (see Appendix C (3) and D3 (a) & D3 (b)) for serial correlation LM test; Breuch-Godfrey test for heterokesdacity in the error terms; and RESET test.

[67] The full results presented in Appendix (Table A (3)).

Similarly, the plots of the CUSUM and CUSUM of Squares Tests (see Appendix D3 (a) and D3 (b) for structural stability both showed that the estimated parameters are stable over the sample period of the study. Lastly, with the R^2 of 0.91 (see Table 7.17), means that 91% of the variation of NOEs to emerging NEICs is jointly explained by the predictor variables used in the model. Within the context of the above, it established that the coefficients are unbiased, efficient and consistent and the model is strong for policy formulation. The next subsection presents the short-run and long run empirical result for the model.

7.5.4 Long and Short-Run Empirical Results

The empirical results of the estimated short and long run coefficients are presented in Table 7.18 and Table 7.19 respectively.

Table 7-18 Estimated Short Run Dynamics and the Error Correction Term

Regressor	Coefficient	Standard error	T-Ratio[Prob]
DLNOE1	0.4195	0.1761	2.3818 [0.02]
DLGDPE	-1.2233	0.5803	-2.1079 [0.04]
DLREEE	0.6196	0.3202	1.9349 [0.06]
DLOP	0.06401	0.0363	1.7651 [0.09]
DC	27.4430	6.9565	3.9450 [0.00]
ECM(-1)	-0.40232	0.1176	-3.4208 [0.00]

As shown in the Table above, the ecm (-1) has a negative coefficient and statistically significant at 1%. This illustrates that 40% of all deviations from the long run equilibrium among the variables is adjusted in one year. This further indicates that a deviation from long- run NOEs volume to emerging NEICs in this period is adjusted by 40% in the forthcoming periods. Similarly, the short run coefficients show an existence of cause and effect bond between Nigerian oil and gas exports to emerging NEICs and the independent variables (dlREE, dlGDPE, dlop). It suggests that all the independent variables could explain the changes in NOEs to emerging NEICs.

Similarly, GDP in emerging NEICs (dlGDPE) has a negative and significant short-run influence on NOEs, with a coefficient of -1.22 and a P-Value=0.04. This suggests that the actions made by emerging NEICs to reduce reliance on Nigerian oil and gas exports is presently affects Nigerian revenue from oil and gas exports.

In comparison with dlGDPE, oil price exhibited the expected sign (0.064 and P-Value=0.09), but, statistically significant at 10%. This suggests that when oil price increases, Nigerian oil and gas exports to emerging NEICs will also increase thereby accruing more revenue to Nigeria. However, with the fall in oil price from 2014, Nigerian has experienced a decline in oil and gas exports revenue, which is having an impact on total government revenue. On the other hand, the one period lagged NOEs showed a positive relationship with the independent variable and statistically significant at 5%. This suggests that NOEs to emerging NEICs would continue despite the fall in their GDP per capita. Interestingly, the short run results of this model is showing the dynamics towards the long run. Table 7.19 below provides the long-run results.

Table 7-19 The Estimated Long Run Coefficients

Regressor	Coefficient	Standard error	T-Ratio[Prob]
LGDPE	-1.1955	0.5148	-2.3224[0.02]
LREEE	0.60556	0.2745	2.2059[0.03]
LOPD	0.06264	0.0316	1.9825[0.05]
C	26.8197	3.3191	8.0804[0.00]

As shown above, all the predictor variables with the exception of GDP per capita in emerging NEICs (LGDPE) are positively related with NOEs. More specifically, the coefficient of LGDPE (-1.96) is negatively related with the dependent variable and statistically significant (p-value=0.02) at 5% (see Table 7.19). Thus, a 1% increase in LGDPE causes 1.96% decrease on Nigerian oil and gas exports, holding other factors constant. In addition, the coefficient of LGDPE is elastic (>1). This suggests that change in GDP per capita in emerging NEICs will have a substantial negative impact on NOEs and government revenue.

On the other hand, renewable energy consumption (LREEE) in emerging NEICs and oil price (LOPD) are positively related with NOEs at 5% and 10% respectively in the long run. The results also indicate that a percentage change in LREEE in emerging NEICs and oil prices causes 0.60% and 0.06% increase in NOEs respectively. However, the LREEE in emerging NEICs coefficient is inelastic (<1), which indicates an insignificant positive long run impact on NOEs. Thus, an

increase in renewable energy consumption in emerging NEICs means a marginal increase in NOEs to these countries. In comparison with dlGDPE, oil price exhibited the expected sign (0.064 and P-Value=0.090), however, is statistically significant at 10%. This suggests that when oil price increases, Nigerian oil and gas exports to emerging NEICs also increase, thereby earning more revenue for Nigeria. Conversely, when oil price decreases, Nigerian oil and gas revenue generated from exports to emerging NEICs will also decrease, thereby affecting total government revenue. Similarly, the one period lagged NOEs shows a positive relationship with the independent variable and statistically significant at 5%. This suggests that NOEs to emerging NEICs would continue despite the fall in their GDP per capita.

In synthesising both the short-run and long run results, a similar pattern of relationship is observed. For instance, the reduction of GDP in emerging NEICs (dlGDPE) has a negative impact on NOEs in the short-run and long run, with both results being statistically significant. This suggests that the efforts made by emerging NEICs to cut dependence on imported energy from Nigeria in order to sustain their economies will continue to have a negative impact on Nigerian oil and gas exports and revenue. This point is supported empirically as a percentage change in renewable energy consumption (dLREEE) in emerging NEICs increases NOEs by 0.61% (Table 7.18). Thus, dLREEE in emerging NEICs increases NOEs and the level of both short and long run impact are almost equal, however, the latter's statistical significance was at 5% while the former at 10%.

This implies that renewable energy in emerging NEICs positively influences Nigerian oil and gas exports both in the short and in long run. This means that Nigeria would continue to depend on emerging NEICs for its oil and gas exports, thereby guaranteeing revenue generation from oil to finance governmental activities. The key findings of this model suggest that we can reject the third null hypothesis, which states as thus:

> **H_0 3:** Renewable energy consumption in emerging NEICs has no influence on Nigerian oil and gas exports

The findings generated from our analysis in this model conflicts with the dynamism assumptions of dependency theory that the existing oil and gas trade relationship between Nigeria and emerging NEICs would change in the future. The finding implies that emerging NEICs would continue to depend on Nigerian oil and gas exports demand. Oil and gas revenue generated from 32% of Nigeria's oil and gas exports to these countries, which makes up the second largest share in financing annual budget, is unlikely to change in the short and long-term.

Based on the findings above, Nigerian government needs to strengthen bilateral relationship with emerging economies such as China, India and South Africa in order to guarantee future oil and gas exports to these countries. Similarly, Nigerian government through NNPC should sign long-term contracts with oil and gas trading partners in emerging NEICs as obtainable in other net energy exporting countries. This will, to a great extent control the dynamism in the relationship between Nigeria and emerging NEICs, as explained by the dependency theory. Although, Nigeria's crude oil is highly sought after by most NEICs due to its low sulphur contents[68], there is still the need for Nigerian government to guarantee its exports in light of global energy transitions and the discovery of new hydrocarbon sources in neighbouring countries.

In addition, there is the need to have flexible oil and gas fiscal regime to encourage FDI flow from emerging NEICs. This suggests a review of both existing and proposed Petroleum Industry Bill (PIB) under consideration at the NASS. This will boost Nigerian oil and gas reserves in view of the impending global energy transition and divestment by MNOCs in the Nigerian upstream sector. The supportive qualitative interview findings to the above quantitative results are presented in the next chapter (**section 8.2.4 and 8.2.5**). The next section states the interim summary of key quantitative findings.

[68]R16 opined in section 8.2.5

7.6 Summary of Major Quantitative Findings

In this chapter, the key findings of the quantitative analysis were presented and will be used in the next chapter. The main aim of the chapter is to empirically estimate the impact of global energy transition (renewable energy consumption and carbon emissions reductions) on Nigerian oil and gas exports. The key findings from the first model revealed that, carbon emission reduction in developed NEICs have negative influence on Nigerian oil and gas exports in the long-run (7.3.4). This result suggests that Nigerian oil and gas exports revenue may be negatively influenced due to anticipated stringent environmental policies and legislations towards reducing their carbon emissions level.

On the other hand, the second model established renewable energy consumption in developed NEICs has a positive influence on Nigerian oil and gas exports in the long-run (7.4.4). This suggests that the bulk of Nigerian oil and gas exports to developed NEICs would be sustainable in the long-term thereby guaranteeing revenue flow to Nigeria. However, in the short-run, renewable energy consumption in developed NEICs has a negative influence on Nigerian oil and gas exports (7.4.4). This may explain the reasons for the recent decrease in Nigerian oil and gas exports and revenue.

The last model established that, renewable energy consumption in emerging NEICs has positive influence Nigerian oil and gas exports in long and short-run (7.5.4). This suggests that Nigeria can depend more on emerging NEICs for its oil and gas exports, which inevitably generate more oil and gas exports revenue. The next chapter will present the qualitative data, analysis and interview findings.

Chapter 8.
Qualitative Data Presentation, Analysis and Interview Findings

8.1 Introduction

The preceding chapter presented and discussed the quantitative empirical results, analysis and findings. This chapter presents findings from the semi-structured interviews conducted with twenty (20) interviewees, divided into three groups, as explained in details in chapter six. A recap, the first group of the interviewees are fifteen top governmental officials from six ministries, department and agencies (MDAs[69]) who are highly influential and their views are very important to the author's analysis. On the other hand, group two consists of two senior lecturers in two universities with finance and economics background, and with experience in public policy issues. Group three is made up of two senior public financial and economic analysts and an independent senior researcher drawn from civil society organisations who follow trends of government policies and assess its impacts and effectiveness on the society.

Overall, the remaining chapter is divided into four sections. Section 8.2 deals with the presentation and analyses of the supportive interview findings in respect of the major quantitative results earlier established in chapter 7. Section 8.3 presents the qualitative comparison between the net effect of renewable energy consumption in developed NEICs and emerging NEICs on NOEs, which is linked to answering research question one and achieving objective four. Section 8.4 presents and analyses the interview findings related to research question two in order to achieving the research objective five. Finally, section 8.5 states the summary of the major findings of the qualitative study.

[69] These are BOF=Budget Office of the Federation; NIPC=Nigerian Investment Promotion Commission; NNPC=Nigerian National Petroleum Corporation; NNPC=National Planning Commission; MOF= Ministry of Finance; OAGF=Office of the Accountant General of the Federation; UNIMAID=University of Maiduguri; CISLAC= Civil Society Legislative Advocacy Centre.

8.2 Presentation and Analysis of Supportive Interview Findings

In this section, the responses of the twenty interviewees on the major quantitative results established in chapter 7 are presented. The twenty interviewees were divided into two equal parts, one part (R1, R2, R6, R7, R8, R12, R13, R14, R16, R18) responded to the quantitative interview questions related to developed NEICs and the other part (R3, R4, R5, R9, R10, R11, R15, R17, R19, R20) answered the quantitative questions that are related to emerging NEICs. The above categorisations of the interviewees are in accordance with their line of responsibilities in their respective organisations, professional competence and experience. The major quantitative findings are re-arranged and restated below.

(i) *Carbon emissions reduction in developed NEICs has a negative influence on Nigerian oil and gas exports*". (ii) "*Renewable energy consumption (REC) in developed NEICs has a negative influence on Nigerian oil and gas exports (NOEs) in the short-run*". (iii) *Renewable energy consumption in developed NEICs has a positive influence on Nigerian oil and gas exports in the long-run".* (iv) *Renewable energy consumption in emerging NEICs has a positive influence on Nigerian oil and gas exports in the short-run*". Lastly, (v) *Renewable energy consumption in emerging NEICs has a positive influence on Nigerian oil and gas exports in the long-run".* The interview responses to the above quantitative findings are presented and analysed sequentially.

8.2.1 Impact of Carbon Emissions Cut in Developed NEICs on NOEs

Similarly, the researcher asked the respondents on the quantitative finding established in 7.2.4 that CO_2 reduction in developed NEICs have a negative influence on NOEs. The interview responses from all the ten interviewees (R1, R2, R6, R7, R8, R12, R13, R14, R16 and R18) designated to answer the interview question are stated below. Interviewees from NIPC and NNPC who are Senior Director (R6) and Senior Managers (R7) opine that:

"There has been increasing awareness about the importance of using environmentally friendly energy sources in order to make the environment safe and that is when renewable energy comes into play. A lot of technological development is going on in this regard. However, in the long run, it will make oil and gas nonessential globally. This is because people would rather use a product that would not pollute the environment (R6).

"In the long-run, oil and gas exports to developed countries will not be sustainable because of two reasons, climate change and energy security concerns which are linked. In terms of climate change, these countries are looking for a way to have zero emission from petroleum by 2030. Nevertheless, in terms of energy security also, they do develop their renewable energy and new renewable energy technologies. So with these twin issues, the Nigerian exports to the developed countries will not be sustainable in the long run" (R7).

Similarly, interviewees (R12 and R13), who are Senior Directors from NPC and MOF asserted that:

"I am convinced that when the world continues to reduce carbon emissions, unavoidably it will affect oil exporting countries as if they are the targets. In the long-run, crude oil and gas exports will not be sustainable because of climate change and energy security" (R12).

"I quite agree that environmental agenda pursued globally will affect fossil fuel importation and consumption and this certainly influences oil exports volume of Nigeria" (R13).

Another respondent (R18), who is a Senior Public Financial and Economic Analysts from CISLAC, stated that:

"With the level of commitment to reduce carbon emission, it is not going to be business as usual. Thus, oil and gas export to the developed countries may not be sustainable in the long run not only for Nigeria but also for all other oil-producing countries. Other sources of energy in the global energy mix may also come into play as we move on" (R18).

Based on the opinion of the above participants (R6; R7; R12; R13 and R18), Nigerian oil and gas exports to developed NEICs may not be sustainable in the future due to the carbon emissions reduction measures adopted in these countries. They further claimed that it would not only affect Nigerian oil and gas exports but including other net energy exporting countries. However, a particular respondent (R8), who is a Director in NNPC, opined that carbon emissions reduction and technological progress might significantly influence Nigerian oil and gas export volumes to net energy exporting countries.

"Oil and gas exports to developed countries will not sustainable if the developed NEICs actually reduce their level of carbon emissions. However, what happens now is negotiation. In addition, many world powers are investing in clean energy to reduce carbon but it is equally very expensive so it is not sustainable. Even now, we are having challenges to sustain our oil export ability even to the emerging economies. For now, we mainly rely on Europe and if they decide not to buy our crude oil, we are in deep trouble. Do not be surprised that tomorrow somebody can discover that water can run a car. If it comes, what can we do?" (R8).

Similarly, other respondents (R1; R2 and R14), who are Senior Directors from the Budget Office and OGOAF, argue that the current fluctuation in Nigerian oil and gas exports is not being influenced by carbon emissions reduction in developed NEICs. However, the respondent believed that it would have a long-run influence on Nigerian oil and gas exports. He narrates as thus:

"I do not think that reducing of their carbon that is affecting our oil and gas export but availability of alternatives especially by USA for now. But if all of these world powers are reducing oil and gas consumption in the future because of carbon emission, it will definitely affect us" (R1).

"*I agree that any global policy that will discriminate against oil and gas is a direct attack on Nigerian oil exports or any OPEC oil and gas exporting country. So the position of Nigeria or any OPEC member country cannot differ from the position of OPEC on the global carbon emission reduction debate" (R2).*

"*Yes I believe that transition to green fuel to reduce carbon emissions will affect Nigerian oil exports because there are environmentally friendly energy sources" (R14).*

Conversely, the last respondent who is a senior lecturer in UNIMAID opines that Nigerian crude oil has very low sulphur content with less density. Thus, the carbon emissions reduction will not affect the exportation of Nigerian oil and gas to the major developed NEICs.

"It is not a straight yes or no answer because the degree of influence of carbon emissions reduction on particular oil and gas exports depends on the quality of the oil being exported. We are lucky ours is the Brent crude, which is quite highly safe. It will still be accommodated till when the renewable energy alternative is found which is healthier to their environment and economy" (R16).

From the responses above, majority of the interviewees are of the view that carbon emission reduction in developed NEICs will have a negative influence on Nigerian oil and gas exports and this view supports the quantitative results. This suggests that reduction in the level of carbon emission in developed NEICs, which are major importers of Nigerian oil and gas could lead to reduction in Nigerian oil and gas exports. This could translate to reducing oil and gas revenue generated

from oil and gas exports to these countries. This result is consistent with the concerns raised by of OPEC member countries that carbon emission reduction has potential effect on global fossil fuel consumption and resultant effects on their export revenues (Yamin 1998; Organisation of the Petroleum Exporting Countries, 2000). Similarly, some previous studies have argued that carbon emission measures to achieve environmental and carbon accountability has the potential to significantly reduce future demand for oil and gas and foreign direct investment into oil producing countries (Linden, et al., 2000; Barnett et al., 2004; Zhang et al., 2010; Dike, 2013; Suranovic, 2013; McCollum, et al., 2014).

Conversely, the result supports the assertion that stabilisation of global concentration of greenhouse gases depends on the reduction in fossil fuel consumption and supports the development of renewable energy sources. However, the remaining two participants believed that carbon emission reduction would not influence the exportation of Nigerian oil and gas to developed NEICs due to its low sulphur. The works of Persson, et al., (2007) and Johansson, et al., (2009) who found that carbon emissions reduction have positive influence on net energy producing and exporting countries support this finding.

8.2.2 Impact of REC in Developed NEICs on NOEs in Short-Run

This section asked whether renewable energy consumption (REC) in developed NEICs has negative influence on Nigerian oil and gas exports (NOEs) in the short-run. The above question was consequent upon the quantitative findings established in section 7.3.4. The followings are the views of all the ten interviewees (R1; R2; R6; R7: R8; R12; R13; R14; R16 and R18). A Senior Directors from the Budget Office and Ministry of Finance (MOF) opined that.

> *"At the moment, renewable energy has no influence in the fluctuations of our oil and gas exports. Renewable energy for now is used for minimum power generation. In terms of transportation, I know that they are demonstrating solar cars, hybrid cars, but they are not in the shelves yet. They are still on a pilot scale. However, in the long-run, when these technologies grow, Nigerian oil exports will not be sustainable to these countries" (R1).*

"We are still far away from renewable energy displacing oil and gas in terms of costs, technological know-how and in terms of availability and affordability by the general populace. In the short-run, the impact will not felt by Nigeria" (R13).

The two respondents above believed that the current decline in Nigerian oil and gas exports has no causal relationship with renewable energy consumption in developed NEICs (R1 and R13). They were also of the opinion that the decline is unconnected to any other external factors. Therefore, the viewpoints of these participants that, renewable energy consumption in developed NEICs have no influence on Nigerian oil and gas exports in the short-run runs contrary to the quantitative results. However, a Senior Director from Nigerian National Petroleum Corporation (NNPC), another Senior Director from the Budget Office and a Public Financial and Economic Analyst from CISLAC opined as thus.

"I think for now it is non-conventional energy sources such as shale oil and gas. The influence has nothing to do with renewable energy consumption" (R2).

"At the moment, it is not renewable energy consumption in developed countries that makes our oil and gas exports to dwindle. It is the production of shale oil and gas in the US" (R7).

"Apparently it is not renewable energy consumption. It is because of shale oil, new oil discoveries from other countries and illegal crude oil flow from war torn countries and Nigeria" (R18).

The above respondents (R2; R7 and R18) opined that renewable energy sources are not responsible for the current Nigerian oil and gas exports plunges. However, the interviewees opined that illegal flow of oil and gas from unstable net energy exporting countries, new discoveries of conventional and unconventional energy sources in other countries were accountable for fluctuations in Nigerian oil and gas exports volume (R2; R7 and R18). In contrast to the above interviewees, other respondent (R12) and R (16) who are Senior Directors from NNPC and

Office of the Accountant General of the Federation (OAGOF) opined that the consumption of renewable energy in developed NEICs is one of the factors that affects Nigerian oil and gas exports in the short-run.

> *"The global energy transition deployed by the advanced economies of course affects the Nigerian oil and gas exports demand. In addition to these are the discovery of shale oil in the US and the recent lift of embargo on Iran" (R16).*

> *"It is not only about renewable energy but the combination of increase in the oil sources in various countries that influence our oil and gas exports volume" (R12).*

In addition to the responses of (R2), (R7) and (R18), interviewees (R6 and R12) also mentioned other external factors such as lifting of Iran's oil embargo, discovery of shale oil and gas and new discoveries of conventional energy sources were also responsible for Nigerian oil and gas exports fluctuations.

This is an interesting finding, which is consistent with the reports released by the US Department of Energy in July 2015 that for the first time since 1973, Nigeria did not export a single barrel of oil and gas to the US. Similarly, current available statistics from Nigerian Petroleum Corporation (2016) shows that the trend has continued up until now. This sudden cut in Nigerian crude oil exports to the US to near zero, has significantly affected Nigerian oil and gas revenue by over 40%. This is consistent with the findings of Mănescu and Nuño (2015) who concluded that the shale oil revolution has caused global supply shocks, which resulted to oil price crash that negatively affected oil and gas revenue of net energy exporting countries.

However, Salameh (2013) concluded that US shale oil and gas production would barely make any significant future impact on OPEC oil and gas supplies because there are not environmentally and economically viable. Similarly, the author argues that the expected supply from US shale oil would mainly compensate their

decrease in conventional oil production; thereby making US to continue to be dependent on oil imports in the near future. Nevertheless, alternative market such as Europe and Asia have cushioned the impact of the Nigeria's oil and gas export loss to the US for now. However, these new markets are still not sustainable considering their levels of commitment towards development and consumption of renewable energy sources to attain energy security and environmental sustainability.

However, other interviewees (R6; R8; and 14) who are Senior Directors and Managers from NIPC, NNPC, OAGOF respectively contested the earlier views by (R2); (R7) and (R18) and believed that renewable energy consumption in developed NEICs has negative influence on Nigerians oil and gas exports.

> *"I believe that renewable energy consumption in developed countries contributes towards the fluctuation in our oil and gas exports" (R6).*

> *"Yes, renewable energy consumption by Nigeria's major oil and gas importers pose a significant threat to Nigerian economy in terms of reduced crude oil and gas exports" (R8).*

> **"** *Yes, it will no doubt affect our country oil and gas exports" (R14).*

The views of these interviewees (R6; R8 and R14) specifically agreed with the quantitative findings that renewable energy consumption in developed NEICs has negative influence on Nigerian oil and gas exports in the short-run. In addition, other interviewees (R12 and R16) have mentioned that the consumption of renewable energy in developed NEICs is amongst the factors that affect Nigerian oil and gas exports in the short-run.

In the overall, the responses suggest that half of the interviewees (R6; R8; R12; R14 and R16) are with the view that renewable energy consumption in developed NEICs has negative influence on Nigerian crude oil and gas exports, and these

views confirmed the quantitative results. While the other half of the interviewees (R2; R7; R18; R11 and R13) holds contrary opinion.

However, the researcher argues that, renewable energy consumption in developed NEICs has a negative impact on Nigerian oil and gas exports. This is because renewable energy sources are substitutes for oil and gas, renewable energy consumption by developed NEICs, being major exports destination for Nigerian oil and gas has affected Nigerian oil and gas exports to these countries. This is evident from the dramatic decrease of Nigerian oil and gas exports, which had significant impact on total government revenue. The above research finding is consistent with findings of Akella, Saini and Sharma (2009), von Eije, von Eije and Westerman (2013) and York (2014). Akella, Saini and Sharma (2009) concluded that renewable energy consumption reduces dependence on imported oil and gas and sustains economic and environmental sustainability in NEICs. Similarly, von Eije, von Eije and Westerman (2013) established that renewable energy utilisation reduces conventional energy consumption and economic growth in the long-term. Finally, York (2014) concluded that on the average, per unit consumption of renewable energy by a particular country displaces about one quarter unit of imported energy sources.

8.2.3 Impact of REC in Developed NEICs on NOEs in Long-Run

In this section, the interviewer asked the question about whether renewable energy consumption (REC) in developed NEICs have a positive influence on Nigerian oil and gas exports (NOEs) in the long-run as the quantitative results established in section 7.3.4. All the ten interviewees (R1, R2, R6, R7, R8, R12, R13, R14, R16 and R18) designated responded to the interview question asked by the researcher. An interviewee who occupy top management level positions from the Budget Office, NNPC, NIPC, MOF and OAGOF opined as thus:

> *"To me, renewable energy consumption by Nigeria's developed oil and gas importers poise significant threat to Nigerian economy in terms of reduced crude oil and gas exports" (R2).*

"There is global effort towards the development of renewable energy. The developed countries accounts for significant fraction. This will definitely affect global use of fossil fuel. By extension, Nigerian crude oil and gas exports will not be an exception" (R6).

"I do believe that the impact of renewables consumption in these countries will be felt by Nigeria in the long-run. For the simple reasons that environmental legislations in developed countries will become tougher to checkmate oil and gas use in the future" (R7).

"I have told you there will be a total shift from conventional energy to renewables in the nearest future. This will affect global oil consumption, including our oil exports" (R8).

"Renewable energy is just coming up. I believe the use of these sources will increase in the future and have an impact on our oil exports" (R13).

"I do not think so. There are high chances that renewable energy will eventually dislodged oil and gas in the long-term which will obviously reduce the country exports and the foreign exchange. The economy will be experiencing perpetual balance of payments deficits and the value of local currency will go down in exchange of scarce dollars. It will no doubt affect the country export in the long-run" (R14).

Interviewees R16 who a Senior lecturer form UNIMAID and R18 is being a Senior Public Analyst from CISLAC corroborated the above views.

"The fact is that most developed countries are moving beyond oil. Germany for example is one of the famous countries using renewable energy. In fact, Germany has become a net exporter of renewable energy. They have gone beyond oil. Therefore, it is clear that the way the energy industry is going; Nigeria has to look beyond oil. Nigeria has to consider seriously other alternatives to oil revenue. It is going to get worst. So no doubt it has adverse effect on Nigerian oil and gas exports" (R16).

"Since we are highly dependent on oil revenue, the energy transition will have an adverse effect in terms of our revenue generation, budget performance and economic and infrastructural development" (R18).

However, the following interviewees (R1 and R12) who are Senior Directors from the Budget Office and NPC have slightly differed with the above respondents. Although, the interviewees acknowledge the impact of renewable energy consumption in developed NEICs on NOEs, they consider oil price and technological advancement as the key factors that will affect NOEs in the long-term.

"Renewable energy may have an influence on our oil and gas exports. Moreover, advancement in technology over a consistent period of time will help reduce the cost of alternative sources of oil in the long-term which will massively affect our oil and gas exports" (R1).

"It is not really about renewable energy. Oil price will be a major determinant of crude oil consumption in the future. If oil price is low, the demand for other form of energy will be low" (R12).

Overall, the responses of all the interviewees shows that, renewable energy consumption in developed NEICs has a negative influence on Nigerian oil and gas exports in the long-run. In this regard, the qualitative findings did not support the quantitative results. However, the researcher views agree with the quantitative results. This is because the quantitative findings were established based on rigorous econometric and statistical screening. Therefore, it can be concluded that, the consumption of renewable energy in developed NEICs will have a positive influence on Nigerian oil and gas exports in the future. This has insignificant implications on Nigerian oil and gas exports revenue, which will not affect total government revenue. This finding is inconsistent with the findings of Szklo and Schaeffer (2006) that alternative energy sources such as renewable energy would serve as a complement for existing integrated systems and consequently replace oil and gas in the long term.

8.2.4 Impact of REC in Emerging NEICs on NOEs in Short-Run

Similarly, in this section, the interviewer asked the question about whether renewable energy consumption (REC) in emerging NEICs has a positive influence on Nigerian oil and gas exports (NOEs) (see section 7.4.4). Below are the responses of the interviewees in respect to this question. An interviewee (R3) who is a Senior Directors from the budget Office opined that:

> *"Like I said earlier, it is not renewable energy consumption in these countries. It is the internal strife in some of the OPEC countries, which allows the militants to pump illegal crude to the market. This drives the price of crude oil down. Again, the recent going down of China's economy has affected our oil and gas exports volume" (R3).*

In addition, interviewees (R4 and R5) who are Senior Directors from NIPC asserted that:

> *"It is true that our oil and gas exports have decreased. However, certainly it is not because of their renewable energy use for now. It is shale oil and gas in the USA, the supply glut of light crude in the Europe and the use of long-term contract by Arab countries against the one-year contract term in Nigeria. Other countries have long-term contract and hedging contract. They can hedge the price of their crude over long-term. This is another reason that is causing the fluctuations to our crude oil exports." (R4).*

> *"Nigerian oil and gas exports to developing countries have been declining since mid-2014 and it is not because of their renewable energy consumption" (R5).*

However, interviewee (R9) who is a Senior Manager from NNPC stated that:

> *"Our oil exports are reducing and the reasons why we are having these fluctuations is that there is glut in the market. Almost every country is finding both conventional and non-conventional oil because of improved technology. America that used to be a net importer of oil is ready to start exporting their non-conventional oil and gas. Also many African countries such as Uganda, Kenya, Mozambique, Ghana and Niger have found oil and gas" (R9).*

While a Senior Researcher replied as:

> *"At the moment, the level of development of renewable energy and technology in emerging economies are still not enough to give us this level of impact" (R20).*

The above interviewees (R3: R4; R5; R9 and R20) believed that renewable energy consumption in emerging NEICs has no influence on Nigerian oil and gas exports in the short-run. However, other interviewees (R10; R11; R15; R16 and R19) hold contrary views, which supported the quantitative results, as stated below.

A Senior Directors (R10 and R11) from NPC states that:

> *"Well, renewable energy consumption in emerging economies has influenced our oil and gas exports (R10)".*

> *"Renewable energy used by emerging economies may influence Nigerian oil and gas exports demand. However, the use of renewable energy is not even much in developed countries for now. What basically influences our oil exports is the discovery of shale oil in the US and the recent lift of embargo on Iran which allows its major trading partners to patronize her oil" (R11).*

In addition, an interviewee (R15) who is a Senior Director from the OAGOF opines below.

> *"I quite I agree that renewable energy in emerging economies will influence our oil and gas exports. However, the declined in our oil and gas exports is largely due to the declined in economic activities in major emerging countries which caused drop in demand for their energy" (R15).*

However, a participant (R16) who is a Senior Lecturer from UNIMAID and (R19) a Senior Public Financial and Economic Analysts from CISLAC were of the view renewable energy consumption in emerging NEICs has an influence on our oil and gas exports.

> **"***The impact of renewable energy use in developing countries may not have immediate effect on our own oil exports volume. But it influences Nigerian oil and gas exports" (R17).*

> *"I do believe that renewable energy use in these countries has influenced our oil and gas exports" (R19).*

In summary, fifty percent of the respondents supported the quantitative results, which established that renewable energy in emerging NEICs has positive influence on Nigerian oil and gas exports. However, the other half believed that at present, consumption of renewable energy in emerging net energy importing countries has no influence on Nigerian oil and gas exports. Therefore, the findings suggest that, the present renewable consumption in emerging NEICs are not much to negatively influence Nigerian oil and gas exports. Most of these countries use conventional energy sources. As a result, the interviewees shed more light on the factors responsible for the current fluctuations in Nigerian oil and gas exports. These include supply glut arising from production of shale oil and gas in the USA, new discovery of oil and gas corridors in some African countries and trading of illegal crude oil in the global energy market. In addition, use of long-

term contract by Arab countries, slowdown of economic activities in emerging countries, and relaxing of economic sanction on Iran.

These are interesting revelations made by this study. It is evident that Iran's oil-related sanction relief has started having impact on other OPEC member's supply, as forecasted by the US Energy Information and Administration (2016). However, the long-term impact depends on Iran's capability to safeguard production decline levels, manage technical challenges, and improve production capacity from new oil fields. In regards to the trading illegal crude oil in the global energy market, Cordesman (2016) argues that it would be difficult to determine its impact as key net energy exporters such as Iraq and Libya are still at war. This suggests that Nigerian oil and gas exports to emerging NEICs will continue to be negatively influence by the instability in other key OPEC member countries, which gives opportunity for an accounted supply of oil and gas to the global energy market. Perhaps, the bulk of the oil and gas are being exported to both developed and emerging NEICs, thereby affecting Nigerian oil and gas exports and revenue. This will definitely affect Nigerian budget and the overall socio-economic development unless the non-oil sectors are revived. However, the Nigerian government can sign long-term contracts with its trading partners as obtainable in other NEECs in order to guarantee oil and gas exports to these countries.

8.2.5 Impact of REC in Emerging NEICs on NOEs in Long-Run

This section provides the responses of all the ten selected interviewees (R3, R4, R5, R9, R10, R11, R15, R17, R19 and R20) as regards the quantitative results established in 7.3.4 that renewable energy consumption (REC) in emerging NEICs has a positive influence on Nigerian oil and gas exports (NOEs) in the long-run. The responses are itemized below.

Interviewee 3 who was a Senior Director in the Budget Office states that:

"The issue of renewable energy becoming global primary energy source thereby dislodging the oil and gas is something that is gradually coming. However, its consumption in emerging economies will not have a long-run effect on Nigeria" (R3).

Similarly, a Senior Manager from NNPC has this to say.

"According to various forecasts of OECD, IEA and OPEC, oil and gas will continue to be the main primary global energy up to the year 2035. However, the issue of renewable energy dislodging the oil and gas as primary sources in emerging countries is practically impossible in the nearest future" (R9).

The above interviewees (R3 and R9) opined that conventional energy sources would continue to dominate the energy share of emerging NEICs. He specifically quoted statistical evidences from OECD, IEA, and OPEC reports to buttress his views. On the other hand, interviewees (R4 and R5) who are Senior Managers from NIPC opined that renewable energy sources in emerging NEICs would not be significant to cause any influence on Nigerian oil and gas exports in the long-term.

"Globally, renewable energy sources are produced in small quantity. It is not enough to serve even one particular country not to talk of countries. There is no enough renewable energy to be used to generate electricity or biofuel to be used in land and air transportation to serve emerging countries" (R4).

"Presently, the world consumes about 84 million barrels of oil on daily basis. Emerging countries accounts for significant percentage of this daily consumption. Therefore, renewable energy cannot replace fossil fuel in emerging countries" (R5).

Similarly, participants (R11 and R15) who are Senior Directors from NPC and OAGOF disclosed that.

> *"I don't know at what stage emerging countries will produce renewable energy to replace conventional energy sources to generate electricity, or replace cooking gas or for transportation" (R11).*

> *"I cannot foresee renewable energy produced in large quantity that can substitute fossil fuels to serve the emerging countries or China and India in particular" (R15).*

Similar to the above responses, other Senior Manager from NPC (R10), Senior Lecturer from University of Abuja (R17) and Senior Public Financial and Economic Analyst (R19) expressed reservations about the possibility of renewable energy in emerging NEICs substituting conventional energy in the long-term despite its perceived growth rate.

> *"Oil and gas will still be the dominant primary energy in the future. For example, in the transport sector, there is no any other replacement up to now in commercial quantity that would replace oil. All over the world, we need oil for our air transport and vehicular movement. The hydrogen and biofuels produced are still not in large quantities to replace oil as a primary source of energy in transport" (10).*

> *"Yes, renewable energy sources in emerging countries will not affect us" (R17).*

> *"Renewable energy to replace oil and gas or even coal in electricity generation or replace oil in for transportation, both land and air or even bunker oil in term of ship transportation is far from coming to reality in emerging or developing countries" (R19).*

It is observed that majority of the above participants believed that oil and gas will continue to be the major energy sources in emerging NEICs that will drive their socio-economic activities in the future. However, an interviewee (R20), who is an Independent Senior Researcher, holds a different view from the above respondents.

> *"The way renewable energy is growing in emerging economies, it will be difficult to maintain our oil and gas exports. However, if we want to maintain maximum revenue from oil in the future, we should be able to convert the crude oil to finished products and exports to these countries" (R20).*

In summary, almost all the interviewees were with the view that renewable energy in emerging NEICs will have positive influence on Nigerian oil and gas exports in the long-run (R3; R4; R5; R9; R10; R11; R15; R17 and 19) and these views confirmed the quantitative results. The findings above are inconsistent with the conclusions by Sadorsky (2009b) and Asif, and Muneer (2007). The former asserts that increase in real per capita income and energy prices impact positively on renewable energy consumption in emerging NEICs. This however suggests that as emerging economies are transiting to become more economically developed, the increased consumption of renewable energy would not lessen their dependence on imported energy; thereby they would continue to rely on Nigerian oil and gas exports. Similarly, Asif and Muneer (2007) which established that, as emerging countries becomes developed economies, they will be more concerned with energy security, environmental sustainability and human development. Thus, renewable energy consumption in emerging NEICs would at the long run, not affect the consumption of carbon based energy sources. This suggests that Nigerian oil and gas exports to emerging NEICs will be sustainable in the long-term.

8.3 Impact of REC in Developed and Emerging NEICs on NOEs

In this section, the comparison between the net effect of renewable energy consumption in developed NEICs and emerging NEICs on Nigerian oil and gas exports are been presented and analysed. This section is directly linked to answering research question one and achieving objective four as stated in chapter one.

Table 8-1 Comparing the Impact of REC in Developed and Emerging NEICs on NOEs

Results	Renewable energy consumption in developed NEICs (REDE)	Renewable energy consumption in emerging NEICs (REEE)
Short-run	P-value-=0.046 and coefficient of -0.26	P-value=0.06 and coefficient of 0.62
Long-run	P-value=0.00 and coefficient of 2.02	P-value=0.03 and coefficient of 0.61

Source: chapter 7, section 7.4.4 and 7.5.4

Based on Table 8.1, the short-run REDE is a lower P-value (<0.05) than that of the those (<0.1) for REEE. On the one hand, with a P-value of <5%, there is a more than 95% probability that the results shown are correct and that REDE is having more of an effect on Nigerian oil and gas exports in the short-run than REEE. On the other hand, the short-run reported P-values (<10%) of REEE indicates that there is a more than 90% probability that their renewable energy is causing some impact on Nigerian oil and gas exports in the short-run.

In determining and comparing the magnitude of the short-run impact between REDE and REEE on NOEs, the coefficients for both REDE and REEE are considered. While the coefficient of REDE in the short-run showed a negative sign (-0.26), which shows NOEs are expected to decrease by 26% when there is an additional change in REDE. The coefficient of REEE in the short-run revealed a positive sign (0.62). This suggests that an additional change in REEE increases NOEs to these countries. However, in the long-run, the reported P-values (<0.01) for REDE is lower compared to that of REEE's P-values (<0.05). While REDE's P-value indicates that there is a more than 99% probability that REDE will have an impact on Nigerian oil and gas exports in the long-run. REEE's P-value demonstrates that there is a more than 95% probability that REEE will have an impact on Nigerian oil and gas exports in the long-run. Similarly, comparing the extent of the long-run impact between REDE and REEE on NOEs, both coefficients

for REDE and REEE are positively related with NOEs. However, the coefficient for REDE (2.02) is much higher than that of REEE (0.61). This suggests that renewable energy consumption in developed NEICs has higher impact on Nigerian oil and gas exports than emerging NEICs. The next section shall present and analyse the interview questions and responses generated from the perception of interviewees as regards the impact of the global energy transition on Nigerian oil and gas revenue, budgets and their plans to mitigate these impacts.

8.4 Presentation and Analysis of Interviewees Perceptions

In this section, the perception of stakeholders in various ministries, departments, and agencies (MDAs) and members of the Civil Society Group (CSG) in Nigeria with regard to objective five, are been presented and analysed. This section is directly linked to answering research question two, as stated in chapter one. The interview questions were divided into four broad themes, which are stated below and subsequently analysed.

(i) *General perception of stakeholders about the energy transition regime and its impact on Nigeria.* **(ii)** *Global energy transition and its impact on FDI flow into Nigerian petroleum sector.* **(iii)** *Global Energy transition and its impact on oil price and petroleum revenue***. (iv)** *Existing plans by MDAs to mitigate the impact of the global energy transition***.**

8.4.1 General Perception of Stakeholders on Energy Transition

The purpose is to enquire from the respondents their perceptions on current energy transition from oil and gas to renewables and its potential impacts on Nigeria. In response to the above question, almost all the participants who cut across different MDAs made similar comments. For instance, interviewees from the Budget Office stated as thus:

> *"The happenings in the global energy market and economy is of concern to us in the budget office. It has serious consequences on us just like any other oil producing and exporting country that depends largely on income from the exportation of oil and gas" (R1).*

"It is clear to anyone following recent developments that there is a shift from oil and gas to alternative energy sources such as renewables. This transition will have a negative impact on Nigeria in terms of oil export volume and revenue. It is well a well-known fact that we are heavily dependent on oil and gas revenue. Therefore, it is high time that Nigeria takes this development seriously" (R2).

"We so much rely on oil revenue to the extent that we have not been able to diversify our economy over the years. So, the global energy shifts from oil to other sources such as renewable energy will further aggravate the problems at hand" (R3).

Similarly, Senior Directors and Managers from NPC (R10, R11, and R12) and NNPC (R7, R8 and R9) opined that their organisations are aware of the global effort to reduce the consumption of conventional energy sources.

"Based on our position in terms of global ranking among oil exporting countries, the energy transition will certainly affect our oil and gas exports. This will have negative impacts on our revenue, which will in turn affect our infrastructural development and rate of prospects in terms of economic growth and development "(R10).

"The global energy transition in most net energy importing countries has started affecting the economies of oil producing countries including Nigeria. However, to me this is blessing to us because our political leaders will start thinking for alternative sources of revenues (R11).

"Renewable energy has become a major power source and substitute for conventional energy for most countries, especially the net oil importing countries. It poses significant threat to Nigerian economy in terms of reduced crude oil and gas exports and revenue. Reduced oil and gas revenue will in turn have huge impacts on government budgetary spending (R12)".

"In its entire ramification, the energy transition will surely affect Nigeria adversely as it will affect the volume of our oil and gas exports. These will affect our entire economy unless we diversify our economy" (R7).

"There is high prospect for renewable energy (RE) because technology is growing. With improving technology, the prospect for RE is very high; and this will make conventional energy sources insignificant in the global energy mix thereby affecting our oil and gas exports volume" (8).

"Nigeria as a net energy exporting country will be affected by the energy transition to renewables. However, this is an opportunity for Nigeria to harness its renewable energy potentials. This will make the country to be on the same page with the world that is interested in achieving zero emission to preserve environment for the future generations" (R9).

It is observed that, the interviewees from NNPC (R9) and NPC (R11) respectively, holds a different view about the global transition from conventional to renewable energy sources and its impact on Nigeria. Both respondents believed that the energy transition might afford Nigeria the opportunity to change the direction of its economy towards other sources of revenue rather than constantly depending on oil revenue. Moreover, Nigeria could develop its vast potentials to protect its environment. However, interviewees from MOF and OAGOF opined that:

"With the global energy transition from petroleum to other non-fossil fuel, our crude oil exports as the major source of foreign exchange earnings would be adversely affected" (R13).

By the time there will be an increase in innovative technology for renewable energy, you will find out that our crude oil exports will drop. Definitely, it would have a very serious impact on our revenue if we continue to base our revenue on crude oil exports" (R14).

"The energy transition and carbon emissions reduction measures deployed by advanced economies will obviously affect Nigerian oil and gas exports" (R15).

In addition, the remaining interviewees (R4, R5 and R6), who are Senior Directors from NIPC, expressed similar opinions and corroborated the previous opinions. However, the participants have acknowledged the global efforts towards the development of renewable energy and its impact on FDI flow into Nigeria.

"I strongly believe that the share of renewable energy in the global energy mix is rapidly increasing. Therefore, we might be witnessing yet another energy transition from fossil fuels to renewables. Speaking as an investment expert, the transition may have colossal impact on FDI flows into our petroleum sector, which used to have the largest share of FDI inflows. This will have adverse effect on our oil and gas industry and the economy at large" (R4).

"Of course, the world is moving away from fossil fuels. This has affected oil price and exports volume but there is nothing we can do about it than to get prepared. Therefore, it has serious consequences on us just like any other oil producing and exporting country that depend largely on income from oil and gas exports. So unless there is stability and improvement, the low rate of oil demand in developed and oil consuming countries will surely affect us" (R5).

Thus, interviewee (R6) opined that the global energy transition could reduce FDI into Nigerian oil industry but will encourage indigenous investors to partake in the industry.

"Globally, renewable energy sources are integrated into the total energy mix. The rate of its development is unprecedented compared to nuclear energy. Therefore, the future is for renewable energy because of its unique features, which could preserve the earth planet from destruction. On the other hand, most of the investments coming from abroad to develop our oil sector may be channel to finance renewable energy projects in their countries. This will reduce FDI flow into Nigeria but it will encourage indigenous investment (R6)".

Generally, from the responses gathered, it appears that all the respondents are aware of the global energy transition from conventional to renewable energy. On one hand, some of the participants are worried about Nigeria's continuous dependence on oil and gas exports revenue despite its glaring socio-economic and environmental consequences. On the other hand, some participants have specifically noted that the energy transition presents an economic opportunity for Nigeria to unlock the non-oil sector to generate revenue. This suggests that diversifying the revenue sources may cushion the effect of potential oil and gas revenue loss arising from the energy transition. This view is supported by Akujuru (2016) and Agbaeze, Udeh and Onwuka (2015). They both conclude that government has to invest heavily in order to unlock potential sectors like agriculture, industries, and solid minerals to compliment loss oil and gas revenue.

8.4.2 Global Energy Transition and FDI Flows

The perception of the stakeholders was sought about whether the global transition affects FDI flow into the Nigerian petroleum industry. Eight interviewees were specifically selected from NIPC, NNPC and NPC to respond to this interview question. The selection of these interviewees is based on their professional expertise, knowledge and experience acquired from working in these organisations. Their views are presented below. Some interviewees (R7; R8 and R9), who are Senior Managers from NNPC have these to say.

"Definitely the global energy transition is affecting FDI flow into Nigerian petroleum sector and is affecting our oil and gas reserves discovery. However, other factors such as lack of passage of the new fiscal regime (the PIB), militant activities in the Niger-Delta region and stringent nature of the Nigerian content law are also affecting FDI flow into the Nigerian oil and gas sector" (R7).

"I believe the global energy transition has an impact on FDI flow into the Nigerian petroleum industry. However, in any oil producing country, there must be clear petroleum policy guideline that will help FDI flow into the industry. So how stable is the Nigerian petroleum fiscal regime? When we say stability, it is a kind of win-win situation to favour both the host government and the investors depending on the economic situation. However, in the case of Nigeria, the government usually changes the petroleum fiscal regime at the slightest economic situation. Therefore, the unstable petroleum fiscal regime is part of the reasons driving away FDI flows into Nigerian petroleum sector "(R8).

"FDI flow into our petroleum sector has substantially reduced over the years. Investors are not willing to invest due to the uncertainties in the global oil and gas industry. Therefore, they prefer to keep on producing the existing oil wells instead of investing to discover new oil reserves. In this situation, it will affect our future oil and gas exports volume" (R9).

Similarly, Senior Directors from NPC opined that:

"Surely if oil consuming nations continue with renewable energy and the clamour to reduce carbon emission, there will be a drastic reduction in FDI into Nigerian petroleum industry. This is because the oil companies are not developing renewables in Nigeria. They come for oil and if crude oil is no longer the primary source of energy, then of course, it makes business sense that they will reduce their investment in Nigeria. So in the long-run, we will see that investment will reduce" (R10).

"The decrease in the FDI flow may be attributed to several factors. Firstly, due to discovery of shale oil and gas in the US, investors from this country have diverted their investments to home country. Secondly, there is increased global awareness on the importance of staying clean and making the environment energy friendly by consuming renewable energy sources. Thirdly, significant technological developments are ongoing in terms of harnessing various sources of renewable energy. Based on these factors, in the long run, alternative energy sources will make oil and gas irrelevant globally. In this regards, investments into the Nigerian petroleum sector will be substantially affected" (R11).

However, when asked about the future impact of the reduction of FDI flow into Nigeria and particularly to the oil and gas sector, interviewees (R4; R5 and R6), who are Senior Directors from NIPC have these to say.

"The oil industry remains top FDI attractor in Nigeria, accounting for significant proportion of the FDI flow of $5.609 Billion and $4.7 Billion in 2013 and 2014 respectively. It could be noted that, there is a decrease of FDI in 2014, which is also substantially accounted for by the oil and gas industry. This decrease to the sector has adversely affected discovery of new reserves and will remain so if the trends persist. Ultimately, this will affect Nigerian future oil production, export and revenue in no small measure" (R4).

"Though some investors are diverting investment into other energy sources such as renewables you mentioned, this might not be enough reason for declining FDI in the oil and gas sector. We believe there are structural and legal debacles that need to be removed to encourage more investment into the sector" (R5).

"The reduction of FDI flow into the petroleum sector will surely affect our oil and gas reserves discovery, production and exports volume. This is largely due to skepticism by oil and gas companies to finance research to discover more reserves due to the changes in the global energy demand" (R6).

In summary, most of the participants believed that the global transition to renewables and increased concerns for global climate security has influenced negatively on FDI flow to the Nigerian oil and gas industry (R4, R6, R9, R10 and R11). In the long-run, it is expected that global efforts for clean energy will re-define the global oil and gas sector and make the consumption of conventional energy less attractive and unassertive. The responses suggest that the Nigerian oil and gas industry that substantially relies on FDI has been affected, although not exclusively by the energy transition to renewable energy sources. Some of the interviewees mentioned internal factors such as unstable petroleum fiscal regime, structural and legal debacles, lack of passage of Petroleum Industry Bill (PIB), militant activities in the Niger-Delta region and stringent nature of the Nigerian content law do contribute in driving away FDI in the Nigerian oil and gas industry (R5; R7; and R8).

8.4.3 Global Energy Transition and Oil Price and Oil Revenue

With regard to the above theme, the five interviewees who were selected from Ministry of Finance (MOF), Office of the Accountant General of the Federation (OAGOF) and NNPC made the following statements.

In the views of one of the Senior Director from MOF, the oil price fall has just started.

> *"Oil price has been continuously decreasing since 2014. Presently, it is $39 per barrel and our budget was pegged at oil price of $53 per barrel. You can see that there is already a deficit of $14. Energy experts have forecasted that it will continue to decline. This will have a significant effect on total government revenue and budget financing" (R13).*

Similarly, another Senior Manager from NNPC stated that:

> *"The oil price fall has significantly affected our revenue flows to such an extent that we are unable to meet our contractual financial obligations. This in turn, is affecting oil and gas exploration and production, thereby reducing exports volume" (R9).*

However, another interviewee from NNPC was with the view that the fall in oil price is a normal phenomenon that happens periodically.

> "*Well, the predictability of oil price volatility is not usually certain because it has a cyclical kind of trend. For instance, in the 1980s, it crashed so much that people think that it will never bounced back; but it still bounced back. Similarly, the current oil price fall may rebound; but it may not reach the $100 mark so soon. However, one should not be deceived that oil will continue to be high revenue earner in the future "(R8).*

However, interviewees from MOF and OAGOF responded to the impact of global energy transition on Nigeria oil and gas revenue as thus.

> *"The issue of oil and gas exports and revenues are highly technical in nature. However, I believe the decline in Nigerian oil exports is not linked with external issues such as renewable energy or other foreign policies. It is massive oil theft, force majeure and decline in oil price" (R13).*

> *"There were combinations of several factors that have affected the inflow of oil revenue into the federation account. These includes drop in oil and gas prices, decrease in oil and gas exports volume and delays in issuance of third quarter 2015 export permit amongst others" (R14).*

Similarly, another interviewee (R15), who is a Senior Director, from OAGOF states that.

> *"Recently, there are reports of decrease in demand of Nigerian crude oil due to falling global oil and gas demand. This is highly worrisome. Oil is the highest foreign exchange earner for our country. Without it, financing of budget becomes very difficult. The economy will be experiencing perpetual balance of payments deficits and the value of local currency will go down in exchange for scarce dollars; probably, the government has to borrow. However, the question is for how long will Nigeria continue to borrow? (R15)".*

In relation to the impact of global energy transition on oil price and Nigeria oil and gas revenue, the same interviewee 15, suggested the need to restructure the fiscal system, unlock the non-oil sector and minimise the cost of governance amongst others. This is his view.

> "*Of course I have the view that oil price has huge impact on our revenue and budget. Basically, the challenge has brought about the need to further review our petroleum fiscal system, reduce the cost of governance and revive the non-oil sector*" *(R15).*

Conclusively, all the participants believed that global energy transition has negative impact on oil price, and by extension, caused difficulty in sustaining oil production and financing investments. This has affected Nigerian oil and gas exports revenue. This finding is consistent with the World Bank (2014) and United Nations Conference on Trade and Development (2015) reports that Nigeria has been experiencing a declining trend in FDI flow despite its natural resource base and large market size, while FDI flows to Egypt grew by 14%. According to the United Nations Conference on Trade and Development (UNCTAD) World Investment Report published (2015), FDI inflows to Nigeria declined by $4.7 Billion, 16.3% reduction compared to the previous years.

This finding is also consistent with the assertion of Donwa, Mgbame and Ezeani, (2015) which states that FDI is also a major determinant that influences oil and gas production, as such, the development in the global energy sector would affect the Nigerian oil and gas sector, being one of the major sector that attract FDI investment into Nigeria. This implies that decline in FDI is linked with the gradual energy transition away from conventional energy sources by NEICs and embracing the new energy paradigm. This suggests that when there is a decline in FDI, future oil and gas production, exports volume and revenue would be negatively affected. Based on the anticipated impact of the global energy transition presented and analysed above, the researcher attempted to find out from the MDAs whether there are any plans on how to overcome these challenges

on Nigeria as an oil revenue dependent country, this will be discussed in the next section.

8.4.4 Plans from MDAs to Mitigate Impact of Energy Transition

This section presents the responses of interviewees as regards the above theme, which are also related to the research question two in order to achieving research objective five. The responses of all the interviewees from all the organisations selected are presented and analysed accordingly.

The first and second interviewees (R1 and R2) that were from the Budget Office stated that:

> *"Our office is aware and is incorporating the global energy shift to our budget plans. In fact, we have reviewed the MTEF by incorporating the current happenings in the global energy market into the next year's budget" (R1).*

> *"The happening in the global energy market worries us in the budget office. We just successfully concluded our 20-year sustainability analysis from 2016-2035. We collaborated with the Debt Management Office (DMO) to carry out a sensitivity analysis using production and price as determinants of oil revenue. The worst pessimistic case scenario indicates that oil revenue will be at its lowest. In this situation, government has to resort to borrowings to finance or cut down budgets" (R2).*

Participants from NPC opined that their organisation is establish for the sole aim of governmental planning and scanning of external environment specifically established their organisation. However, the respondents admitted that the energy transition constitutes a serious economic challenge for Nigeria and the Commission will look into it.

"Certainly, that is the mandate of the commission and we have been doing that. We develop all the developmental plans for the country. The most recent one is the Vision 2020. Beside this, we have what we called the National Integrated Infrastructure Master plan. It is a 30-year sector plan to improve our poor state of infrastructure. In addition, we did what we called the Transformation Agenda. It is a 3-year medium term plan for the period 2013-2015 that contains policies and programmes of the immediate past President. However, I have to be honest you that political interest and interference have affected the implementation of these plans. However, the current emerging trends of low oil exports caused by oil price and alternative energy sources will be seriously looked into" (R10).

In addition to the admission of the above respondents, another interviewee from NPC stated that most of the existing plans are to be executed using oil and gas revenue.

"I think there are a number of frameworks that were developed by various governmental agencies and regimes to generate revenues other than oil. I know about Nigerian Vision 20:2020, the Transformation Agenda, Nigeria Industrial Revolution Plan and Agricultural Transformation Agenda. Unfortunately, the success of these plans was anchored on anticipated oil revenue. I do not think the issue of energy transition was envisioned" (R11).

However, some of the respondents from the Budget Office and NIPC are of the view that the existing plans and policies are good. However, these policies are not implemented due to absence of political will.

"Nigeria has a general plan called the Vision 20:2020 Master plan. This plan is divided into three phases. The first National Implementation Plan (NIP) is for the periods 2010-2013. The second plan (2014-16) and third National Implementation Plan. However, there was a delay in the implementation of the first phase of the plan. A presidential review of the implementation of the plan showed huge gap between the plan and the actual result. The reviewed report was submitted to the presidency and was rejected due to political interest of the then President. This eventually affected the commencement of the second and third plans. On the overall, over-ambition and the political interest are major challenges for the success of any plan in our country" (R3).

"We have lots of existing good policies but the problem is implementation. Before now, there is the Nigerian Industrial Revolution Plan. However, it is still at policy level without implementation. The current regime has promised that all the necessary economic policies on ground will be revisited with a view to implement them. So we look forward to the new government in implementing all the good plans or if need be, re-strategize and come out with a better ones and ensure their implementation" (R4).

Respondent 12 who was a Senior Director in NPC also supported the assertion of the above participants. However, he admitted that some policies have been implemented, and suggested that new policies should be developed to reduce the impact of oil revenue on the Nigerian economy.

"There are several plans but have not been effectively implemented by the previous regimes. However, government is a continuous process. The new government should evolve new strategies that will reduce Nigerian dependence on oil and gas revenue and ensure their implementation" (R12).

The above responses suggest that the MDAs have recognized the enormity of the impact of global energy transition. However, the existing plans have not projected

the occurrence of energy transition away from conventional sources. Hence, most of the plans are anchored on anticipated oil and gas revenue. With the increasing global energy transition, the plans may not be realised. Similarly, they revealed that presently, the MDAs have not developed any specific plans and measures to mitigate the impact of global energy transition. Conversely, the next interviewee from NIPC opined that government has started developing strategies to address effectively the impact of the energy transition.

> "*Our organisation has recently developed a diamond strategy aimed at moving Nigeria beyond oil and save the country from shackles of economic mono-culturalism. This could be achieved by attracting huge investment into the non-oil sector and uncover alternative revenue source other than oil and gas exports. Such efforts might help to meet increasing government expenditure and accelerate the pace of economic growth and development in Nigeria" (R5).*

Another respondent from the Budget Office observed that:

> *"The government has already made pronouncement severally that there will be diversification of the economy. However, in reality, the policies were not being implemented and the economy is not diversified. Agriculture, which is the highest contributor to GDP, does not seem to grow significantly. However, the commercialisation of our agriculture, which was started by the former Minister of Agriculture, has made an impact especially with the introduction of the e-wallet system where farmers receive fertiliser allocation via text message. Once agriculture is boasted the Agro-Allied industry will also expand and this will ease the pressure on the oil revenue (R1)".*

However, a Senior Director from NIPC and an Independent Senior Researcher from Civil Society Group enumerated some of the challenges facing the non-oil sector, which made it undeveloped for decades to cushion impact of the global energy transition.

"There have been lots of strategies and polices planning in the Agriculture and Agro Allied industries in order to boost the non-oil sector. However, the real farmers and entrepreneurs in the rural areas do not seem to benefit from such policies. The factors that hinders the growth of local farmers and industries includes: low level of technological know-how to preserve, process raw-materials to semi-finished and finished goods; in-accessibility of credit facilities, unfavourable operating environment and inconsistencies in policies" (R6).

"I think the issue is how prepared is the government towards the development of the non-oil sector. Government has not been putting sustained commitment in opening up the sector and there are no achievable targets and robust plans. When you look at our GDP, the contribution of agriculture and manufacturing sector has reduced considerably. This suggests that we are shifting away from agriculture and manufacturing. Currently, there is no incentives to encourage agricultural business and the power supply is not stable to propel the manufacturing sector" (R20).

From the above responses, the interviewees have clearly stated that inconsistent policies and infrastructural deficit are amongst the reasons for non-development of the non-oil sector. In contrast, a respondent amongst the Public Financial and Economic Analyst commented that:

"Government has not really implemented the reforms within the non-oil sector. If you look at the sector, there are lot of leakages in terms of revenue. For instance, from what Federal Inland Revenue Service (FIRS) is collecting in terms of VAT, there are cases of non-remittances of collected revenue resulting into low total government revenue. Also, revenue generation from customs and exercise duties is becoming very low due to granting of waivers and tax holidays arbitrarily to politicians and this has also affected the non-oil revenue" (R19).

However, an interviewee from OAGOF opined that the government has started addressing the leakages from revenue generation, collection and remittances into the Federation Account through the newly implemented Treasury Single Account (TSA).

> *"There have been lots of leakages in the system. It is good news that the new government is trying to block all the leakages by ensuring remittance of taxes and revenue into a single account called Treasury Single Account (TSA). TSA has been in the system before the coming of this regime. However, previous governments refused to implement it" (R15).*

In contrast, another public commentator stated that government was off-track in terms of its existing policies and the country has to revisit previous polices in order to minimise the impact of the energy transition.

> ***"****I think there was a disconnection in our policies pursued because in the middle of 1980s, this concept of growth post, industrial clusters or incubators were much promoted by UNIDO and World Bank agencies. Every States had developed industrial clusters and every Local Government was supposed to be seeing as incubators for industrial growth. If we had sustained that, the economy may have been strong, but somewhere along the line, the commitment level started dwindling. This is mostly link to Nigerian overdependence on oil revenue. For us to succeed, we have to go back to the policies of the past in order to lessen the impact of the energy transition on our economy" (R18).*

A representative of academic community opined that if not because of Nigeria's continuous dependence on oil revenue, the development of the non-oil sector might have solved the impact of the energy transition.

"For us to succeed, we must unlock other sources of revenue. One of the greatest misfortunes that Nigeria has faced is the nearly complete dependency on mono-source of revenue, which is oil. All the three tiers of governments depend on monthly statutory allocation largely generated by oil and gas. This has nearly destroyed other sources of generating revenue in the country and for Nigeria to safeguards its budget and economy from any external shock, oil revenue dependence has to be broken" (R17).

Similarly, an interviewee from MOF specified in absolute terms that Nigeria must reduce dependence on oil revenue and find alternative sources in order to cushion the impact of the energy transition.

"Nigeria must go beyond oil by diversifying the economy to develop other sources of revenue generation. Nigeria should replicate other oil producing countries such as United Arab Emirates (UAE) that are already diversifying their revenue sources. Basically, the plans and policies on ground in our country either have to be amended or develop new ones to practically address the emerging challenges" (R13).

Moreover, interviewees from NNPC (7 and 9) stated that:

"We are all deceiving ourselves. We will only ease the impact of the energy transition when we sincerely focus on agriculture and halt the exploration and production of oil and gas. Before the discovery of oil, cash crops such as Groundnut, Cocoa and Palm Oil are the foreign exchange earners to our economy. However, today, nobody wants to go the farm. Our people are forming Co-operative Societies for buying Tricycles instead of forming Co-operatives for farming" (7).

"I believe that when we invest into petrochemicals, it will be a way to trigger the expansion and development of our industrial sector because end-users will always be there. In addition, if you look at a petrochemical like methanol, if you process it, you find that the derivatives are almost endless and some of the industries are presently importing some of these products. In a country like Nigeria, oil and gas will still be a dominant source of energy in years to come. There is the need for Nigeria to use and add value to its energy resources to derive the maximum revenue. However, we always emphasis on raw crude export" (9).

Lastly, another Senior Lecturer from UNIMAID, representing the academic community opined that.

"Several academicians have written books showing that oil is a curse. Why is it a curse? It is a curse to producers like us because we are exporting only the raw material without adding value. So many activities are contained in crude oil. Therefore, if we can develop a local capacity to refine and set up petrochemical plants, we will generate lot of revenue and employment. This may mitigate the impact of the energy transition. Similarly, Nigeria is the largest economy in Africa by virtue of its GDP of N85 trillion which we hope next year will grow to N105 trillion. When we stimulate domestic activities and get the downstream running, we will be fine. Today, as am talking to you, how many fertilizer companies do we have in Nigeria? How many of our petrochemical plants are working?" (16).

Overall, the foregoing responses suggest that there are generic plans developed by the Nigerian government as regards the overall economy. However, most of the participants believed that in many instances, the plans were only implemented partially. Similarly, some participants observed that governments have not been consistent in implementation of plans and policies and some of the existing policies were impracticable. More specifically, findings established that existing policies put in place by governments might not mitigate the impact of the energy transition. This is because of overwhelming dependence on oil and gas revenue, acute infrastructural deficit, weak institutions, and absence of political will towards the development of the non-oil sector in Nigeria.

The above findings agree with existing literature which has established that Nigerian dependence on oil and gas oil revenue had caused significant negative effects on transparency, service delivery and has undermined technological progress and crippled the revenue earning potential of the non-oil and gas sector of the economy (Ibrahim, 2008 and Anthonsen et. al, 2012). Similarly, Budina and Wijnbergen (2008) argued that countries such as Nigeria are characterised by slow economic growth, de-industrialization; low savings, lagging human and physical capital accumulation, and stagnating or declining productivity despite numerous oil and gas revenue received over the years. Above all, it appears that there is no definite and robust plan to mitigate the impact of the energy transition on Nigeria. The next section presents the interim summary of the qualitative findings.

8.5 Summary of Major Qualitative Findings

The chapter presented and analysed the findings of the semi-structured interviews. The participants were interviewed in order to supports the quantitative findings generated in the previous chapter and provide further comments that addressed research question two in order to achieving the research objective five (section 8.3). The summary of major findings is presented below.

The findings of section **8.2.1** supported the validity of the quantitative results, which shows that carbon emissions reduction in developed NEICs will negatively influence Nigerian oil and gas exports. This suggests that reduction in the level of carbon emission in developed NEICs, which are major importer of Nigerian oil and gas, could translate to reducing oil and gas revenue generated from oil and gas exports to these countries. This has serious implications on financing Nigerian annual budget, which the expected bulk of revenue is to come from oil and gas exports revenue.

In respect of section **8.2.2,** the short-run qualitative findings supported the quantitative results and showed that renewable energy consumption in developed NEICs has negative influence on Nigerian crude oil and gas exports.

Moreover, the short-run qualitative findings revealed that other external factors affects Nigerian oil and gas exports. The discovery of non-conventional energy sources, new discoveries of conventional sources in many countries, the improvement in the level of technology, massive trading of illegal crude oil and lifting of ban on Iran's oil exports were amongst the several factors affecting Nigerian oil exports now. However, the long-run qualitative findings **(section 8.2.3)** show that the interviewees unanimously do not support the quantitative findings. In the contrary, the interviewees opined that consumption of renewable energy in developed net energy importing countries would have a negative influence on Nigerian oil and gas exports.

Sections 8.2.4 and **8.2.5** provides for the qualitative findings for both short and long run in respect of the quantitative results respectively. The short-run qualitative findings supported the quantitative results, which established that renewable energy in emerging NEICs has positive influence on Nigerian oil and gas exports. However, other external factors influencing Nigerian oil and gas exports fluctuations were also being discovered. These are supply glut, use of long-term contract by Arab oil producing countries, slowdown of economic activities in emerging countries amongst others. Similarly, the long-run qualitative findings supported the long-run quantitative results that revealed renewable energy consumption in emerging NEICs would have positive influence on Nigerian oil and gas export. This suggests that renewable energy in these countries will not have the potentiality in substituting Nigerian oil and gas exports. Consequently, conventional energy sources will continue to remain as the dominant energy source for emerging NEICs. This implies that Nigerian oil and gas exports will continue to emerging NEICs in order to drive and sustain their socio-economic activities.

Section 8.3 findings indicated that renewable energy consumption in developed NEICs appears to have higher impact on Nigerian oil and gas exports both in the short and long-run than in emerging NEICs.

Section 8.4.1 revealed that almost all the MDAs were fully aware of the global effort to replace conventional energy with other sources of energy such as renewable. Similarly, the interview findings revealed that global energy transition would have an impact on Nigeria as an oil revenue dependent country. The impact could be in terms of reduced oil exports, revenue and foreign exchange earnings. This would further aggravate the existing problems of infrastructural deficit, economic under development and growth. However, the findings revealed that the energy transition would be an opportunity for Nigeria to change the direction of its economy from an oil revenue dependent to a diversified economy.

Section 8.4.2 relates to whether the global transition affected FDI flow into Nigerian petroleum industry. The findings from section **8.4.2** reveal that global energy transition has affected FDI flow into Nigerian petroleum industry. This will affect discovery of new oil and gas reserve, oil and gas production and exports volume. The study has also established that lack of clear petroleum policy guideline; activities of militants and the stringent nature of the Nigerian content law as some of the internal factors affecting the Nigerian petroleum industry. However, the global energy transition could help Nigeria to attract investment into the non-oil sector. Furthermore, the gradual divestment of foreign investors may afford opportunity to indigenous investors to be active players in the Nigerian oil and gas industry.

Section **(8.4.3),** revealed that the global energy transition together with other factors have affected oil price and Nigerian oil and gas exports to developed NEICs. This in turn has caused significant reduction in total government revenue, budget financing and savings made to the Nigerian sovereign wealth fund. The last section **(8.4.4)** established that despite their awareness of the implications of the global energy transition, the MDAs have not able to unveil any strategic plans or policies in order to mitigate the impact of the global energy transition. This calls for the development of strategic plans and policies that is measurable and attainable, which could fast track the detachment of Nigerian economy from the exhaustible and environmentally unfriendly revenue sources.

Chapter 9.
Conclusion

9.1 Introduction

This PhD project has examined the impact of renewable energy consumption and carbon emissions reduction by NEICs on Nigerian oil and gas exports (NOEs) and obtained the perceptions of stakeholders in Nigeria about the impact of global energy transition on oil and gas revenue, budget and plans to mitigate these impacts. The pragmatic approach explained in details in chapter 6 was employed to undertake the study. As engrossed within the body of this approach, the study is divided into two parts. The first part used ARDL-Bounds testing approach of co-integration econometric based method to investigate and analyse how renewable energy consumption and carbon emissions reduction in net energy importing countries (NEICs) affect NOEs. The quantitative findings were obtained and presented in chapter 7. The second part used primary data in form of semi-structured interviews to support the quantitative results and obtain the perceptions of stakeholders in Nigeria. The qualitative findings were presented in chapter 8.

This chapter will interpret the major findings enumerated in the preceding in both chapters (7 and 8) and discuss them within the context of the reviewed literature, the theory used, draw the possible practical implications and serve as a basis for concluding the study. The chapter is structured in the following format. The next section discusses in details the main research findings. Subsequently, section 9.3 highlights the policy implications. Similarly, section 9.4 outlines the strategic plan recommended for policy makers in order to mitigate the impact of energy transition. The following section 9.5 deliberates and presents the study contributions that emanates from the academic exercise. The limitations of the study are captured and discussed in section 9.6. Finally, an area for future studies and improvement in the study are discussed in section 9.7.

9.2 General Discussions on the Main Research Findings

The aim is to interpret and discuss both the quantitative and qualitative findings in details as reported in chapter 7 and 8 within the context of the reviewed literature, theory and practice. The findings were discussed to provide the basis to show that the research hypotheses and questions raised in chapter 1 were answered and subsequently achieved the research objectives. Consequently, it is expected to facilitate the generation of practical policy implications and recommendations. The first part discusses the findings in respect to impact of carbon emission reduction in developed NEICs on NOEs.

9.2.1 Findings on Impact of Carbon Emission Cut on NOEs

Objective 1: To investigate and analyse how carbon emission reduction in developed NEICs affect Nigerian oil and gas exports.

Ha: 1: Carbon emission reduction in developed NEICs has influence on Nigerian oil and gas exports.

This section discusses the findings in respect of the impact of carbon emission reduction in developed NEICs affect Nigerian oil and gas exports to achieve the above objective. The finding obtained as a result of testing the above hypothesis revealed that CO_2 reduction in developed NEICs have negative influence on NOEs in the long-run (**section 7.2.4).** Therefore, the null hypothesis is rejected. This finding is supported in the reviewed literature such as the works of Berg et al., (1997); McKibbin et al. (1999); Radetzki, (2002); Barnett, Dessai, and Webber (2004); Dike, (2013) and McCollum, et al., (2014) who found that carbon emissions reduction could reduce oil importations and consumption and this would have significant effects on OPEC members' oil and gas revenue. Similarly, the qualitative interview findings supported the above quantitative findings as presented in **section 8.2.1**. However, the finding has contradicted certain studies establishing that carbon emissions reduction have positive influence on net energy producing and exporting countries (Persson, et al., 2007 and Johansson, et al., 2009).

Positioning these findings within the context of dependency theory, it suggests that Nigeria as a net energy exporter that relies substantially on developed NEICs for its oil and gas exports. On the other hand, the developed NEICs on whose Nigeria depends heavily for its oil and gas exports are pursuing policies aimed at reducing their oil and gas imports volume. While these will result in achieving macro environmental and carbon accountability for these NEICs, perhaps Nigeria is bound to loss significant share of oil and gas exports volumes. This has an implication of reducing Nigerian oil and gas volume, which in turn may affect its total revenue and budget financing. This finding could also be contextualised within the lens of strategic issue analytical framework. Developed countries have made binding commitments in the Kyoto protocol agreement and have adopted national targets to reduce carbon emissions by means of reducing oil and gas consumption. This suggests that realising these objectives are of strategic national importance to the developed net energy importing countries. Therefore, this result indicating reduced oil and gas imports volume by developed NEICs from Nigeria suggests the achievement of this strategic policy objective.

Scrutinising the carbon emission reduction in developed NEICs on Nigeria within the strategic issue analytical framework, it portends an economic loss arising from reduced oil and gas exports volume and revenue. However, it could be a strategic issue for Nigeria to explore ways of increasing its market share of oil and gas exports volume to emerging NEICs in order to substitute the potential reduction by the developed NEICs. Similarly, it could be a strategic opportunity for Nigeria to capitalise on and diversify to other sources of revenue in order to mitigate the potential impacts of the carbon emissions reduction. The succeeding discussions of findings are in respect to renewable energy consumption (REC) in developed NEICs and its impact on NOEs.

9.2.2 Findings on Impact of REC in Developed NEICs on NOEs

Objective 2: To investigate and analyse how renewable energy consumption in developed NEICs affect Nigerian oil and gas exports.

Ha: 2: Renewable energy consumption in developed NEICs has influence on Nigerian oil and gas exports.

This section discusses the findings related to objective 2 and hypothesis 2. The findings revealed the existence of a negative relationship between renewable energy consumption in developed NEICs and NOEs in the short-run (**section 7.3.4**). Similarly, the finding further confirms that the projections made about renewable energy to account for significant share in developed NEICs' total energy mix in the future would be realised. This has serious implications on Nigerian oil and gas exports, which will perhaps affect government revenue. However, contrary to the short-run results, the long-run results indicated a positive relationship (**section 7.3.4**). These research outcomes were supported by findings in the literature (Szklo and Schaeffer, 2006; Akella, Saini and Sharma, 2009; Jorgenson, 2012; York, 2012; Smith, 2014). In addition, evidence from International Energy Agency (2015) and Energy Information Administration (2014) also indicates the insignificant level of renewable energy in the total global energy basket.

However, to supports the quantitative findings of the study, opinions of stakeholders were sought and mixed findings were found on the short-run results (**section 8.2.2**) and the long-run quantitative findings does not support the quantitative results (**section 8.2.3**). In regards to the short-run qualitative findings (**section 8.2.2**), half of the interviewees are with the view that renewable energy consumption in developed NEICs has negative influence on Nigerian oil and gas exports, and these views supported the quantitative results. While the other half of the interviewee's holds contrary opinion. However, the researcher's opinion fits with the first group, which is also consistent with the

quantitative results that, renewable energy consumption in developed NEICs has a negative impact on Nigerian oil and gas exports. This is because renewable energy sources are substitutes for oil and gas, renewable energy consumption by developed NEICs, being are major exports destination for Nigerian oil and gas has affected Nigerian oil and gas exports to these countries. This is evident from the dramatic decrease of Nigerian oil and gas export, which had significant impact on total government revenue.

For the long-run qualitative findings (section 8.2.3) that do not support the long-run quantitative results (**section 7.3.4**), the participants were of the view that in the long-term, renewable energy consumption in developed NEICs will significantly affect NOEs considering their present level of investment towards the development of renewable energy. However, in this circumstance, the researcher's view tilts towards the quantitative findings, which is more robust and empirically tested. However, it is inconsistent with the findings of Szklo and Schaeffer (2006); Akella, Saini and Sharma (2009); York (2012) and Smith (2014). They all concluded that renewable energy would displace conventional energy sources, which most net energy importing countries believed to affect their energy security, financial reserves and GDP. However, the differences between the long-run quantitative and qualitative findings is interesting as it confirms the methodological dichotomy in social sciences, which strengthened the robustness of the study.

The above findings can be explained within the context of dependency theory, which underpins this study. On the one hand, developed NEICs will be importing more of Nigerian oil and gas to meet their energy requirement in the long run. Thus, developed NEICs will continue to depend on Nigerian oil and gas exports perhaps due to the insignificant output in their renewable energy production in the long term, discouraged by withdrawal of incentives and support by their governments. On the other hand, Nigeria will continue depending on these developed NEICs for its oil and gas exports, which may perhaps translate to more oil and gas revenue thereby increasing total government revenue.

However, in the short-run, renewable energy consumption in developed NEICs negatively influence NOEs volume (**section 7.3.4**). This suggests that Nigerian dependency on developed NEICs' importation of its oil and gas will be reduced thereby may affect revenue realised from these sources. Although, stakeholders in Nigeria were of the view that the current decrease in the NOEs was not exclusively caused by renewable energy consumption in developed NEICs (section 8.2.3). Other external factors such as discovery of non-conventional energy sources, new discoveries of conventional sources in other countries, the improvement in the level of technology, massive trading of illegal crude oil and lifting of ban on Iran's oil exports were also responsible for the fluctuation in NOEs.

Also, going by the interview narratives, the global energy transition from conventional to renewable energy by the developed NEICs to attain macro environmental and carbon accountability as well as energy security is considered strategic issue to Nigeria. It is strategic because already, it has started having negative impacts on Nigerian total government revenue sequel to reduced NOEs volume. Continuation of these trends may translate to cumulative budgetary financing problems for Nigeria in the future. On the other hand, it could as well be a strategic opportunity to diversify the Nigerian economy away from oil and gas revenue dependence. Indeed, responses from some of the interviewed decision makers indicated that these decreases in oil and gas exports volume present strategic opportunity for Nigeria.

Therefore, diversification to non-oil sector is a strategic issue of focus for Nigerian public policy and decision makers. On the other hand, concerns for energy security, environmental and macro accountability are strategic issues to the developed NEICs. Thus, carbon emission reduction and renewable energy consumption are strategic issues to decision makers in these countries. Therefore, strategy issue analytical framework is useful in underpinning this study within the context of Nigeria as net energy exporting country and the developed

countries as NEICs. The next part discusses the findings in respect to the impact of renewable energy consumption in emerging NEICs on NOEs.

9.2.3 Findings on Impact of REC in Emerging NEICs on NOEs

Objective 3: To investigate and analyse how renewable energy consumption in emerging NEICs affect Nigerian oil and gas exports.

Ha: 3: Renewable energy consumption in emerging NEICs has influence on Nigerian oil and gas exports.

In this section, the findings in respect of the above objective and hypothesis are discussed. The quantitative findings revealed that NOEs are positively influenced by renewable energy consumption in emerging NEICs both in short and long run (**section 7.4.4**). Therefore, we rejected the null hypothesis and hence concluded that emerging NEICs will continue to demand Nigerian oil and gas exports in the future irrespective of the growth level of renewable energy in their total energy mix. However, this finding is inconsistent with the literature findings of Akella, Saini and Sharma (2009) who concluded that renewable energy consumption reduces dependence on imported oil and gas and sustains economic and environmental sustainability in NEICs. However, both the long and short-run qualitative findings (**section 8.2.4** and **8.2.5**) supported the quantitative short and long-run results that renewable energy consumption in these emerging NEICs will positively influence NOEs to these countries (**section 7.4.4**).

These findings suggest that despite the anticipated increase in renewable energy consumption in emerging net energy importing countries, their demand for Nigerian oil and gas will be high to sustain their current and future socio-economic activities. Moreover, conventional energy sources will continue to remain as their dominant energy sources, as predicted by OPEC World oil outlook (2015) that oil will remain central to the global energy mix over the next 25 years, especially in emerging countries where populations continue to grow and many are expected to move out of poverty.

Explaining the above findings within the context of dependency theory, Nigeria as a net energy exporter will continue to depend on emerging countries' for its oil and gas exports in the short and long run. Similarly, the argument being that, the energy intensity of renewable energy will not be able to satisfy the energy requirements of emerging NEICs of China, India, Brazil and South Africa. This is consistent with International Energy Agency (2014) forecast that, the consumption of conventional energy by emerging countries, driven by population and economic growth will significantly increase in the future and surpass oil volume exported to develop NEICs.

Therefore, Nigeria may continue to be dependent on oil and gas exports to these destinations as constituents of its total oil and gas exports volume and revenue to continue financing its budgets. On the part of these countries, they will continue to depend on Nigerian for oil and gas sources of energy. Explaining these dynamics within the context of strategic issue analytical framework, emerging NEICs are strategic destinations for NOEs volume. Likewise, Nigeria will continue to be a strategic source of oil and gas imports to these emerging NEICs to meet their energy requirements for economic growth and developments. This suggests the need for Nigeria and emerging NEICs to strengthen their economies ties for mutual benefits.

9.2.4 Findings on Comparison between Developed and Emerging NEICs

Objective 4: To compare and analyse the extent of the net effect of renewable energy consumption in developed NEICs and emerging NEICs on Nigerian oil and gas exports.

RQ: 1: The net influence of renewable energy consumption by developed NEICs on Nigerian oil and gas exports is higher than emerging NEICs.

This objective is aimed to qualitatively compare and analyse the effect of renewable energy consumption in developed NEICs and emerging NEICs on

Nigerian oil and gas exports in order to answer research question one as restated above. The findings indicated that renewable energy consumption in developed NEICs have higher impact on Nigerian oil and gas exports than in emerging NEICs. The reviewed literature suggests that the drive for renewable energy consumption has been increasing in all countries irrespective of being developed or emerging NEICs. Some of the reasons that drives the increase are energy security concerns, oil price shock, economic and environmental effects it has to their respective countries. Energy insecurity as result of supply disruption and future uncertainty due to peaking of hydrocarbon resources has been the primary challenge to net energy importing countries in their pursuit to meet their growing energy demand. Simultaneously, it is also evident that strategy to uncover sustainable energy pathways to this problem has remained a topmost priority of their respective governments since the first oil price shock of 1973.

More importantly, most countries especially in Europe, America and Asia have strong policies frameworks on renewable energy development. However, despite the increase in renewable energy consumption in both developed and emerging NEICs, they may continue to depend on imported energy from countries such as Nigeria in the long-run. This could be due to fact that the supports rendered by their governments towards the development of renewable energy would not be sustainable in the long-run. This would make price of renewable energy higher than oil and gas prices. Considering the low intensity of renewable energy, NEICs would prefer to consume oil and gas in order to drive and sustain their socio-economic activities. The next part discusses the qualitative findings relating to the perceptions of public stakeholders in Ministries, Department and Agencies (MDAs) and other stakeholders about the impact of global energy transition on Nigerian oil and gas revenue, budgets and plans to mitigate the impacts.

9.2.5 Findings on the Perceptions of MDAs

Objective 5: To investigate and analyse the perceptions of public decision and policy makers in ministries, departments and agencies (MDAs) and other stakeholders in Nigeria about the impact of the global energy transition on Nigerian oil and gas revenue, budgets and plans to mitigate these impacts.

RQ 2: What are the perceptions of public decision and policy makers in MDAs and other stakeholders about the impact of the global energy transition on Nigerian oil and gas revenue, budgets and plans to mitigate these impacts?

In this section, the findings in respect of the above raised research question meant to achieve objective five are discussed. The qualitative findings established that the various MDAs responsible for managing the Nigerian economy are aware of the global energy transition and its impact on Nigeria as net energy exporting and dependent nation. In terms of the impact, the study discovered that global energy transition is one of the several external factors responsible for decrease in Nigerian oil and gas exports. The other factors such as lifting of oil embargo on Iran, discovery of shale in USA and discovery of oil and gas in other countries were also identified.

Similarly, it was established that the global energy transition has affected FDI flow into Nigerian oil and gas industry, which in turn had affected the discovery of new oil reserve. It is expected that these will affect Nigerian oil and gas production and exports volume in the future. Similarly, the study revealed that the global energy transition has affected total government revenue, Naira value; savings made to the sovereign wealth fund.

Reflecting these impacts within the ambit of dependency theory and strategic issue analytical framework, it brings to light the extent to which the Nigerian economy is predicated on external influence. It demonstrates the vulnerability of depending on oil and gas revenue that is determined by external variables. These findings practically demonstrate how the Nigerian government is currently faced

with severe financial challenges to undertake the functions of governance. With the sustained effort to increase the level renewable energy and the global effort to reduce carbon related energy sources, the future impact in financing budgets will be enormous.

Similarly, consistent and sustained effort to reduce carbon emission through the implementation of the Kyoto protocol may affect Nigerian oil and gas exports over time. Thus, the implementation of the Kyoto protocol as a platform for carbon emission reduction has been ongoing since 1997. More countries are committing to reduce their carbon emissions level. In addition, it requires some time for investment in renewable energy in NEICs to mature. Therefore, it is anticipated that certain period may elapse from the occurrence of the massive oil and gas revenue shock.

Based on the foregoing enumerated impacts of the global energy transition on Nigerian oil and gas revenue and budget, the interviewer asked the interviewees whether there are plans to mitigate these impacts. Subsequently, the study found out the inexistence of specific strategic plans or policies by the government in addressing the impact of the global energy transition. This calls for the development of strategic plans and policies that are measurable and attainable towards making the non-oil sectors viable and efficient in contributing to government revenue. Based on the foregoing, this study has identified the following policy implications for public policy and decision makers in Nigeria.

9.3 Policy Implications

Based on the discussions of the major findings above, the policy implications of this study can be summarized as follows:

1. The findings point to the fact that, carbon emission reduction in developed countries is not only an economic threat but also an opportunity to Nigeria as oil dependent country. It is an economic threat because; it portends a loss of oil and

gas exports, thereby putting pressure on budget financing and socio-economic growth and development. Therefore, Nigeria should take cautionary position in the global climate change debate in order not to adversely affect the country's economic interest. On the other hand, it could be considered as an opportunity to navigate the country out of the resource dependent trap.

2. The consumption of energy from renewable sources in both developed and emerging NEICs is an opportunity for Nigeria to export not only its conventional energy but also harness its abundant renewable energy potentials and exports them to these countries. This suggests that Nigerian should also invest heavily in renewable energy production.

3. The study brings to light the need to review existing contractual agreements by signing long-term contracts with its oil and gas trading partners to guarantee oil and gas exports to these countries. Similarly, Nigeria should hasten the passage of the PIB, review the Nigerian content law and secure the Niger-Delta region in order to attract investors and guarantee their stay in Nigeria.

4. There is a need for Nigeria to focus on developing internal market trajectories to increase domestic utilisation of its conventional energy rather than dependent on external markets for the sale of the nation's energy resources.

5. The findings bring into light the urgent need for public policy and decision makers to make sustainable policies, developed a practical strategic plan and religiously implement these plans in order to effectively deal with the external economic threat arising from the influence of global energy transition.

9.4 The Recommended Strategic Plan for Nigeria

Based on the findings and policy implications, the study recommends the need for Nigeria to unlock a sustainable revenue platform anchored on three pillars, namely, structural and institutional reforms, citizen's reorientation and economic diversification to achieve sustainable development. Thus, placing Nigeria on the path of sustainable revenue and development requires a synergy between

citizens, institutions and the economy. On the one hand, the citizens being the major actors and subsequent beneficiaries of the sustainable economy are required to demonstrate certain characteristics such as good behaviour, responsible and accountable life style. The basic elements of discipline, the use of human conscience of what is right and wrong should be entrenched in private and public life. The empowerment of citizens through education and skills acquisition will contribute significantly towards identifying and utilising available opportunities within their environments. Educational institutions, religion bodies and media outfits should be used to change the perceptions of citizens and enable them utilise their potentials based on their intellectual capacity and focus on sustainable resources embedded within their locality and beyond.

When citizens are empowered, will act as actors of change to directly transform institutions and place them on sustainable paths or indirectly bring a popular government to undertake structural and institutional reforms to create economic opportunities, improve resource allocation and increase accountability in governance. This will boost productive capacity and improve efficient service delivery with a view to achieve human capital development and improvement of citizen's social welfare. Moreover, it will help in generational transformation, restore and improve public confidence on institutions, and adherence to constituted authority. Subsequently, resilient institutions, with capacity to empower people backed by efficient laws will drive productivity growth across sectors and tiers of government. The emphasis will be gradual detachment of the Nigerian economy from oil and gas revenue dependence, increasing non-oil revenue sources and adding value to raw materials produced locally. It is expected that this will translate to achieving robust economic growth and ensure sustainable governance.

When sustainable governance is established, it will create diverse economic opportunities, boost productivity and sustain economic growth. However, for Nigeria to achieve sustainable economy, government should map out the economic blue print of the transition from oil revenue dependence to other sources starting from bottom-up (Local Government, State and then Federal).

The identification of opportunities and resources at the Local and State level and its development will ensure economic synergy and sustainable economy. The practical and broad based economic plan should be divided into phases that will ease implementation and ensure measurability. While doing that, it has to undertake structural and institutional reforms in the MDAs and other revenue generating units of government. In addition, there should be forward and backward linkages of the economy by linking the oil and gas produced with the power sector. The provision of stable power will make the non-oil sector self-sustaining without depending on oil and gas export revenue. Nigeria is the largest economy in Africa by virtue of its GDP and population size. More importantly, Nigeria has a big market due to its population size and surrounded with many countries having a reasonable population. With these socio-economic variables, policy and decision makers should look inwards and enhance domestic capacity in maximise the value chain.

In terms of agricultural development, Nigeria has the capacity to produce sufficient agricultural produce to satisfy internal demand and at the same time export surpluses. However, most of the existing policies and programme on agriculture were focused on non-commercial farming. Hence, government should boast the agriculture sector through rural and urban agricultural schemes-in schools (formal and informal), and Tertiary institutions. Similarly, government should encourage corporate farming and collaborate with corporate organisations to establish agro-allied industries in order to add value to the agricultural products thereby substituting the imported ones and creating jobs.

Furthermore, the solid mineral sector, which remains untapped, has the potential to generate significant revenue for the government. A country like Botswana is adjudge as the only African country that succeeded in the exploration and utilization of solid mineral resources. If Nigerian government opens up that sector, it will attract substantial FDI into the country and that will replace the diminishing FDI from the oil and gas sector.

When the country succeeds in creating broad based economy, the citizens, SMEs and corporate organisations will have sustainable income and become taxable. Therefore, government would generate more revenue and it will cushion the oil revenue displacement because of the global energy transition. Similarly, the Nigerian economy will be immune to external shocks, thereby achieving economic growth and development. The next section itemised the study contributions.

9.5 The Study Contributions

Firstly, the study has made theoretical and methodological contributions. Theoretically, to the best knowledge of the researcher, this study is the first that used dependency theory and strategic issue analytical framework. Therefore, theoretically, the study has contributed in applying dependency theory and strategic issue analytical framework in explaining the consequences of mutual inter-relationship between dominant countries (net energy importing countries) and dependent countries (Nigeria) which influences the economy of the latter as a result of renewable energy consumption and carbon emissions reduction in the former country. In terms of methodological contribution, this study adopted the pragmatic approach (combined philosophies, paradigms, research approach and data). Thus, this study is arguably the first to adopt the recently developed ARDL bounds testing approach to co-integration to investigate an important issue facing a net energy exporting and developing country characterised by high dependent on oil and gas export demand. Moreover, the researcher interacted with public policy and decision makers that cut across different ministries, departments and agencies in Nigeria and other stakeholders in order to obtain their professional perceptions about the global energy transition and to support the quantitative results.

Secondly, the study has made significant contribution to the vague body of literature on the subject area particularly the impact of global energy transition on net energy exporting countries, which hitherto attracted less interest from researchers and funders. Most of the existing studies undertaken on the impact of renewable energy were centred on net energy importing countries, as

discussed in chapter three. For example, see Jorgenson, (2012); Tugcu, Ozturk and Aslan (2012); York, (2012) and Smith, (2014). In view of Nigeria being a developing and net energy exporting country, this study contributed to investigate the impact of renewable energy consumption and carbon emissions reductions in net energy importing countries on Nigerian oil and gas exports. The study finds out that with the increasing renewable energy consumption and carbon emission reduction especially in developed countries, Nigerian oil and gas exports will remain progressively uncertain. Hence, the study highlighted the future implications of global energy transition on net energy exporting and dependent countries such as Nigeria. Consequently, the study has presented a robust strategic plan that will effectively and practically address these economic threats within the peculiarity and context of Nigeria. Similarly, the recommended strategic plan will be of immense and practical relevance to public policy and decision makers in Nigeria towards dealing with the global energy transition as both external economic threat and opportunity of achieving sustainable revenue pathways and realising national objectives. Lastly, the study has achieved all the objectives of the study.

9.6 Limitations of the Study

It is generally considered a norm in any research to have certain form of limitations and this study cannot be an exception. In this regard, the followings are identified as the limitations of this study.

1. Although the findings of the study may not be generalised on all net energy exporting and developing countries such as United Arab Emirate that has succeeded in diversifying its economy against oil and gas revenue dependent. However, having the understanding of the implications on Nigeria may give an idea of other countries with similar characteristics such as Venuzuela and Angola.

2. The secondary data used in the study have not included shale oil and gas, which is also part of the global energy transition. As shown from the qualitative findings, the consumption of shale oil and gas has played a

significant role in affecting Nigerian oil and gas exports. However, a reasonable data on shale oil and gas are not available to satisfy the protocols of the method used in this study. This may be because shale oil and gas are new source of energy produced in commercial quantity in few countries. Whereas, the data on all the other variables used in the study are from 1980-2014. Another reason is that, most of the NEICs selected are not using shale oil and gas as energy resources. Similarly, technological development is identified as a key driver of the global energy transition, thus the non-inclusion of technological development as variable in the quantitative model may be considered as one of the limitation of the study. It appears that there is no basis for the measurement of technological advancement in the reviewed literature.

3. Oil and gas exports volume was used as the dependent variable in order to achieve the aim of the study. However, studies that may focus on impact of global energy transition on oil and gas exports revenue may use monetary based values such as oil and gas exports revenue than volume.

4. The researcher has faced challenges before and during the collection of the primary data through interviews. The researcher visited the selected MDAs after the new government assumed power in May 2015 thus, most MDAs were regularising their records. In this regard, most public decision and policy makers in the MDAs were busy while some are sceptical to grant the researcher an audience. Similarly, there were difficulties in accessing some interviewees due to administrative protocols and bureaucracies of public service. For instance, some of the top management staff in the Ministry of Finance and the Office of the Accountant General of the Federation declined to grant the researcher's request to conduct an interview for reasons best known to them. Similarly, the interviews did not include the perceptions of members of the National Assembly. The researcher could not have access to them. However, if the views of these stakeholders are sought, it is likely that other vital information would have been discovered which may improve the

robustness of the study. Furthermore, the researcher has repeated a particular interview due to inability of the recorder to record the interview.

9.7 Areas for Future Study and Improvement

There is the need for future studies to be undertaken in the perspective of other net energy exporting countries and developing countries. Similarly, a comparative study can be carried out between different net energy exporting countries and developing countries. Moreover, future studies could be undertaken to evaluate the impact of global energy transition on oil and gas revenue and using oil and gas revenue as the independent variable. In addition, non-conventional energy (shale oil and gas) and technological advancement can be included as independent variables when reasonable data becomes available and if the basis for measurement is established respectively. Lastly, if future studies could make access to the National Assembly members and other key stakeholders, it could reveal vital information and provide a more comprehensive view about the subject matter. Furthermore, the use of more than one voice recorder may prevent repeating an interview already conducted or help in complimenting any technical failure arising from a recorder.

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Appendices

APPENDICES A

Table A (1): Underlying ARDL Model 1 Results

Autoregressive Distributed Lag Estimates			
ARDL(1,1,2,1) selected based on Schwarz Bayesian Criterion			
Dependent variable is LNE			
32 observations used for estimation from 1983 to 2014			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LNOE(-1)	0.45183	0.14431	3.1309[0.00]
LCEDE	2.4132	1.4657	1.6465[0.11]
LCEDE(-1)	-5.8569	1.3702	-4.2744[0.00]
LOPD	-0.070635	0.13201	-0.53506[0.59]
LOPD(-1)	0.19761	0.13001	1.5199[0.14]
LOPD(-2)	-0.34688	0.12775	-2.7153[.012]
LGDPDE	-0.72252	0.30877	-2.3400[0.03]
LGDPDE(-1)	0.85494	0.29521	2.89600[0.01]
C	16.4548	3.7316	4.4096[0.00]
R-Squared	0.82831	R-Bar-Squared	0 .76859
S.E. of Regression	0.12862	F-stat. F(8, 23)	13.8699[0.00]
Mean of Dependent Variable	10.1831	S.D. of Dependent Variable	0.26738
Residual Sum of Squares	0.38051	Equation Log-likelihood	25.5058
Akaike Info. Criterion	16.5058	Schwarz Bayesian Criterion	9.9099
DW-statistic	2.1856	Durbin's h-statistic	-0.90894[0.363]

Table A (2): Underlying ARDL Model 2 Results

Autoregressive Distributed Lag Estimates			
ARDL(1,0,0,1) selected based on Schwarz Bayesian Criterion			
Dependent variable is LNOE			
32 observations used for estimation from 1983 to 2014			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LNOE(-1)	0.35893	0.18003	1.9937[0.05]
LGDPDE	-1.8942	1.0194	1.8582[0.07]
LOPD	0.010549	0.077123	0.13678[0.89]
LREDE	-0.25567	0.63090	-0.40525[0.04]
LREDE(-1)	1.5515	0.71666	2.1649[0.040]
C	23.5367	12.808	1.8376[0.07]
R-Squared	70965	R-Bar-Squared	0.63997
S.E. of Regression	0.17747	F-stat. F(6, 25)	10.1840[0.000]
Mean of Dependent Variable	10.2106	S.D. of Dependent Variable	0.29577
Residual Sum of Squares	0.78738	Equation Log-likelihood	13.8704
Akaike Info. Criterion	6.8704	Schwarz Bayesian Criterion	1.7403
DW-statistic	2.1956	Durbin's h-statistic	

Table A (3): Underlying ARDL Model 3 Results

Autoregressive Distributed Lag Estimates			
ARDL(2,0,0,0) selected based on Schwarz Bayesian Criterion			
Dependent variable is LNOE			
32 observations used for estimation from 1983 to 2014			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LNOE(-1)	0.39625	0.19737	2.0076[0.05]
LNOE(-2)	-0.41948	0.17612	-2.3818[0.02]
LGDPE	-1.2233	0.58033	-2.1079[0.04]
LREEE	0.61963	0.32024	1.9349[0.06]
LOPD	0.064098	0.03631	1.7651[0.09]
C	27.4430	6.95651	3.9450[0.00]
R-Squared	0.91628	R-Bar-Squared	0.89619
S.E. of Regression	0 .084265	F-stat. F(6, 25)	45.6037[0.00]
Mean of Dependent Variable	20.2701	S.D. of Dependent Variable	0.26153
Residual Sum of Squares	0 .17751	Equation Log-likelihood	37.7049
Akaike Info. Criterion	30.7049	Schwarz Bayesian Criterion	25.5749
DW-statistic	1.9362		

APPENDICES B

Table B (1): Model 1 Joint F Test Result (Bound Test)

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	8.925228*	(4, 7)	0.007
Chi-square	35.70091	4	0

Note: * denotes F-statistic value which was compared with the critical values obtained from Narayan (2004b), case II: restricted intercept and no trend under K=3, n=35.

Table B (2): Model 2 Joint F Test Result (Bound Test)

F-Test			
Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	5.348048	(4, 20)	0.0043
Chi-square	21.39219	4	0.0003

Note: * denotes F-statistic value which was compared with the critical values obtained from Narayan (2004b), case II: restricted intercept and no trend under K=3, n=35.

Table B (3): Model 3 Joint F Test Result (Bound Test)

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	4.195822*	(4, 5)	0.0083
Chi-square	18.20046	4	0

Note: * denotes F-statistic value which was compared with the critical values obtained from Narayan (2004b), case II: restricted intercept and no trend under K=3, n=35.

APPENDICES C

TABLE C (1): MODEL 1 DIAGNOSTIC TESTS

*Test Statistics *	LM Version	* F Version
* A:Serial Correlation*	CHSQ(1)= 0.56067[0.454]	*F(1, 22)= 0.39233[0.538]*
* B:Functional Form	*CHSQ(1)= 0.022488[0.881]	*F(1, 22)= 0.015471[0.902]*
* C:Normality	*CHSQ(2)= 0.55804[0.757]	* Not applicable *
* D:Heteroscedasticity	*CHSQ(1)= 4.7733[0.029]	*F(1, 30)= 5.2596[0.029]*
A:Lagrange multiplier test of residual serial correlation		
B:Ramsey's RESET test using the square of the fitted values		
C:Based on a test of skewness and kurtosis of residuals		
D:Based on the regression of squared residuals on squared fitted values		

Table C (2): Model 2 Diagnostic Tests Results

Diagnostic Tests		
Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= 1.0799[0.299]	F(1,24)= 0.83818[0.369]
B:Functional Form	CHSQ(1)= .35749[0.550]	F(1,24)= 0.27115[0.607]
C:Normality	CHSQ(2)= 2.0328[0.362]	Not applicable
D:Heteroscedasticity	CHSQ(1)= .12695[0.722]	F(1, 30)= 0.11949[0.732]
A:Lagrange multiplier test of residual serial correlation		
B:Ramsey's RESET test using the square of the fitted values		
C:Based on a test of skewness and kurtosis of residuals		
D:Based on the regression of squared residuals on squared fitted values		

Table C (3): Model 3 Diagnostic Tests

Diagnostic Tests		
*		
* Test Statistics *	LM Version *	F Version *
*		
* A:Serial Correlation*	*CHSQ(1)= 0.66813[0.414]*	F(1, 24)= 0.51179[0.481]*
* B:Functional Form	*CHSQ(1)= 0.073448[0.786]*	F(1, 24)=0.055212[0.816]*
* C:Normality	*CHSQ(2)= 0.86945[0.647]*	Not applicable *
* D:Heteroscedasticity	*CHSQ(1)= 0.011424[0.915]	*F(1,30)=0.010714[0.918]*
A:Lagrange multiplier test of residual serial correlation		
B:Ramsey's RESET test using the square of the fitted values		
C:Based on a test of skewness and kurtosis of residuals		
D:Based on the regression of squared residuals on squared fitted values		

APPENDICES D

Figure D1 (a): Model 1 CUSUM Test Results

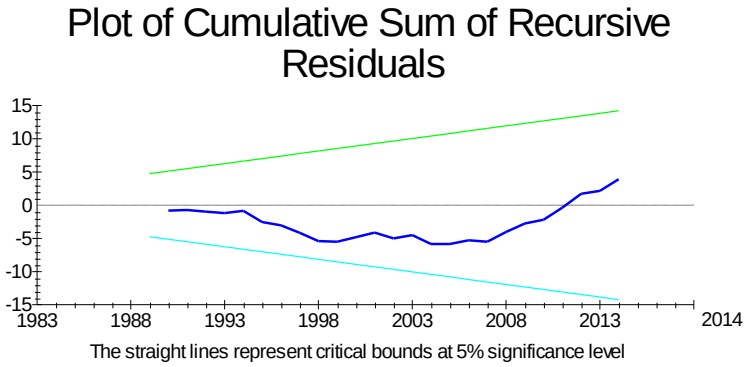


Figure D2 (a): Model 2 CUSUM Test Results

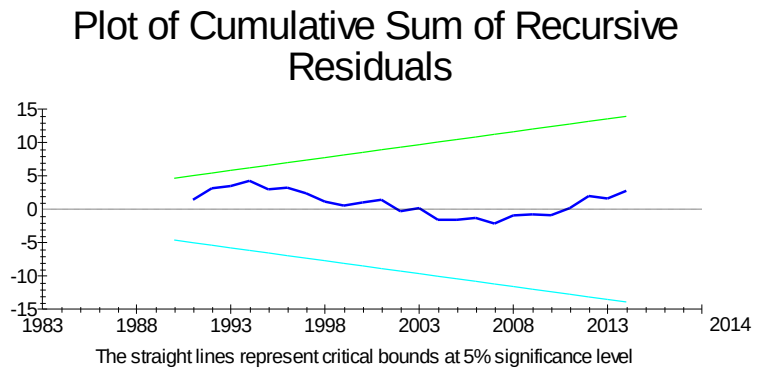


Figure D3 (a): Model 3 CUSUM Test Results

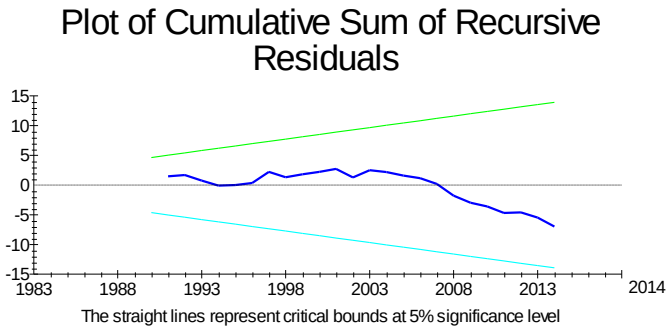


Figure D1 (b): Recursive CUSUM of Squares Test Results

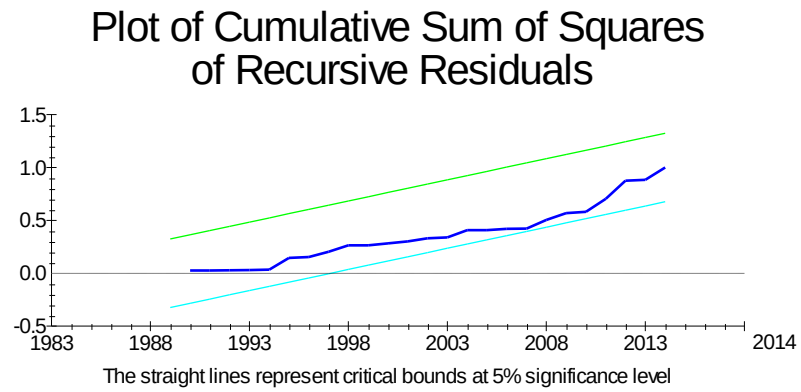


Figure D2 (b): Model 1 Recursive CUSUM of Squares Test Results

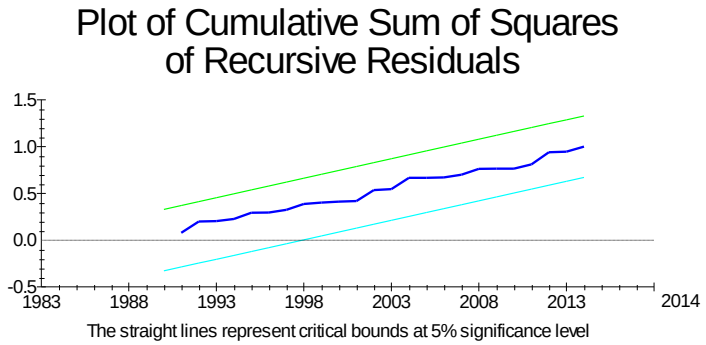
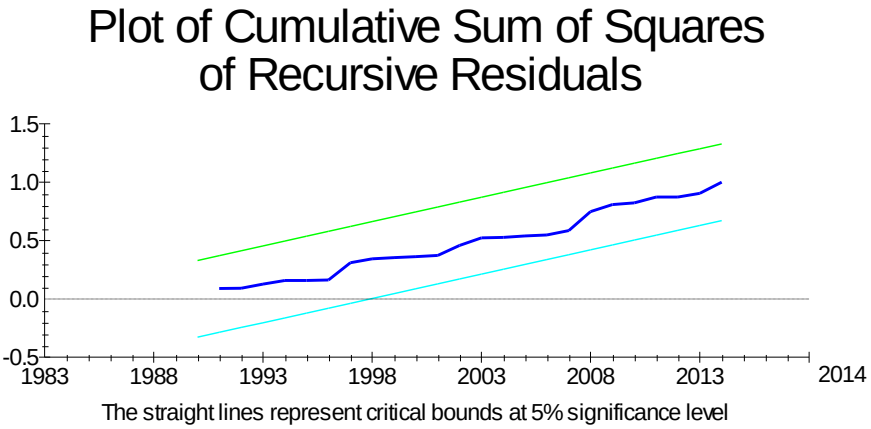


Figure D3 (b): Recursive CUSUM of Squares Test Results



APPENDICES E: Narayan (2004b) Critical Value Bounds

APPENDIX E1

Appendix A1: Critical values for the bounds test: Case II: restricted intercept and no trend

1 percent level

n	k = 0		k = 1		k = 2		k = 3		k = 4		k = 5		k = 6		k = 7	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
30	7.595	7.595	6.027	6.760	5.155	6.265	4.614	5.966	4.280	5.840	4.134	5.761	3.976	5.691	3.864	5.694
31	7.485	7.485	5.847	6.637	5.075	6.240	4.654	5.920	4.320	5.785	4.071	5.741	3.901	5.611	3.826	5.691
32	7.485	7.485	5.913	6.710	5.065	6.190	4.570	5.928	4.223	5.763	4.057	5.636	3.871	5.571	3.762	5.460
33	7.380	7.380	5.787	6.580	5.048	6.053	4.578	5.864	4.252	5.668	3.990	5.516	3.849	5.476	3.718	5.461
34	7.360	7.360	5.750	6.493	4.943	6.128	4.522	5.792	4.165	5.650	3.960	5.603	3.764	5.431	3.641	5.446
35	7.350	7.350	5.763	6.480	4.948	6.028	4.428	5.816	4.093	5.532	3.900	5.419	3.713	5.326	3.599	5.230
36	7.405	7.405	5.757	6.483	4.968	6.058	4.480	5.700	4.097	5.580	3.867	5.444	3.686	5.310	3.536	5.238
37	7.425	7.425	5.737	6.490	4.920	5.975	4.400	5.664	4.030	5.463	3.810	5.404	3.619	5.286	3.513	5.190
38	7.290	7.290	5.807	6.490	4.895	5.940	4.376	5.690	4.092	5.457	3.881	5.241	3.680	5.148	3.546	5.084
39	7.230	7.230	5.640	9.390	4.833	5.885	4.324	5.642	3.983	5.448	3.796	5.299	3.621	5.184	3.468	5.057
40	7.220	7.220	5.593	6.333	4.770	5.855	4.310	5.544	3.967	5.455	3.657	5.256	3.505	5.121	3.402	5.031
45	7.265	7.265	5.607	6.193	4.800	5.725	4.270	5.412	3.892	5.173	3.674	5.019	3.540	4.931	3.383	4.832
50	7.065	7.065	5.503	6.240	4.695	5.758	4.188	5.328	3.845	5.150	3.593	4.981	3.424	4.880	3.282	4.730
55	6.965	6.965	5.377	6.047	4.610	5.563	4.118	5.200	3.738	4.947	3.543	4.839	3.330	4.708	3.194	4.562
60	6.960	6.960	5.383	6.033	4.558	5.590	4.068	5.250	3.710	4.965	3.451	4.764	3.293	4.615	3.129	4.507
65	6.825	6.825	5.350	6.017	4.538	5.475	4.056	5.158	3.725	4.940	3.430	4.721	3.225	4.571	3.092	4.478
70	6.740	6.740	5.157	5.957	4.398	5.463	3.916	5.088	3.608	4.860	3.373	4.717	3.180	4.596	3.034	4.426
75	6.915	6.915	5.260	5.957	4.458	5.410	4.048	5.092	3.687	4.842	3.427	4.620	3.219	4.526	3.057	4.413
80	6.695	6.695	5.157	5.917	4.358	5.393	3.908	5.004	3.602	4.787	3.351	4.587	3.173	4.485	3.021	4.350

26

APPENDIX E2

Appendix A2: Critical values for the bounds test: Case II: restricted intercept and no trend

5 percent level

n	$k=0$		$k=1$		$k=2$		$k=3$		$k=4$		$k=5$		$k=6$		$k=7$	
	$I(0)$	$I(1)$	$I(0)$	$I(1)$	$I(0)$	$I(1)$	$I(0)$	$I(1)$	$I(0)$	$I(1)$	$I(0)$	$I(1)$	$I(0)$	$I(1)$	$I(0)$	$I(1)$
30	5.070	5.070	4.090	4.663	3.538	4.428	3.272	4.306	3.058	4.223	2.910	4.193	2.794	4.148	2.730	4.163
31	5.065	5.065	4.063	4.653	3.535	4.423	3.256	4.264	3.033	4.188	2.899	4.143	2.780	4.084	2.713	4.094
32	5.025	5.025	4.013	4.637	3.505	4.398	3.208	4.252	3.002	4.150	2.846	4.091	2.741	4.060	2.670	4.047
33	4.960	4.960	4.003	4.593	3.500	4.373	3.198	4.202	3.010	4.105	2.863	4.077	2.749	4.044	2.664	4.004
34	4.985	4.985	3.990	4.573	3.990	4.358	3.160	4.218	2.957	4.117	2.826	4.049	2.729	3.994	2.658	3.973
35	4.945	4.945	3.957	4.530	3.478	4.335	3.164	4.194	2.947	4.088	2.804	4.013	2.685	3.960	2.597	3.907
36	4.980	4.980	3.990	4.590	3.458	4.343	3.170	4.160	2.962	4.062	2.819	3.989	2.696	3.963	2.619	3.921
37	4.975	4.975	3.993	4.533	3.468	4.295	3.152	4.156	2.928	4.042	2.770	3.973	2.663	3.923	2.581	3.887
38	4.960	4.960	3.960	4.513	3.438	4.275	3.130	4.128	2.933	4.043	2.780	3.989	2.663	3.893	2.583	3.849
39	4.945	4.945	3.937	4.483	3.438	4.255	3.116	4.094	2.907	3.982	2.757	3.927	2.641	3.881	2.558	3.846
40	4.960	4.960	3.937	4.523	3.435	4.260	3.100	4.088	2.893	4.000	2.734	3.920	2.618	3.863	2.523	3.829
45	4.895	4.895	3.877	4.460	3.368	4.203	3.078	4.022	2.850	3.905	2.694	3.829	2.591	3.766	2.504	3.723
50	4.815	4.815	3.860	4.440	3.368	4.178	3.048	4.002	2.823	3.872	2.670	3.781	2.550	3.708	2.457	3.650
55	4.795	4.795	3.790	4.393	3.303	4.100	2.982	3.942	2.763	3.813	2.617	3.743	2.490	3.658	2.414	3.608
60	4.780	4.780	3.803	4.363	3.288	4.070	2.962	3.910	2.743	3.792	2.589	3.683	2.456	3.598	2.373	3.540
65	4.780	4.780	3.787	4.343	3.285	4.070	2.976	3.896	2.750	3.755	2.596	3.677	2.473	3.583	2.373	3.519
70	4.750	4.750	3.780	4.327	3.243	4.043	2.924	3.860	2.725	3.718	2.564	3.650	2.451	3.559	2.351	3.498
75	4.760	4.760	3.777	4.320	3.253	4.065	2.946	3.862	2.725	3.718	2.574	3.641	2.449	3.550	2.360	3.478
80	4.725	4.725	3.740	4.303	3.235	4.053	2.920	3.838	2.688	3.698	2.550	3.606	2.431	3.518	2.336	3.458

27

APPENDIX E3

Appendix A3: Critical values for the bounds test: Case II: restricted intercept and no trend

10 percent level

n	k = 0		k = 1		k = 2		k = 3		k = 4		k = 5		k = 6		k = 7	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
30	4.025	4.025	3.303	3.797	2.915	3.695	2.676	3.586	2.525	3.560	2.407	3.517	2.334	3.515	2.277	3.498
31	4.020	4.020	3.273	3.800	2.890	3.680	2.662	3.578	2.518	3.513	2.386	3.479	2.303	3.483	2.256	3.454
32	4.030	4.030	3.273	3.780	2.885	3.670	2.646	3.566	2.493	3.497	2.384	3.469	2.293	3.448	2.238	3.443
33	4.025	4.025	3.260	3.780	2.880	3.653	2.644	3.548	2.482	3.472	2.367	3.447	2.284	3.428	2.229	3.399
34	4.005	4.005	3.240	3.767	2.868	3.633	2.626	3.550	2.465	3.472	2.361	3.433	2.274	3.399	2.216	3.392
35	3.980	3.980	3.223	3.757	2.845	3.623	2.618	3.532	2.460	3.460	2.331	3.417	2.254	3.388	2.196	3.370
36	3.995	3.995	3.247	3.773	2.863	3.610	2.618	3.502	2.460	3.435	2.346	3.384	2.264	3.369	2.206	3.360
37	3.980	3.980	3.253	3.747	2.865	3.608	2.622	3.506	2.458	3.432	2.339	3.396	2.240	3.361	2.187	3.336
38	3.995	3.995	3.243	3.730	2.838	3.590	2.598	3.484	2.448	3.418	2.323	3.376	2.233	3.354	2.172	3.321
39	3.985	3.985	3.230	3.727	2.833	3.570	2.596	3.474	2.442	3.400	2.316	3.371	2.224	3.339	2.169	3.306
40	3.955	3.955	3.210	3.730	2.835	3.585	2.592	3.454	2.427	3.395	2.306	3.353	2.218	3.314	2.152	3.296
45	3.950	3.950	3.190	3.730	2.788	3.540	2.560	3.428	2.402	3.345	2.276	3.297	2.188	3.254	2.131	3.223
50	3.935	3.935	3.177	3.653	2.788	3.513	2.538	3.398	2.372	3.320	2.259	3.264	2.170	3.220	2.099	3.181
55	3.900	3.900	3.143	3.670	2.748	3.495	2.508	3.356	2.345	3.280	2.226	3.241	2.139	3.204	2.069	3.148
60	3.880	3.880	3.127	3.650	2.738	3.465	2.496	3.346	2.323	3.273	2.204	3.210	2.114	3.153	2.044	3.104
65	3.880	3.880	3.143	3.623	2.740	3.455	2.492	3.350	2.335	3.252	2.209	3.201	2.120	3.145	2.043	3.094
70	3.875	3.875	3.120	3.623	2.730	3.445	2.482	3.310	2.320	3.232	2.193	3.161	2.100	3.121	2.024	3.079
75	3.895	3.895	3.133	3.597	2.725	3.455	2.482	3.334	2.313	3.228	2.196	3.166	2.103	3.111	2.023	3.068
80	3.870	3.870	3.113	3.610	2.713	3.453	2.474	3.312	2.303	3.220	2.303	3.154	2.088	3.103	2.017	3.052

28

APPENDICES F: Summary of the Datasets

Year	NOE to Dev. NEICS	OPD	GDPDE	REDE	CEDE	NOE to Emerg. NEICs	GDPE	REEE
1980	604921428.6	0.55	323281.1	658.5403	3698	700138614	10224.93	235.5088
1981	387357142.9	0.61	324629.5	647.6857	3427	447814027	10127.4	247.4947
1982	363521428.6	0.67	325495.6	694.7598	3271	366410179	9917.472	264.9919
1983	325164285.7	0.72	331462.1	735.8652	3225	341360910	9501.361	289.062
1984	327214285.7	0.77	342567.3	731.6196	3284	400428085	9777.33	307.8629
1985	373028571.4	0.89	352910.2	689.128	3250	453758591	9828.986	322.2443
1986	387457142.9	2.02	362161.8	680.5181	3340	445673729	9956.951	332.3895
1987	342085714.3	4.02	370842.7	677.2306	3377	388815449	10043.51	335.1888
1988	381385714.3	4.54	381207.8	683.3421	3495	406443000	10113.58	368.9966
1989	469035714.3	7.39	391995.5	710.6032	3517	556953500	10204.8	387.4571
1990	473300000	7.39	406305.2	765.5677	3459	565750000	9909.023	405.621
1991	488142857.1	9.91	408732.7	763.9083	3811	587650000	9780.831	417.53
1992	476221428.6	17.4	412692.5	758.7276	3903	580110000	9573.495	426.238
1993	476328571.4	22.16	412952.4	807.0185	3908	568305000	9733.178	456.905
1994	498371428.6	22	424562.2	793.4018	3939	580350000	10024.61	494.58
1995	464314285.7	22	436957.9	846.2179	3963	607725000	10278.03	517.759
1996	517807142.9	22	448282.8	869.6286	4086	620135000	10494.88	526.988
1997	512071428.6	22	464128.4	901.9622	4121	767949757	10665.24	556.2071
1998	464371428.6	22	478937.4	888.1569	4192	706200387	10607.31	586.2014
1999	388042857.1	92.69	493747.8	892.9688	4228	678056747	10661.32	595.4641
2000	499871428.6	102.11	512632.9	890.1065	4255	714285756	10940.08	610.8561
2001	497742857.1	111.95	519902.6	840.264	4290	780024075	11079.11	631.4821
2002	345257142.9	120.97	524446.7	868.1779	4273	663277870	11371.06	652.6211
2003	458378571.4	129.36	528196.2	871.7946	4342	790950832	11600.36	680.0281
2004	505521428.6	133.5	540824.3	908.1032	4431	871216143	12131.62	775.4831
2005	529228571.4	132.15	552163	927.2689	4456	843459838	12643.85	856.3312
2006	536535714.3	128.65	567429.3	971.1617	4431	817313397	13266.29	924.6092
2007	529971428.6	125.83	579785.4	984.045	4387	791752290	14057.24	1012.031
2008	507500000	118.57	575745.5	1048.242	4209	724408461	14586.68	1109.479
2009	447414285.7	148.88	550111.9	1107.725	3999	769132292	14622.15	1174.85
2010	507450000	150.3	558431.4	1195.469	3962	864630716	15399.35	1341.545
2011	480428571.4	153.86	564661.9	1297.165	3935	822014098	15974.38	1422.748
2012	414071428.6	157.5	563499.6	1370.447	3826	830709814	16338.28	1446.667
2013	353542857.1	157.31	563226.9	1440.797	3840	761993509	16800.96	1464.763
2014	325278571.4	159	571461.9	1522.123	3580	675067478	17065.42	1498.345

APPENDICES G: Interview Questions

G1: Supporting interview questions in respect of the quantitative results are listed below.

1. Carbon emissions reduction in developed NEICs has negative influence on Nigerian oil and gas exports.
2. Renewable energy consumption in developed NEICs has negative influence on Nigerian oil and gas exports in the short-run.
3. Renewable energy consumption in developed NEICs has positive influence on Nigerian oil and gas exports in the long run.
4. Renewable energy consumption in emerging NEICs has positive influence on Nigerian oil and gas exports in the short-run.
5. Renewable energy consumption in emerging NEICs has positive influence on Nigerian oil and gas exports in the long run.

G2: Interview questions related to the perceptions of interviewees with regards research question two in order to achieve objective five.

Question one: *What are the perceptions of MDAs and other stakeholders about the global energy transition and its impacts?*

Themes related to question one:

I. *The general perception of stakeholders about the energy transition regime and its impact on Nigeria.*

II. *Global energy transition and its impact on FDI flow into Nigerian petroleum sector.*

III. *Global Energy transition and its impact on oil price and petroleum revenue***.**

Interview question related to question one:

a) Are you aware of the renewable energy consumption energy and carbon emissions reduction measures in net energy importing countries?

b) What is your view that the fluctuations in Nigerian oil and gas exports is as a result of the global energy transition and carbon emissions reduction measures in net energy importing countries?

c) What is your view that the decrease in FDI flow to the Nigerian oil and gas sector is as a result of the global energy transition regime?

d) What is your view that the decrease in Foreign Direct Investment (FDI) flow has affected oil and gas reserves and will affect future oil production and exports volume?

e) What is your view that global energy transition has affected global oil price?

f) How do you foresee the negative impact of global energy transition on Nigerian oil and gas exports revenue, especially when renewable energy dislodges oil and gas as the dominant global primary energy?

g) Do you share the view that Nigerian excess crude savings account (ESCA/SWF) is affected by global energy transition regime? Can you please comment on other factors that have affected the efficient operation of the ESCA?

Question two: *What are the plans to mitigate the impact of the global energy transition on Nigeria?*

Theme related to question two:

(iv) *Existing plans by MDAs to mitigate the impact of the global energy transition***.**

Interview questions related to question two:

a) Does your MDAs take into consideration the impact of global renewable energy transition on Nigerian budgetary, financial and economic planning?

b) Are there any plans to mitigate the impact of global energy transition? If yes, what are the plans and can you please comment on what the government has implemented and the impact it has made so far?

c) In your opinion, how can Nigeria mitigate the impact of global energy transition?

1. Supervisor's Letter and Letter of Introduction for Primary Data Collection in Nigeria

Abertay University

Petroleum Technology Dev. Fund
Office of the Executive Secretary
10 AUG 2015
RECEIVED
Area 11, Garki - Abuja

24 July 2015

The Executive Secretary,
Petroleum Technology Development Fund (PTDF)
Abuja, Nigeria.

Re: [redacted]

This is to confirm that [redacted] (funded by PTDF) has been registered as a full time PhD student in the Dundee Business School (DBS), Abertay University. He is studying under my supervision for his PhD research project entitled "Impact of Global Energy Transition and Carbon Emission Reduction on Nigeria's Budgeted and Actual Oil and Gas Exports Revenue".

[redacted] as part of his PhD research needs to visit Nigeria for a period of two and half months (07/08/2015 to mid-October 2015) in order to collect the necessary data as part of his empirical work for the project. As his supervisor I have considered his plan for the empirical part of his studies and at this stage I believe that two and half months should be enough for this purpose and he has my approval for this trip. In view of this, I would really appreciate it if you support [redacted] in any possible way which facilitates the data collection for the empirical part of his PhD.

The PhD research project has a very applied orientation that should appeal to the Nigerian Oil & Gas industry and Nigerian Government since it is intended primarily to address the issue of Energy Transition that could influence the Nigeria's Oil and Gas Exports Revenue. [redacted] has been very committed to his PhD project and has presented his research work in various conferences such as British Accounting & Finance Association (BAFA) Annual Conference in London School of Economics (April 2014); in University of Manchester (March 2015) and in Strategy Conference; University of Edinburgh Business School (May 2015).

I would appreciate it if you provide him with any necessary help and assistance in order to complete this empirical work.

[redacted]

Abertay University
Dundee Business School

Dundee Business School
Chair of University Research Degrees Committee
Abertay University
Dundee, Scotland, DD1 1HG
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E:dbs@abertay.ac.uk | W: abertay.ac.uk

Dear Sir/Madam,

REQUEST TO CONDUCT AN INTERVIEWS FOR MY PhD STUDY

I am a PhD research student from Abertay University where I am conducting a research on the topic entitled **"Impact of Global Energy Transition and Carbon Emission Reduction on Nigeria's Budgeted and Actual Oil and Gas Exports Revenue"**. This study has a much applied orientation that would help the Nigerian Government to address the influence of global energy transition on Nigeria's oil and gas exports revenue and annual budget.

Therefore, you have been carefully chosen to participate in these interviews because of your knowledge and expertise connected to this study. I will sincerely appreciate your contribution and assure you of utmost confidentiality. The information will be used strictly for the intended purpose and in compliance with research ethics. I assure you that the interviews will not take long time.

Please find attached letter of introduction from my sponsors-**PTDF and the interview themes** for your perusal. I will be grateful if you can study the interview themes before the interview date. I can be contacted at any time to come and conduct the interview. Below are my contact details.

GSM:
E-mail

While looking forward to your response, please accept my sincere appreciation for all your support.

Best regards

Dundee Business School
Abertay University
United Kingdom

PETROLEUM TECHNOLOGY DEVELOPMENT FUND (PTDF)

6, Port-Harcout Crescent, Off Gimbiya Street, Off Ahmadu Bello Way, Area 11, Garki - Abuja
P. O. Box 9899, Area 10, Garki - Abuja. Tel: +234 9 8700532-3.

DIRECTOR GENERAL
Received
18 AUG 2015
BUDGET OFFICE OF THE FEDERATION

14th August, 2015

The Permanent Secretary
Federal Ministry of Finance
Ahmadu Bello Way
Central Business District
Abuja

Dear Sir,

LETTER OF INTRODUCTION –

Mr. is a PhD student at the Abertay University, United Kingdom under the sponsorship of the Petroleum Technology Development Fund (PTDF) which commenced in January 2013. The PTDF is the Federal Parastatal charged with the mandate of building indigenous capacity in the Nigerian Oil and Gas Industry through the development, promotion, implementation of programs and activities aimed at enhancing competencies in the petroleum and allied sectors.

2. The student is undertaking a research on the topic **"Impact of Global Energy Transition and Carbon Emission Reduction on Nigeria's Budgeted and Actual Oil and Gas Exports Revenue".**

3. He is currently at the level of data gathering and he has identified your organization as one of the key organizations to collect primary data in the form of structured interviews. Consequently, he wishes to visit your organization in order to gather necessary data that will assist him in his research.

4. You are therefore kindly requested to render all necessary assistance to him in this regard.

5. Please accept the assurances of the Fund's highest regard.

For: The Executive Secretary

Cc: Budget Office of the Federation
Office of the Accountant General of the Federation

PETROLEUM TECHNOLOGY DEVELOPMENT FUND (PTDF)
6, Port-Harcout Crescent, Off Gimbiya Street, Off Ahmadu Bello Way, Area 11, Garki - Abuja
P. O. Box 9899, Area 10, Garki - Abuja. Tel: +234 9 8700532-3.

14th August, 2015

The Permanent Secretary
National Planning Commission
Plot 421, Constitution Avenue,
Central Business District
Abuja

OFFICE OF THE SECRETARY TO THE COMMISSION
RECEIVED
17 AUG 2015
NAT. PLANNING COMMISSION

Dear Sir,

LETTER OF INTRODUCTION –

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For: The Executive Secretary

PETROLEUM TECHNOLOGY DEVELOPMENT FUND (PTDF)

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P. O. Box 9899, Area 10, Garki - Abuja. Tel: +234 9 8700532-3.

14th August, 2015

[redacted]

The Executive Secretary
Nigerian Investment Promotion Commission
Maitama District
Garki, Abuja

OFFICE OF THE EXECUTIVE SECRETARY
RECEIVED
19 AUG 2015
Sign .....
NIPC

Dear Sir,

LETTER OF INTRODUCTION – [redacted]

[redacted] is a PhD student at the Abertay University, United Kingdom under the sponsorship of the Petroleum Technology Development Fund (PTDF) which commenced in January 2013. The PTDF is the Federal Parastatal charged with the mandate of building indigenous capacity in the Nigerian Oil and Gas Industry through the development, promotion, implementation of programs and activities aimed at enhancing competencies in the petroleum and allied sectors.

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For: The Executive Secretary

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P. O. Box 9899, Area 10, Garki - Abuja. Tel: +234 9 8700532-3.

14th August, 2015

The Permanent Secretary
Federal Ministry of Finance
Ahmadu Bello Way
Central Business District
Abuja

PERMANENT SECRETARY'S OFFICE
RECEIVED
18 AUG 2015
FED. MIN. OF FINANCE ABUJA

Dear Sir,

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is a PhD student at the Abertay University, United Kingdom under the sponsorship of the Petroleum Technology Development Fund (PTDF) which commenced in January 2013. The PTDF is the Federal Parastatal charged with the mandate of building indigenous capacity in the Nigerian Oil and Gas Industry through the development, promotion, implementation of programs and activities aimed at enhancing competencies in the petroleum and allied sectors.

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For: The Executive Secretary

Cc: Budget Office of the Federation
Office of the Accountant General of the Federation

PETROLEUM TECHNOLOGY DEVELOPMENT FUND (PTDF)

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P. O. Box 9899, Area 10, Garki - Abuja. Tel: +234 9 8700532-3.

14th August, 2015 [redacted]

Koya
19/8/15

The Group Managing Director
Nigerian National Petroleum Corporation
NNPC Towers
Central Business District
Abuja

Dear Sir,

LETTER OF INTRODUCTION – [redacted]

[redacted] is a PhD student at the Abertay University, United Kingdom under the sponsorship of the Petroleum Technology Development Fund (PTDF) which commenced in January 2013. The PTDF is the Federal Parastatal charged with the mandate of building indigenous capacity in the Nigerian Oil and Gas Industry through the development, promotion, implementation of programs and activities aimed at enhancing competencies in the petroleum and allied sectors.

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For: The Executive Secretary

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P. O. Box 9899, Area 10, Garki - Abuja. Tel: +234 9 8700532-3.

[redacted]

14th August, 2015

The Group Managing Director
Nigerian National Petroleum Corporation
NNPC Towers
Central Business District
Abuja

Dear Sir,

LETTER OF INTRODUCTION - [redacted]

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[redacted]

For: The Executive Secretary

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P. O. Box 9899, Area 10, Garki - Abuja. Tel: +234 9 8700532-3.

14th August, 2015

[redacted]

The Permanent Secretary
Federal Ministry of Finance
Ahmadu Bello Way
Central Business District
Abuja

Dear Sir,

LETTER OF INTRODUCTION - [redacted]

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Cc: Budget Office of the Federation
✓Office of the Accountant General of the Federation