ENERGY COMMISSION OF NIGERIA

FEDERAL MINISTRY OF SCIENCE AND TECHNOLOGY
FEDERAL REPUBLIC OF NIGERIA

NATIONAL ENERGY MASTERPLAN

(Draft Revised Edition)

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Foreword

The National Energy Policy (NEP), often sought after by investors, scholars and development partners, first approved by Government in April 2003, provided a powerful set of recommendations to address the nation's energy challenges. However, due to developments in the energy sector, the 2003 policy had to be reviewed in 2013 to address the dynamics in the sector. This National Energy Masterplan directly responds to the challenges brought out in the reviewed National Energy Policy and puts the government's commitment to this policy into action. It seeks to achieve the goals of the revised NEP by converting the strategies to actionable programmes, activities and projects. Moreover, it establishes the framework that will allow all stakeholders to jointly understand their roles and participate in the agenda important to achieving the nation's energy goals for stable, reliable and diverse sources of domestic energy as specified in the National Energy Policy.

The National Energy Masterplan has been developed to capture all factors germane to the balanced development of the energy sector, including energy demand and supply, production, processing, research and development, training and manpower development, energy databank, fossil fuels, nuclear energy, renewable energy, environment, energy efficiency and conservation and international cooperation. It also specifies procedures for implementation, monitoring and evaluation of the level of compliance with the objectives of the National Energy Policy.

By bringing in a wide range of stakeholders and specifying their roles, the energy sector is expected to take advantage of the synergy among the relevant agencies and all levels of government, non-governmental agencies, the private sector, investors, development partners, and the international community. In working together under the framework of this National Energy Masterplan, stakeholders reinforce their commitment to the goals of the reviewed National Energy Policy, the National Energy Masterplan and the balanced development of the energy sector. It is my belief that energy is an all-pervading factor in the quest for socio-economic development and improved quality of living and that the National Energy Masterplan is the most efficient and effective way to develop the sector.

Finally, this National Energy Masterplan is intended to be a living document that will be updated periodically. I commend it to all Nigerians and stakeholders in the Nigerian energy sector.

Dr. Abdu Bulama
Honourable Minister,
Federal Ministry of Science and Technology

Preface

The provision of adequate, reliable and affordable energy is crucial to the ongoing reform in Nigeria. In order to alleviate poverty and enhance quality of living, energy in one form or the other has to be expended for living and income generating activities. Hence, the supply and utilization of energy has to be managed effectively and efficiently in a sustainable manner. It was in recognition of these facts that government inaugurated the National Committee on Energy Masterplan (NCEM) on May 4th 2006, to articulate the first National Energy Masterplan (NEMP) for the nation. The objective is to provide a framework for the implementation of the National Energy Policy, which was approved by the Federal Government in April 2003. The fundamental principle of the NEP is the optimal utilization of the nation's viable energy resources for sustainable national development and their utilization to foster regional and international cooperation.

The translation of the provisions of the NEP into a National Energy Masterplan, for implementation over the short, medium and long terms, is in keeping with Article 5(d) of Decree No. 62 of 1979, which empowers the Energy Commission of Nigeria (ECN) to "prepare, after consultation with such agencies of government, whose functions relate to the field of energy development or supply as the Commission considers appropriate, periodic Masterplans for the balanced and coordinated development of energy in Nigeria." The NEMP is expected to provide the set of strategies through which the NEP could be implemented or achieved.

Membership of the National Committee cut across policy and planning Ministries, Departments and Agencies (MDAs), energy producers and marketers, promoters of sustainable energy systems, energy consumers, energy regulators, non-governmental organizations, development partners, the banking sector, women organizations, the organized private sector, private energy consultants, tertiary institutions, research centres & institutes and professional bodies. To carry out the assignment, the NCEM appointed Sub-committees on: Oil and Gas and Other Conventional Energy Sources; Nuclear Energy; New and Renewable Energy Sources; Energy Efficiency and Conservation, Electricity, Energy Utilization; Other Energy Issues; Energy Financing and Energy Planning, Implementation, Monitoring and Evaluation. Each sub-committee held several meetings separately to obtain inputs from its members and other relevant sources on the specific subjects assigned to it. In some cases, studies were conducted to complement the inputs.

The NEMP went through several reviews. The reports submitted by the sub-committees were reviewed by a Harmonization Committee, comprising the chairmen, secretaries and assistant secretaries of the sub-Committees, and the Directors of the Energy Commission of Nigeria, which adopted the format in which the NEMP is currently presented. A technical editorial sub-committee, comprising a few of the chairmen of the sub-committees, all the secretaries and assistant secretaries and some selected members, also reviewed the submissions of the Harmonization Sub-committee. A draft NEMP was therefore produced in 2007.

In 2013, the Energy Commission of Nigeria (ECN) with active participation of stakeholders reviewed the National Energy Policy (NEP) to reflect recent developments in the national and international energy scenes. Consequently, this made a review of the 2007 draft National Energy Master Plan (NEMP) very imperative. In the last quarter of 2014, stakeholders were again brought together to carry out a preliminary review of the 2007 draft NEMP in line with the revised NEP. In January 2015, the revised NEMP was validated by wider stakeholders.The revised draft NEMP document consists of fourteen chapters: Chapter 1: Introduction; Chapter 2: Energy Supply and Demand Projections/Targets; Chapter 3: Petroleum Resources; Chapter 4: Coal and Tar Sand/Bitumen; Chapter 5: Nuclear Energy; Chapter 6: Renewable Energy; Chapter 7: Bio-Energy; Chapter 8: Electricity; Chapter 9: Energy Utilization; Chapter 10: Energy Efficiency and Conservation; Chapter 11: Environment and Climate Change; Chapter 12: Other Energy Issues; Chapter 13: Energy Financing Policy and Chapter 14: Planning and Policy Implementation.

It is my sincere hope that this document will provide the framework for a sustainable development of the Nigerian energy sector and enhance the contribution of the sector to the national economy.

Director-General,
Energy Commission of Nigeria
Abuja

Abbreviations and Acronyms

ABU	Ahmadu Bello University
ADPs	Agricultural Development Projects
AGFA	Associated Gas Framework Agreement
AGUFI	Associated Gas Utilization Framework Agreement
ARCON	Architects Registration Council of Nigeria
AU	African Union
BPE	Bureau of Public Enterprises
BPIC	Bitumen Project Implementation Committee
BPP	Bureau of Public Procurement
CAC	Corporate Affairs Commission
CBN	Central Bank of Nigeria
CBOs	Community Based Organizations
CERD	Centre for Energy Research and Development
CERT	Centre for Energy Research and Training
CNG	Compressed Natural Gas
COREN	Council for the Regulation of Engineering in Nigeria
DICON	Defense Industries Corporation of Nigeria
DPR	Department of Petroleum Resources
DPs	Development Partners
ECN	Energy Commission of Nigeria
ECOWAS	Economic Community of West African States
EFCC	Economic and Financial Crimes Commission
ESI	Electricity Supply Industry
ETF	Education Trust Fund
FCT	FederalCapitalTerritory
FDI	Foreign Direct Investment
FGN	Federal Government of Nigeria
FMA&RD	Federal Ministry of Agriculture and Rural Development
FMCT	Federal Ministry of Communication Technology
FMEd.	Federal Ministry of Education
FMEnv.	Federal Ministry of Ennvironment
FMF	Federal Ministry of Finance
FMH	Federal Ministry of Health
FMIT&I	Federal Ministry of Industry, Trade & Investment

FMJ	Federal Ministry of Justice
FML&P	Federal Ministry of Labour and Productivity
FMLH&UD	Federal Ministry of Lands, Housing and Urban Development
FMST	Federal Ministry of Science & Technology
FMT	Federal Ministry of Transportation
FMTC&NO	Federal Ministry of Tourism, Culture and National Orientation
FMWA&SD	Federal Ministry of Women Affairs and Social Development
FMYD	Fedral Ministry of Youth Development
FRCN	Federal Radio Corporation of Nigeria
FRSC	Federal Roads Safety Commission
GDP	Gross Domestic Product
GENCO	Generation Company
IAEA	International Atomic Energy Agency
IOCs	International Oil Companies
IOPs	Indigenous Oil Producers
IPMAN	Independent Petroleum Marketers Association of Nigeria
IPP	Independent Power Producers
ITF	Industrial Training Fund
JDZA	Joint Development Zone Authority
JV	Joint Venture / Joint Ventures
LGCs	Local Government Councils
LGHQs	Local Government Headquarters
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MAED	Model for Analysis of Energy Demand
MAN	Manufacturers Association of Nigeria
MDG	Millennium Development Goals
MFA	Ministry of Foreign Affairs
MI	Ministry of Interior
MMSD	Ministry of Mines and Steel Development
MPA	Ministry of Police Affairs
MPR	Ministry of Petroleum Resources
NA	Nigerian Army
NAC	National Automotive Council
NAE	NigerianAcademy of Engineering

NAEC	Nigeria Atomic Energy Commission
NAF	Nigerian Air Force
NAPEP	National Poverty Eradication Programme
NAS	Nigerian Academyof Sciences
NASENI	National Agency for Science and Engineering Infrastructure
NASRDA	National Space Research and Development Agency
NASS	National Assembly
NBRRI	NigerianBuilding and Road Research Institute
NBS	National Bureau of Statistics
NBTE	National Board for Technical Education
NBTI	National Board for Technology Incubation
NCC	Nigerian Coal Corporation/
NCCE	National Commission for Colleges of Education
NCEM	National Committee on Energy Masterplan
NCCOM	Nigerian Communications Commission
NCP	National Council on Privatization
NCS	Nigerian Customs Service
ND	National Databank
NDDC	Niger Delta Development Commission
NDE	National Directorate of Employment
NEEDS	National Economic Empowerment and Development Strategy
NEM	National Energy Masterplan
NEP	National Energy Policy
NERC	Nigerian ElectricityRegulatory Commission
NERDC	Nigerian Educational Research and Development Council
NESTI	Nigerian Electricity Science and Technology Institute
NGOs	Non-Governmental Organizations
NGSA	Nigerian Geological Survey Agency
NIA	Nigerian Institute of Architects
NIMET	Nigerian Meteorological Agency
NIOB	Nigerian Institute of Building
NIPC	Nigerian Investment Promotion Council
NIS	Nigerian Immigration Service
NISER	Nigerian Institute of Social and Economic Research
NITDA	National Information Technology Development Agency

NITP	Nigerian Institute of Town Planners
NIWA	Nigerian Inland Waterways Authority
NLN	National Library of Nigeria
NMC	Nigerian Mining Corporation
NN	Nigeria Navy
NNPC	Nigerian National Petroleum Corporation
NNRA	Nigerian Nuclear Regulatory Authority
NOA	National Orientation Agency
NOSDRA	National Oil Spill Detection and Response Agency
NOTAP	National Office for Technology Acquisition and Promotion
NPC	National Planning Commission/National Population Commission
NPF	Nigeria Police Force
NRC	Nigerian Railway Corporation
NSE	Nigerian Society of Engineers/Nigerian Stock Exchange
NSIWC	National Salaries, Incomes and Wages Commission
NTA	Nigerian Television Authority
NUC	National Universities Commission
NWRI	National Water Resources Institute
NYSC	National Youth Service Corps
OPEC	Organization of the Petroleum Exporting Countries
OPS	Organized Private Sector
PHCN	Power Holding Company of Nigeria
PPPRA	Petroleum Products Pricing and Regulatory Authority
PTDF	Petroleum Technology Development Fund
R&D	Research and Development
RCs	Research Centres
RD&T	Research, Development and Training
RE	Renewable Energy
REA	Rural Electrification Agency
RET	Renewable Energy Technology
RIs	Research Institutes
RMRDC	Raw Materials Research and Development Council
S, M, L	Short, Medium, Long
SASS	States Assemblies
SEC	Securities and Exchange Commission

SEPA	States Environmental Protection Agency
SGs	State Governments
SHESTCO	Sheda Science and Technology Complex
SMEDAN	Small and Medium Enterprises Development Agency of Nigeria
SON	Standards Organization of Nigeria
TIs	Tertiary Institutions
TOPREC	Town Planners Registration Council
UBE	Universal Basic Education
UCC	Utility Charges Commission
UNIDO-RC-SHP	United Nations Industrial Development Organization Regional Centre for Small Hydropower

Units of Measurement

bscf	billion standard cubic feet
GWh	Gigawatt hour
kgoe	kilogramme of oil equivalent
kWh/day	kilowatthour per day
mbpd	million barrels per day
MW	Megawatt
MWe	Megawatt electric
Mtoe	Million tonnes of oil equivalent
scf	standard cubic feet

Executive Summary

1. Background

The energy sector is critical to the nation's socio-economic development andgrowth, hence the need for a comprehensive plan for its development. This National Energy Masterplan (NEMP) for Nigeria will ensure a guided implementation of the National Energy Policy (NEP). The NEMP focuses on all energy sources (including, renewable energy and energy efficiency); energy utilization; manpower development; energy financing; energy planning, implementation, monitoring and evaluation; and other cross-cutting issues. It is a blueprint for the sustainable development, supply and utilization of the various sources of energy available within the country, and for the use of these resources in international trade and co-operation.

The NEMP is thus an implementation plan and roadmap for the realization of the energy policy objectives given the strategies enunciated in the NEP. For every sector of the economy, the NEMP details the programmes or activities required for each strategy, together with their associated executing, collaborating, and funding agencies and their timelines. The timelines in the NEMP are the Short term, Medium term and Long term. Monitoring and evaluation strategies for the energy policy implementation plans have also been developed to ensure early corrective action on set targets within the timelines.

2. Crude Oil

Given that oil will continue to play a major role in the nation's economy being the most valuable economic asset and a non-renewable resource, the NEMP recommends:

- The need to expand the reserve base through continuous and intensive exploration activities;
- Promoting conservation of oil resources;
- Encouraging the use of domestic raw materials such as bentonite and barytes as substitute for imported ones in the sub-sector;
- Environmentally friendly exploitation and utilization of oil resources;
- Wider distribution of oil products to all parts of the country to ensure access to commercial energy for socio-economic activities;
- Encouragement and intensive promotion of private sector participation in all facets of the oil value chain;
- Intensification of human capacity building and establishment of an R, D &T institution to progressively improve local content in the sub-sector and eventually domesticate oil technology;

- Promoting the expansion of the processing sub-sector to allow for the export of value-added petroleum; and,
- Legal and regulatory reform to provide stable and attractive investment environment.

3. Natural Gas

In view of the diversity and immensity of the benefits accruable to the nation from the development of its natural gas resources the NEMP recommends planned exploration for natural gas and a wide range of activities and programmes to encourage the utilization of natural gas in all sectors of the national economy and for export. Based on all the foregoing, the NEMP recommends:

- Increasing the penalty for gas flaring from N10.00 to N5000.00 per 1000 scf;
- Ensuring that the provisions of the Downstream Gas Bill are pursued and achieved at target time;
- Ensuring accelerated completion of all on-going gas utilization projects and commencement of proposed ones;
- Encouraging R&D on natural gas within the country;
- Reviewing of existing urban and regional planning regulations with a view of incorporating gas transmission, distribution and utilization infrastructure;
- Increasing the level of development of infrastructural facilities such as pipelines and associated transmission facilities.

4. Shale Hydrocarbon

Recognizing the potential of oil shale in meeting the present and future global energy needs, NEMP recommends:

- Incorporating shale hydrocarbon research activities into the activities of the existing petroleum research centres;
- Carrying out feasibility studies on the potential of shale oil and gas in the country;
- Developing and enacting appropriate law for the exploration of shale oil and gas resources;
- Ensuring continuous Environmental Impact Audit of all shale oil and gas projects.

5. Bitumen and Tar Sands/Bitumen

Bitumen and tar sands can significantly contribute to the energy mix of the nation by producing bitumen emulsion for power generation and coke for use in iron and steel manufacture. Considering the significance of the bitumen and tar sands deposits, the NEMP recommends as follows:

- Completing the current geological data generation programme embarked upon by government;

- Completing the privatisation of the bitumen blocks;
- Ensuring that successful bidders implement their work programme;
- Government should provide infrastructure such as roads, power, pipelines and development of the ports to facilitate private sector investment in the sector;
- Providing a world class training institute with a strong research and development arm for the Bitumen and Tar sands industry;
- Ensuring the establishment of best international practice in exploitation of the resource with high premium given to the environment.

6. Coal

The nation's coal industry faces some daunting challenges, which need to be addressed if the potential for coal utilization is to be optimally exploited. These include uncertainties in the actual reserves of coal on which long-term projects could be based, low productivity of the coal mines, low level of mechanization of production facilities, and absence of cost-effective transportation system such as rail system and port facilities for its export. To overcome the challenges and make coal contribute to energy security in Nigeria as well as earn foreign exchange through its export, the NEMP recommends:

- Completing the privatization of the sub-sector in the short – term;
- Fast-tracking the passage of the new Minerals and Mining Bill into an Act;
- National stock-taking to ascertain the actual coal reserves in the country;
- Encouraging the establishment of coal briquetting plants and development of effective marketing strategies;
- Revamping of domestic industries that can utilize Nigeria's coal;
- Identifying of export markets for Nigeria's coal;
- Providing of strong R & D support for the coal industry;
- Developming of coal based power plants;
- Developing infrastructure for coal transportation.

7. Nuclear Energy

NEMP has articulated measures to enhance peaceful applications of nuclear science and technology in the areas of electric power production, agriculture and animal production, water supply, health care delivery, petroleum exploration, solid mineral exploration, and environmental protection. These measures include:

- Reviewing and strengthening institutional framework and infrastructure for the development of nuclear science and technology in the country;
- Developing and implementing structured manpower development programmes inthe utilization of nuclear energy for peaceful purposes;

- Developing a critical mass of professionals for successful implementation of the nuclear power programme;
- Fast tracking the on-going process of building nuclear power plants for electricity generation;
- Encouraging the optimal use of all nuclear science and technology facilities in solving problems in industry, agriculture, medicine and water resources management;
- Quantifying and characterizing the nuclear mineral resources in the country;
- Undertaking regular public enlightenment campaigns on applications of nuclear technology, nuclear safety and radiation protection;
- Maintaining good relationship with the IAEA; and
- Adopting a set of incentives to attract and retain nuclear science and technology professionals.

8. New and Renewable Energy

The main constraints on the rapid development and diffusion of technologies for the exploitation and utilization of renewable energy resources in the country are unstimulated demand, lack of appropriate legal, regulatory and institutional framework as well as incentives to attract investors. The comparatively high initial investment cost also constitutes a barrier to the development of the market.

In order to deal with the afore-mentioned constraints the NEMP recommends amongst others:

- Intensifying public awareness through the mass media and community based organizations;
- Significant investment in Research, Development and Demonstration activities;
- Building of indigenous human and manufacturing capacities;
- Intensifying on-going economic reforms;
- Providing enabling environment through financial and fiscal incentives, legal and regulatory framework for attracting FDI and indigenous participation in the establishment and operation of renewable energy plants;
- Establishing strategic factories for local manufacturing of major renewable energy equipment and spare parts;
- Sensitizing the Federal, State and LGCs' on the potentials of renewable energy as source of heating and electrification;
- Developing codes and standards for renewable energy systems and components;
- Establishing a renewable energy fund;
- Establishing a renewable energy agency as a regulatory body for renewable energy.

9. Bio-Energy

Bio-energy is energy from non-fossil type organic matter referred to as biomass and bio-fuels. Bio-fuel is a deliberate attempt to integrate the agricultural sector of the economy with the downstream petroleum sector. Since, over 60% of Nigeria's population still depends on fuel-wood for cooking and other domestic uses; NEMP recommends:

- Developing nurseries and intensifying the cultivation of plantation of fast growing energy trees/plants;
- Building local capacity and training extension workers on the applications, installation, and maintenance of biomass energy technologies;
- Identifying suitable bio-energy based technologies and embarking on intensive R&D activities on same;
- Providing fiscal incentives to encourage local production of biomass energy systems;
- Establishing more shelter belts in the semi-arid frontal states and woodlots in the buffer states;
- Developing indigenous capacity in the design, development, installation and maintenance of Renewable Energy Technologies;
- Building indigenous capacity in the design, development, installation and maintenance of efficient wood stoves and briguetting machines;
- Setting minimum technical know-how for due diligence on potential Biofuel partners;
- Enacting and enforcing Biofuels usage Act Mandate on use of E5, E10, B10 and B20 in Nigeria;
- Formulating and implementing appropriate policy guidelines, regulatory and incentive regimes in the agricultural sector to support the bio-fuels industry.

10. Electricity

The annual consumption of electricity has been increasing very rapidly over the last three decades. It increased from 1,273 GWh in 1970 to *29,573 GWh in 2012.* This however represents a suppressed demand caused by inaccessibility to the national grid and inadequacies of the electricity supply. One consequence of this is that various industries and other consumers have installed generators, whose total capacity is estimated to be at least 80% of installed capacity of the national grid.

In recent times, the domestic sector has accounted for over 50% of the grid electricity consumed in the country while the commercial and industrial sectors have accounted for about

25% each. In view of the ever-increasing demands for electricity in the country, NEMP recommends:

- Periodic review of the electricity laws and guidelines;
- Periodic review of the exisiting Multi-Year Tariff Order (MYTO);
- Total overhauling of power plants for greater efficiency;
- Fast-tracking the completion of all on-going IPP and Government funded generation, transmission and distribution projects;
- Rehabilitating, upgrading and continuous expansion of the national grid for a steady and reliable power supply;
- Establishing Electricity Research and Development Fund;
- Reviewing and enforcing the existing laws on vandalization of public utility infrastructure;
- Designing & implementing a long-term coordinated programme for rural electrification based on distributed decentralized generation;
- Ensuring effective administration of Rural Electrification Fund.

11. Energy Utilization

The energy supply situation is erratic and epileptic, coupled with inadequate coverage in terms of geographical spread.

In a study conducted by the Presidential Advisory Committee on 25-year Power Development Plan, the electricity demand projection for a 10% annual growth of the GDP was given as about 16,000 MW, 30,000MW and 192,000MW for the years 2010, 2015 and 2030 respectively. The achievement of the above projected generation capacity will ensure that per capita electricity consumption would be about 5,026kWh, that is at per with the current consumption level in most industrializing countries. The same study also suggested an electricity generation mix of Nuclear (2%); Hydro (7%); Renewables (10%); Coal (11%) and Natural Gas (70%) in the long term.

To achieve these goals, the NEMP recommends:

- Rehabilitating existing power plants and strict adherence to both preventive and turn around maintenance schedules;
- Completion of all on-going energy-related projects and fast-tracking the commencement of all proposed electricity projects;
- Designing and implementing a long-term coordinated programme for rural electrification based on distributed decentralized generation;
- Designing a long-term R & D portfolio for the Electricity Supply Industry (ESI);

- Sensitizing the general public on the ills of vandalizing public utility infrastructure and enforcing the existing laws; and
- Improving the distribution network;
- Fast tracking the commencement and completion of legal and administrative work on the setting up of NESTI;
- Providing the legal, fiscal, administrative and regulatory environment for the setting up of small scale foundries and machine shops dedicated to the ESI within NESTI in each geopolitical zone.

Furthermore, the NEMP recommends measures for waste minimization, energy conservation and efficiency, as well as increased productivity in industrial, agricultural, domestic and transport sub-sectors. Furthermore, the NEMP recommends:

- Developing a database on energy supply, demand and consumption for all the sectors of the economy;
- Enacting a law mandating all relevant organizations to supply energy and allied data on their energy supply, demand and consumption annually to the ECN;
- Promoting energy efficiency and conservation measures;
- Encouraging industry, agriculture and transport sectors to switch over to more appropriate and environmentally friendly energy types;
- Promoting human capacity building to meet manpower needs of the sectors;
- Establishing National 90-day Strategic Fuel Depots in each of the six geopolitical zones of the country.

12. Energy Efficiency and Conservation

In Nigeria, energy demand-supply imbalance is high, with low energy access. In order to increase energy access to all, energy efficiency and conservation best practices must be imbibed. There is significant potential for energy savings in the supply and demand sides of the nation's energy sector. Therefore, sector-wide adoption of supply and demand side's energy efficiency and conservation measures in the entire energy production and utilization is imperative.

Unfortunately, energy efficiency is facing a lot of obstacles such as: Low level of awareness; lack of baseline energy consumption data; weak enforcement of laws and regulations leading to proliferation of low quality energy-efficient (EE) products; low local manufacturing capacity of energy-efficient equipment/appliances; High initial capital cost; poor billing systems by utilities (e.g, estimated bills); unreliable power supply and poor instrumentation and lack of energy audit toolkits and expertise. In order to promote energy efficiency and conservation, NEMP recommends:

- Streamlining and harmonizing all policies and plans on energy efficiency and conservation for a unified target setting;

- Passing into law the existing regulatory measures to ban the importation and sale of inefficient appliances;
- Developing Minimum Energy Performance Standard for end-use appliances;
- Encouraging Federal and State Institutions to mainstream energy efficiency and conservation programmes into their development efforts;
- Introducing mandatory energy audits in the commercial, industrial and public sectors of the economy;
- Setting up an energy efficiency fund to accelerate the implementation of energy efficiency policies and plans;
- Intensifying public awareness programmes on the need for energy efficiency and conservation practices;
- Intensifying Demand Side Management programmes in the electicity companies;
- Developing an appropriate and acceptable energy label for the Country.

13. Environment and Climate Change

The major environmental problems related to energy production, distribution and consumption in the country are mainly deforestation and pollution (air, water and soil). Over the years, oil spillage and gas flaring have had significant negative effects on the nation's economy. As a result of these possible negative impacts, there is a need to incorporate environmental considerations into the nation's energy development and utilization. Hence, NEMP recommends:

- Reviewing, updating and harmonizing the existing energy-related "Guidelines and standards for environmental pollution control in Nigeria";
- Developing and implementing projects on natural gas power plants, Petrochemical plants, LNG plants, and gas re-injection to ensure complete phase out of gas flaring as soon as possible.
- Ensuring 10% reduction in energy-related emissions by 2020.
- Carrying out massive sensitization and awareness campaign on energy related environmental problems, their mitigation and adaptation.
- Monitoring of solid, liquid, gaseous, thermal and radioactive wastes and emissions from energy activities and installations.
- Ensuring strict adherence to the recommendations of EIA on all energy projects.
- Funding R & D on energy-related environmental problems.

14. Other Energy Issues

The major energy issues addressed in this section are: gender, local content, research, development and training as well as bilateral, regional and international cooperation.

The promotion of R & D in all its ramifications is necessary in tackling energy related problems. Moreover, effective bilateral, regional and international cooperation will assist in ensuring energy security for Nigeria, the West African sub-region and the African continent.

Based on the forgoing, the NEMP recommends:

- Reviewing, updating and harmonizing the existing "Guidelines and Standards for Environmental Pollution Control in Nigeria" especially as they relate to energy production, supply and utilization;
- Ensuring adherence to laid down environmental standards;
- Establishing definite targets and timelines for the attainment of specific environmental quality parameters, as in the case of ending gas flaring by 2008;
- Carrying out massive sensitization and awareness campaign on energy related environmental problems, their mitigation and control;
- Strengthening the existing Energy Management Unit of the ECN to enable it transform into a full-fledged Energy Efficiency and Conservation Agency in the medium to long term;
- Encouraging R & D activities in energy through collaborative public – private patnership in the nation's Research Centres, Research Institutes and Tertiary Institutions;
- Promoting public awareness on the benefits of energy efficiency and conservation through seminars, lectures, short courses, print and electronic media;
- Promoting research, development and training in exploration, exploitation and utilization of all energy types;
- Ensuring full representation, participation and payment of dues to sub-regional, regional and international energy bodies;
- Vigorously pursuing the realization of the ongoing sub-regional and regional energy projects;
- Developing common standards for energy related plants, machinery and spares for use in the ECOWAS sub-region.

15. Manpower Development and Training

The National Energy Manpower Development Plan, which is aimed at developing the human capacity needs of the nation's energy sector puts particular emphasis on the national energy manpower stock and needs; training to meet energy manpower needs; energy curriculum in the nation's education system; integrating R & D, training and production; as well as the development of energy training institutions and linkages.

In order to address the afore-mentioned issues, the NEMP recommends:

- Conducting periodic a national manpower survey to determine the human resource needs and supply in the energy sector;
- Introducing energy components into the nation's educational curriculum;
- Developing and incorporating specialized energy curricula into the nation's higher educational system;
- Establishing technical cooperation with specialized institutions and industries on energy programmes outside the country;
- Reviewing energy-related manpower development programmes of the nation's Tertiary Institutions, research institutes and research centres;
- Evaluating the existing infrastructural facilities in the nation's energy research institutes and centres with a view to providing a conducive atmosphere for R & D activities;
- Organizing regular interactive fora for stakeholders in Research, Development, Production and training;
- Developing institutional framework for effective hands-on training and train-the -trainers programmes in the productive energy sector.

16. Energy Financing

Energy infrastructure projects are capital-intensive. Therefore ensuring easy accessibility to adequate, reliable and affordable energy services, in Nigeria, requires huge investment.

In Nigeria, access to energy finance is affected by inadequate national support system that guarantees the attraction and security of investment, financial capacity for investment, and strategies for attracting offshore financing. Other factors include slow judicial process in settling dispute, inadequate incentives to business to invest in new technologies and presence of political and regulatory risks for investment in new technologies. The following are recommended to mitigate these factors:

- Establishing renewable energy fund;
- Providing fiscal and financial incentives;
- Sustaining the electricity sector reforms;
- Environmental regulations that encourage investment in environmentally friendly technologies;
- Introducing tariffs that guarantee good rate of return on investment;
- Introducing concessionary feed-in tariff for renewable based energy supply;
- Attracting long-term financing from local and international institutions;
- Providing adequate security facilities; and
- Establishing and implementing favourable monetary policies.

18. Energy Planning, Monitoring and Evaluation

For effective and efficient implementation of the NEM, monitoring and evaluation mechanisms must be put in place in order to make sure that the implementation of the plan is on course and if necessary to revise it every five years to fulfill its objectives and goals. The National Energy Masterplan also recommends critical measures to be adopted in monitoring and evaluating its progress of implementation, some of which are:

- Strengthening co-operation among stakeholders in the energy sector;
- Establishing State and Local Government Energy Planning and Implementation Units;
- Carrying out integrated energy planning studies;
- Presenting the results of energy planning studies to stakeholders;
- Strengthening the National Energy Information System;
- Fast-tracking the development of national energy databank; and
- Periodic presentation of report on progress made in the implementation of the NEP and the NEM.

CHAPTER ONE

GENERAL INTRODUCTION

Energy is central to sustainable development. It affects all aspects of development – social, economic, environmental and even cultural. The energy sector is very strategic to the Nigerian economy. In addition to its macroeconomic importance, it also has major roles to play in reducing poverty, improving productivity and enhancing the general quality of lives of our people. The energy system and the other sectors of the economy are interwoven in some ways. While on the one hand, the energy sector contributes to a stable growth of the economy and the realization of social and political objectives; on the other hand, the modernization and expansion of energy supply system to meet future energy demand require a large amount of human and financial resources.

Against this background, the Energy Commission of Nigeria embarked on the development of a comprehensive National Energy Masterplan to translate the provisions of the National Energy Policy into implementable projects, activities and programmes with timelines in order to achieve the desired objectives. It will also provide ready information for prospective private investors and ensure an integrated development of the energy sector. Without a national energy master plan that gives high premium to major improvement in the quality and quantity of energy services, the realization of the goals and objectives of the Vison 20:20, Transformation Agenda and Sustainable Energy for All (SE4ALL) by 2030, cannot be met. Such a masterplan must of necessity include a ‘road map’ which gives ‘what’, ‘when’, ‘where’, and ‘how’, of energy forms and energy infrastructures deployment to meet national energy demands on the short, medium and long term basis. It should also identify who would carry out specific activities among the various stakeholders involved in the effective management of the energy sector.

Nigeria is blessed with a rich variety of depletable and renewable energy resources, the reserves of which are shown in Table 1.1.

Table 1.1: Nigeria's Energy Reserves /Capacity as at December 2013

S/ N	Resource Type		Reserves
1.	Crude Oil		37.2 billion barrels (DPR, 2014)
2.	Natural Gas		182.3 trillion SCF (DPR, 2014)
3.	Coal and lignite		2.734 billion tonnes
4.	Tar Sands		31 billion barrels of oil equivalent
5.	Large Hydropower		11,250 MW
6.	Small Hydropower ($\leq$ 30MW)		3,500 MW
7.	Solar Radiation		3.5 - 7.0 kWh/m^2/day
8.	Wind		(2-4) m/s at 10m height
9.	Biomass	Fuelwood	11 million hectares of forest and woodland
		Municipal waste	30 million tonnes/year
		Animal waste	245 million assorted animals in 2001
		Energy Crops and Agric Residue	72 million hectares of Agric Land
10.	Nuclear Element		Not yet quantified

Source: i) NNPC (2013): Annual Statistical Bulletin; ii)TCN (2013): Annual Technical Report; iii) ECN (2005): Renewable Energy Masterpaln (REMP); iv) DPR (2014)

The country possesses the seventh largest reserves of crude oil and the ninth largest natural gas reserve in the world. Associated and non-associated natural gas reserves are in the ratio 53.5 : 46.5. The Federal Government has intensified efforts to harness the tar sands and coal deposits by providing enabling environment to encourage the private sector to drive the development of the sub-sectors. The fundamental principle of the National Energy Policy is the optimal utilization of the nation's viable energy resources for sustainable development. The National Energy Masterplan articulates the sets of activities through which this can be achieved.

Apart from this introductory chapter, the National Energy Masterplan consists of thirteen other chapters, namely; Chapter 2 – Energy Demand and Supply Projections/Targets for Nigeria; Chapter 3 – Petroleum Resources (Crude Oil, Natural Gas and Shale Hydrocarbon); Chapter 4 - Tar Sands/Bitumen and Coal; Chapter 5 – Nuclear Energy; Chapter 6 - Renewable Energy Resources; Chapter 7 – Bio-Energy; Chapter 8 – Electricity; Chapter 9 - Energy Utilization; Chapter 10 – Energy Efficiency and Conservation; Chapter 11 – Environment and Climate Change; Chapter 12 – Other Energy Issues; Chapter 13 - Energy Financing, and Chapter 14 – Planning and Policy Implementation. Each chapter presents the national policies and the

objectives of each energy sub-sector and issues that need to be addressed for the balanced development of the overall energy sector. The set of activities required for accomplishing the objectives and each strategy, including the implementing and funding agencies as well as the timelines for each sub-sector are tabulated in every chapter.

In order to meet the requirement of the National Energy Masterplan, the short, medium and long term energy demand and supply studies is imperative. To this effect, Model for Analysis of Energy Demand (MAED) and Model Energy Supply Strategy Alternatives and their General Environmental impacts (MESSAGE) were employed to conduct the studies for Nigeria.
Chapter 2 presents the results of the energy demand projection study carried out by the Energy Commission of Nigeria (ECN) based on government's vision for industrializing Nigeria by 2030 using the Model for Analysis of Energy Demand (MAED) developed by the International Atomic Energy Agency (IAEA). Three scenarios were considered in the study (with year 2000 as the base year), namely: Reference Scenario, wherein the real GDP grows over the period by a mean of 7 per cent per annum which is an assumption consistent with the MDG objective to reduce poverty by half by 2015; the High Growth Scenario, in which the real GDP grows over the period by a mean of 10 per cent per annum in line with government objective of growing the economy to accelerate Nigeria's economic development; and the Optimistic Scenario within which the real GDP grows over the period by a mean of 11.5 per cent. This is a very optimistic scenario, which is intended to further accelerate the pace of economic development.

In the base year, some 12.71Mtoe of non-commercial energy was used, mainly in households and the services sectors. The use of non-commercial energy has been projected to decline in the three scenarios due to improved electrification and income levels of households and the drive to eradicate poverty. The study also projected that the total final commercial energy requirements under the three economic growth scenarios will rise by 7.52%, 9.18% and 10.25% for the Reference, High and Optimistic Growth Scenarios respectively from 17.63Mtoe in the base year. The per capita commercial energy consumption of 149.06 kgoe in the base year is projected to increase by 4.62, 7.33 and 9.75 times the base year value in the final year for the Reference, High and Optimistic Growth Scenarios respectively.

Chapter 3 deals with the Crude Oil, Natural Gas and Shale Hydrocarbon. Given the importance of this sub-sector, the masterplan is oriented towards promoting conservation of oil resources,

intensive exploration, wider distribution of oil products to all parts of the country in order to ensure energy security, gradual replacement of oil with gas and gas derivatives as the driver of the economy. The plan has also articulated measures to eliminate gas flaring in the short term and promote its utilization for power generation and in other sectors of the economy. The large reserves of tar sands/bitumen have been identified to be a possible major petrochemical feedstock.

Chapter 4 deals with the Tar Sands/Bitumen and Coal. The abundant reserves of coal are envisaged to contribute to power generation using clean technologies and industrial and domestic applications. Measures are articulated for creating and finding markets for coal, increasing the productivity of the coal mines, reducing cost of production through mechanization and establishing a cost-effective transportation system through an expansion of the rail system and port facilities for the export of coal. The masterplan emphasizes the need for increased private sector participation in the development of the oil and gas and other conventional energy sources.

The plan in Chapter 5 articulates measures to ensure peaceful applications of nuclear science and technologies in the area of electric power production, agriculture and animal production, water supply, health care delivery, petroleum exploration, solid mineral exploration, and environmental protection among others. Other issues recognized that there exist certain levels of expertise in the country. It has therefore articulated measures to achieve the required critical mass of professionals for the successful implementation of the nuclear power generation programme as well as incentives to retain and attract nuclear professionals.

The Masterplan identifies with the global environmental concerns on the imminent dangers of the fossil economy, in which oil is the main driver of industrialization, the expediency of adopting environmentally sound development path and the need for a diversified and sustainable energy supply mix. It has therefore put in place carefully selected measures, as presented in Chapter 6 and 7, to ensure the removal of existing barriers to increased utilization of renewable energy.

Chapter 6 acknowledges that the current state of exploitation and utilization of the renewable energy resources in the country is very low: limited largely to pilot and demonstration projects developed by the research centres and other tertiary institutions.

In view of the potential of RE, if properly harnessed in the drive to achieve the Transformation Agenda and Sustainable Energy for ALL targets, the masterplan has put in place incentives to promote investment in critical areas of R&D, building of indigenous human and manufacturing capacities and the creation of level play ground for the RE to compete with the conventional sources.

It is envisaged that renewable energy (RE) excluding large hydropower, will contribute about 1.3%, 8% and 16%, in meeting the national electricity demand in the short- medium-, and long term horizon respectively (REMP, 2012).

In Chapter 8, electricity industry programmes and activities for increased electricity access are highlighted. For decades, electricity generation has been generally public sector monopoly that led to inadequate supply and inefficient consumption pattern. During that time, prices were heavily subsidized. However, a number of reforms have been instituted by government towards redressing the above inadequacies ranging from deregulation, privatization of public sector monopolies, upgrading and expansion of power sector infrastructures. For instance, the expected spin-offs in the electricity sub-sector are availability of adequate spinning reserve, enhanced national grid and improvement in system security.

Chapter 9 is focused on the energy utilization plan, which stresses the conservation and rational use of energy in all the sub-sectors which envisages a gradual removal of subsidies and vigorous drive towards richer energy mix with increasing role for renewable energy. Mass transit system (electric trains, large buses) is expected to take over from the more energy intensive small and medium buses. Furthermore, the plan envisages a tariff order that will allow private investment in the electricity industry. The plan also provides opportunities for introducing more energy efficient end-use technologies and technological developments relating to renewable energy. The goal is to ensure sustainable development through decentralized energy demand and supply technologies that will contribute significantly to improving the living conditions of the rural populace in the near future.

Chapter 10 focused on energy efficiency and conservation issues in all sectors of the economy, namely: residential, commercial, industrial, transport, building designs and agriculture. Energy efficiency measures like energy auditing, awareness creation, minimum energy performance standards, energy labels, etc…

Chapter 11 addresses a number of environmental issues related to exploration and exploitation of fossil fuels (air and water pollution), land degradation, deforestation as well as ways and means of mitigating them.

Chapter 12 that deals with other energy issues addresses methods of enhancing indigenous capacity as well as issues relating to gender, local content, research, development and training in energy, as well as Bilateral, Regional and International Cooperation for ensuring energy security and economic development in Nigeria, the West African sub-region and indeed Africa. In addition, the National Energy Manpower Development Plan which is aimed at meeting the manpower needs of the nation's energy sector with particular emphasis on the national energy manpower stock and needs; training to meet energy manpower needs; energy curriculum in the nation's education system; integrating R & D, training and production and energy training institutions and linkages.

Energy Financing is dealt with in Chapter 13. Here, constraints on energy financing were identified and various financing options prescribed. The plan recommends energy financing measures, including fiscal incentives that would promote increased investments in the energy sector. It also emphasizes the need for private sector investments.

In Chapter 14, issues relating to energy planning, implementation, monitoring and evaluation are addressed. Energy planning and policy implementation in the country take place at four different levels. At the *National Level*, they involve macro-planning and policy implementation as part of the multi-sectoral national development policies and plans, which are the responsibilities of the National Planning Commission. At the *Sectoral Level*, they involve overall sectoral planning, monitoring and co-ordination of policy implementation for the energy sector, in all its ramifications. The function ensures consistency of sub-sectoral energy policies and plans with the overall national energy policies and plans and that the implementation of the latter is in accordance with provisions. At the *Sub-sectoral Level*, more specific sub-sectoral planning and policy implementation for the development, exploitation and utilization of particular energy resources, are carried out in the various energy sub-sectors, namely oil and gas, electricity, solid minerals, etc. These involve the Ministries of Petroleum Resources, Power and Steel, Solid Minerals, and others respectively. Other energy utilization sub-sectors such as transport, industry, agriculture, as well as research and development, are also relevant. Finally, at the *Operational Level*, activities involve the execution of the policies and plans developed at the

sub-sectoral level by operational establishments such as oil exploration, production and marketing companies, power generating, transmission and distribution companies.

In addition, for effective and efficient implementation of the master plan, monitoring and evaluation mechanisms must be put in place in order to make sure that the implementation of the plan is on course and if necessary to revise it to fulfill its objectives and goals. In order to adequately monitor and evaluate the achievement of targets set in the master plan, a number of performance variables or parameters would have to be defined for each activity to be monitored and evaluated.

From the foregoing, it can be concluded that the National Energy Master Plan (NEMP) seeks to achieve the goals of the National Energy Policy (NEP) by converting its strategies to actionable programmes, activities and projects in the short, medium and long terms. Moreover, NEMP establishes the framework that allows all stakeholders to jointly understand their roles and participate in the national efforts towards achieving the nation's energy goals for stable, reliable and diverse sources of domestic energy as specified in the National Energy Policy.

CHAPTER TWO

ENERGY DEMAND AND SUPPLY PROJECTIONS/TARGETS FOR NIGERIA

2.0 Introduction

A full energy demand projection study was carried out recently by the Energy Commission of Nigeria (ECN) based on government's vision for industrializing Nigeria by 2030. The study estimates the levels of energy requirements necessary for the transformation of Nigeria into an industrializing nation by 2030 using the Model for Analysis of Energy Demand (MAED), which was developed by the International Atomic Energy Agency (IAEA). The economic and demographic characteristics (major drivers of energy demand) of industrializing nations, mainly middle income countries, were identified and applied in the implementation of the model. The electricity demand projections by the Presidential Advisory Committee were adopted in the study.

Nigeria has envisioned growing its economy at a rate of 11% - 13% so that it can be reckoned within the 20 largest economies in the world by 2020. Energy demand and supply studies conducted by the Energy Commission of Nigeria under various growth scenarios and taking into consideration the economic vision, demography, available energy resources and modern developmental path, using MAED and MESSAGE energy planning models of IAEA, has indicated that huge amount of energy in the form of electricity, fuel and heat would be required to meet this vision.

Three scenarios were considered in the study (with year 2009 as the base year), namely: Reference Scenario, wherein the real GDP grows over the period by a mean of 7 per cent per annum which is an assumption consistent with the Transformation Agenda to industrialize Nigeria by 2020; the High Growth Scenario, in which the real GDP grows over the period by a mean of 10 per cent per annum in line with government objective of growing the economy to accelerate Nigeria's economic development; and the Optimistic Scenario within which the real GDP grows over the period by a mean of 11.5 per cent. This is a very optimistic scenario, which is intended to further accelerate the pace of economic development.

The following growth scenarios were considered:

- **Reference Growth Scenario:**
    - GDP grows by an average of 7% per annum
    - The main driver of growth is the manufacturing sector

- Manufacturing accounts for 15% of GDP by 2020 from 4% in 2011
- Consistent with the MDG objective of reducing poverty by half by 2015

▪ **High Growth Scenario:**

- GDP grows by an average of 10% per annum
- Manufacturing contributes 22% to GDP by 2030 from 4% in 2011
- Nigeria is transiting from an agrarian economy to an industrializing nation

▪ **Optimistic Growth Scenario:**

- GDP grows by an average of 13% per annum
- Manufacturing contributes 22% to GDP by 2030 from 4% in 2011
- Nigeria is transiting from an agrarian economy to an industrializing nation

Table 2.1 shows the amounts and shares of total final energy demand by the various sectors. For the Reference Scenario, the demands will vary over the plan period from 1.15Mtoe to 105.52Mtoe, for industry, 7.65Mtoe to 28.51Mtoe, for transport, 24.09Mtoe to 46.29 Mtoe for households and 3.13Mtoe to 10.67Mtoe for services. The final energy demand for other scenarios is as shown in the same table 2.1. All sectors indicate positive growths, except household, which indicated a negative growth rate for the Optimistic Scenario. The fastest growing sector is industry (agriculture, construction, mining and manufacturing) with overall annual growth rates of 24.01%, 28.78% and 32.45% for the Reference, High and Optimistic Growth Scenarios respectively. These growths will have been dominated by energy demand in the manufacturing sector, whose energy use far outweighs those of agriculture, construction and mining.

Similarly, the services sector will experience growth rates of 6.01%, 7.3% and 9.25% p.a. for the respective scenarios; and transport with 6.46%, 7.49% and 7.88%; while, households will be having growth rates of 3.16%, 4.85% and 4.68% for the Reference, High and Optimistic growth scenarios, respectively. In the base year, households had the highest share of energy demand at 66.9% of the total, followed by transport, services and industry sectors with shares of 21.2%, 8.7% and 3.2%, respectively. However, the structure is projected to change markedly over the plan period. By 2030 and for the Reference Scenario, the dominant sector will be industry, with a share of 55.3%. The households sector will come next with 24.2%, followed by transport with 14.9%. The services sector will have the lowest share of 5.6%. For the High Growth Scenario, the industry sector will have the largest share of 67.2%, followed by households, transport and services with shares of 18.8%, 10.1% and 4.0% respectively. Industry will still have the highest

share, with 77.7% for the Optimistic Scenario, followed by households, transport and services with 11.6%, 7.0% and 3.7% respectively.

Table 2.1: Total Energy Demand Projection by Sector

Scenario/Sector	Demand, Mtoe						Growth rate, %	Share, %					
	2009	**2010**	**2015**	**2020**	**2025**	**2030**	**2009-2030**	**2009**	**2010**	**2015**	**2020**	**2025**	**2030**
Reference Growth Scenario (7%)	**36.02**	**37.12**	**61.43**	**94.29**	**138.84**	**190.99**	8.27	**100**	**100**	**100**	**100**	**100**	**100**
Industry	1.15	0.47	23.34	46.72	73.80	105.52	24.01	3.2	1.3	38.0	49.6	53.2	55.3
Transport	7.65	9.26	11.63	15.53	21.12	28.51	6.46	21.2	24.9	18.9	16.5	15.2	14.9
Household	24.09	24.68	23.40	27.28	36.46	46.29	3.16	66.9	66.5	38.1	28.9	26.3	24.2
Services	3.13	2.71	3.055	4.76	7.46	10.67	6.01	8.7	7.3	5.0	5.0	5.3	5.6
High Growth Scenario (10%)	**36.02**	**37.56**	**75.25**	**124.16**	**200.97**	**346.9**	11.39	**100**	**100**	**100**	**100**	**100**	**100**
Industry	1.15	1.73	30.46	62.21	115.30	233.12	28.78	3.2	4.6	40.5	50.1	57.4	67.2
Transport	7.65	7.36	11.04	16.49	24.02	34.88	7.49	21.2	19.6	14.7	13.3	11.9	10.0
Household	24.09	27.32	30.44	39.53	52.16	65.15	4.85	66.9	72.7	40.4	31.8	26.0	18.8
Services	3.13	1.15	3.305	5.93	9.49	13.75	7.30	8.7	3.1	4.4	4.8	4.7	4.0
Optimistic Growth Scenario	**36.02**	**40.66**	**77.15**	**143.75**	**278.46**	**541.42**	13.78	**100**	**100**	**100**	**100**	**100**	**100**
Industry	1.15	6.92	34.97	81.66	190.01	420.74	32.45	3.2	17.0	45.3	56.8	68.2	77.7
Transport	7.65	5.56	11.11	16.51	24.71	37.63	7.88	21.2	13.7	14.4	11.5	8.9	7.0
Household	24.09	24.72	26.37	36.60	49.75	62.97	4.68	66.9	60.8	34.2	25.5	17.9	11.6
Services	3.13	3.46	4.70	8.98	13.99	20.08	9.25	8.7	8.5	6.1	6.2	5.0	3.7

Source: Report on "Energy Demand Projections for an Industrializing Nigeria", Report ECN/EPA/2014/01

1Table 2.2: Projected Total Energy Demand for Fuel Petroleum Products for Nigeria (Million Litres)

Year	PMS		DPK		AGO		Fuel Oil		LPG	
	7%	**13%**	**7%**	**13%**	**7%**	**13%**	**7%**	**13%**	**7%**	**13%**
2009	5096.94	5096.94	356.06	356.06	565.64	565.64	120.01	120.01	74.16	74.16
2010	6180.00	8890.00	464.00	902.00	791.68	1177.85	160.00	270.00	93.20	132.90
2015	14460.00	19510.00	3788.00	7039.00	2301.86	3651.10	1800.00	3380.00	1107.00	1871.20
2020	28170.37	35587.13	9038.71	22704.49	4176.76	6270.84	4632.07	9277.93	2862.50	5733.51
2025	39769.44	55459.38	15984.94	44285.43	6231.84	11408.42	7806.10	20797.42	4823.96	12852.25
2030	56457.15	88369.15	22064.93	77255.68	8902.43	21349.73	11374.64	45443.40	7029.22	22903.70

Table 2.3: Electricity Demand Projections per Scenario, MW

Scenario	2009	2010	2015	2020	2025	2030
Reference growth (7%)	4,052	7,440	24,380	45,490	79,798	115,674
High growth (10%)	4,052	8,420	30,236	63,363	103,859	196,875
Optimistic growth (11.5%)	4,052	9,400	36,124	76,124	145,113	251,224
Optimistic growth (13%)	4,052	10,230	41,133	88,282	170,901	315,113

Table 2.4: Electricity Supply Projections by Fuel Type: Optimistic II Scenario 7%

	2009 (Based Yr)	2010	2015	2020	2025	2030
Coal	0	609	1850	6527	7545	10984
Electricity Import	0	0	0	0	0	31948
Gas	3803	4572	18679	33711	61891	80560
Hydro (Large & Small	1930	1930	3043	6533	6533	6533
Nuclear	0	0	1000	1500	2500	3500
Small Hydro	20	60	172	409	894	1886
Solar	0	260	1369	3455	7000	25917
Wind	0	10	19	22	25	29
Biomass	0	0	3	16	35	54
Supply	5753	7440	26092	52174	86422	161411

Table 2.5: Electricity Supply Projections by Fuel Type: Optimistic II Scenario 10%

	2009 (Based Yr)	2010	2015	2020	2025	2030
Coal	0	870	2579	9324	10778	15691
Electricity Import	0	0	0	0	0	45640
Gas	3803	6957	21328	44763	82702	115086
Hydro (Large & Small	1930	2174	4348	9332	9332	9332
Nuclear	0	0	1500	2500	3500	3500
Small Hydro	20	81	246	585	1277	2694
Solar	0	377	1956	4936	10000	370225
Wind	0	18	28	32	36	42
Biomass	0	0	4	23	50	77
Supply	5753	10476	31989	71495	117675	229086

Table 2.6: Electricity Supply Projections by Fuel Type: Optimistic II Scenario 11.5%

	2009 (Based Yr)	2010	2015	2020	2025	2030
Coal	0	1000	2966	10723	12395	18045
Electricity Import	0	0	0	0	0	52486
Gas	3803	8000	23377	45728	106607	132348
Hydro (Large & Small	1930	2500	5000	10732	10732	10732
Nuclear	0	0	2500	4500	5500	6369
Small Hydro	20	93	283	672	1469	3098
Solar	0	434	2250	5677	14127	42578
Wind	0	20	32	36	42	48
Biomass	0	0	4	27	58	88
Supply	5753	12047	36412	78095	150929	265794

Table 2.7: Electricity Supply Projections by Fuel Type: Optimistic II Scenario 13%

	2009 (Based Yr)	2010	2015	2020	2025	2030
Coal	0	3353	3353	12122	14011	20399
Electricity Import	0	0	0	0	0	59333
Gas	3803	13110	26426	49996	120512	164307
Hydro (Large & Small	1930	4157	11207	12132	12132	12132
Nuclear	0	0	3600	7200	7200	7200
Small Hydro	20	105	320	760	1660	3502
Solar	0	490	2543	6417	15970	48132
Wind	0	23	36	41	47	54
Biomass	0	0	5	30	65	100
Supply	5753	21238	47490	88698	171598	315158

Table 2.8: Summary of Renewable Energy Targets

(i) Renewable Electricity Supply Projection in MW (7% GDP Growth rate)

S/N	System	Short Term	Medium Term	Long Term
1	Hydro (LHP)	3,000	6,000	6,000
2	Hydro (SHP)	43	533	533
3	Solar PV	1,400	3,000	20,000
4	Solar Thermal	-	45	6,000
5	Biomass	5	16	50
6	Wind	20	22	30
	All Renewable (MW)	4,468	10,026	32,613
	All Energy Resources (MW)	26,000	52,000	160,000
	% RE	17%	19%	20%

Source: Energy Commission of Nigeria

(ii) Renewable Electricity Supply Projection in MW (10% GDP Growth rate)

S/N	System	Short Term	Medium Term	Long Term
1	Hydro (LHP)	4,000	8,000	8,000
2	Hydro (SHP)	350	1,332	1,332
3	Solar PV	2,000	4,000	25,000
4	Solar Thermal	-	936	12,000
5	Biomass	5	23	77
6	Wind	28	32	42
	All Renewable (MW)	6,383	14,323	46,451
	All Energy Resources (MW)	32,000	72,000	230,000
	% RE	20%	20%	20%

Source: Energy Commission of Nigeria

(iii) Renewable Electricity Supply Projection in MW (13% GDP Growth rate)

S/N	System	Short Term	Medium Term	Long Term
1	Hydro (LHP)	11,207	12,132	12,132
2	Hydro (SHP)	320	760	2,600
3	Solar PV	2,500	5,000	30,000
4	Solar Thermal	-	1,400	18,132

5	Biomass	5	30	100
6	Wind	36	41	54
	All Renewable (MW)	14,068	19,363	63,018
	All Energy Resources (MW)	48,000	90,000	315,000
	% RE	29%	22%	20%

Source: Energy Commission of Nigeria

CHAPTER THREE

PETROLEUM RESOURCES

3.0 Introduction

Crude Oil

Oil exploration in Nigeria witnessed steady growth over the past few years. The nation had a proven reserve of 25 billion barrels of predominantly low sulphur light crude in 1999 which substantially increased to 34 billion barrels in 2004, and currently about 36.5 billion barrels. The growth in reserves is attributable to improved funding of Joint Venture operations, timely payment of cash call arrears, introduction of alternative funding scheme, the emergence of new production sharing arrangements and the opening up of new frontier and deepwater/offshore blocks. Based on various oil prospects already identified especially in the deepwater terrain and the recent development efforts, it was projected that proven reserves will reach about 40 billion barrels by year 2020 and potentially 68 billion barrels by year 2030. Oil production in the country also increased steadily over the years, however, the rate of increase is dependent on the economy, technology and geopolitics of both producing and consuming countries. Nigeria's current producibility is about 2.4 million barrels per day even though actual production is averaging around 2.4 million barrels per day partly due to the problems in the Niger Delta and OPEC production restriction. Average daily production was projected to increase to 4.0 million barrels per day by 2020 and potentially to over 5.0 million per day in year 2030. However, these high potentials will be realized only with the adoption of high exploration strategic development policies and programmes covering the onshore–basins of Niger Delta, Anambra, Benin (Dahomey), Benue, Bida, Chad and Sokoto Basins, as well as the offshore continental shelves and deepwater terrains.

In the downstream oil sub-sector, Nigeria has four refineries with a total installed capacity of 445,000 barrels per day and 5001km network of pipeline from the refineries to 22 oil depots. The Federal Government also established petrochemical and fertilizer plants. The capacity utilization of these plants and facilities has been considerably low, due to high level of decay arising from poor maintenance and operating conditions, under -funding, criminal vandalization especially on the pipelines, and the various companies' lack of management autonomy for efficient operation. Consequently, annual domestic demand for petroleum products is not fully met by internal production and has to be supplemented by imports. However, the downsream sub-sector reforms which encompass deregulation and participation of the private sector in petroleum refining will ameliorate the current supply – demand imbalance.

Oil will continue to play a major role in the nation's economy, hence the need to expand the reserve base through continuous exploration activities. This of course will require huge amount of investments in exploration and development activities. There is also the need to promote the expansion of downstream processes and businesses for value-added benefits to the economy and the production of export based products. This notwithstanding, it is necessary to diversify the domestic energy mix away from the ever – increasing consumption of petroleum products in order to avert any possible conflict between domestic and export requirements.

Natural Gas

Nigeria's proven natural gas reserves, estimated at about 180 trillion standard cubic feet as at 2014, are known to be substantially larger than its oil resources in energy terms. Gas discoveries in Nigeria are incidental to oil exploration and production activities. Consequently as high as 75% of the gas produced was being flared in the past. However, gas flaring was reduced to about 13% as at 2012 as a result of strident efforts by Government to monetize natural gas.

Domestic utilization of Natural gas is mainly for power generation which accounted for over 80% while the remaining are in the industrial sector and very negligible in the household sector. In order to encourage domestic utilization of natural gas and its derivatives, government has embarked on massive investment in gas gathering, processing and distribution infrastructures such as the Escravos-Lagos and Escravos-Ajaokuta gas pipelines with plans for future expansion to major consuming centres in the country. Government and Independent Power Producers have also embarked on the establishment of gas-based power projects. Government is also poised to ensure that the LPG distribution depots built within the country through the butanisation programme is adequately utilized.

In view of the increasing domestic oil consumption, an economically optimal strategy to replace oil with gas and gas derivatives will enhance the availability of more oil for export. This will also promote the conservation of the oil reserves. Apart from the economic advantage, fuel substitution from oil to gas is desirable as a result of environmental considerations.

Given the current reserves and rate of exploitation, the expected life-span of Nigerian crude oil is about 44 years, based on about 2mb/d production, while that for natural gas is about 88 years, based on the 2005 production rate of 5.84bscf/day. It is therefore, strategically important to undertake major investments in the gas sector in order to prepare adequately for gas as a substitute for oil both for domestic needs and foreign exchange earnings.

The continued flaring of natural gas has resulted in a substantial waste of energy resources, in addition to contributing to atmospheric pollution. It is therefore imperative to take effective measures to curtail gas flaring, so that the ending of gas flaring does not exceed the deadline as may be prescribed by government as soon as. The Associated Gas Re-injection Decree of 1979 and subsequent amendments Associated Gas Framework Agreement (AGFA) and Associated Gas Utilization Framework Incentives (AGUFI) have given deadlines for the end of natural gas flaring. These incentives have encouraged the establishment of various LNG projects, which are at various stages of completion. The West African Gas Pipeline project, the proposed Trans Sahara Gas Pipeline project, Trans Nigeria Gas Pipeline project, are steps towards achieving the stoppage of gas flaring, as soon as possible.

The Kyoto Protocol which Nigeria is a signatory to, will also reduce gas flaring as companies invest on such project that can earn them carbon credit.

Shale Hydrocarbon

Nigeria is endowed greatly in conventional petroleum, nonetheless, fossil fuel is a wasting asset, and hence any future discoveries of shale oil/gas should be welcome for reserves addition apart from expanding the national energy mix. Besides, since conventional petroleum is not presently found in most inland basins, any discovery of commercial quantities of the shale hydrocarbon resources in the associated states will no doubt boost their economy apart from its overall salutary effect on the nation, as a whole.

Oil shale is an organic-rich fine-grained sedimentary rock from which both liquid and gaseous hydrocarbons called shale oil and shale gas, respectively, can be produced. Shale oil and shale gas are unconventional petroleum and are substitutes for conventional crude oil and natural gas, respectively. However, extracting shale oil/gas from oil shale is more costly than the production of their conventional counterparts both financially and in terms of its environmental impact. Deposits of oil shale sedimentary rocks occur around the world, including deposits all around the country. Estimates of global deposits shale oil range from 2.8 to 3.3 trillion barrels.

3.1 CRUDE OIL

3.1.1 Policies

i. The nation shall engage extensively in exploration and production of crude oil and associated liquid petroleum.

ii. The nation shall place emphasis on internal self-sufficiency in processing and export of petroleum products.

iii. The nation shall encourage the participation of indigenous and foreign companies in both upstream and downstream activities of the oil industry.

iv. The nation shall encourage the adoption of environmentally friendly oil exploration, exploitation, handling and storage methods.

v. The nation shall complete deregulation and privatization of the oil industry.

vi. The nation shall aggressively pursue research and development studies, and human capacity development to derive maximum economic benefit from its oil resources.

vii. The nation shall support the development of its marginal fields.

3.1.2 Objectives

i. To increase the reserves and the production capacity.

ii. To derive maximum economic benefits from the nation's liquid petroleumresources.

iii. To ensure that refining to consumption ratio is greater than one (1), so as to ensure domestic self-reliance in the production of petroleum products for domestic consumption.

iv. To ensure adequate and reliable supply and distribution of petroleum products to meet the demand of the domestic market.

v. To accelerate the process of technology acquisition and diffusion in the oil industry.

vi. To enhance indigenous capability in the industry in the interest of national security.

vii. To promote the efficient management and environmentally-friendly operation in line with global best practices.

viii. To attract increased private sector capital inflow to the oil industry.

ix. To mainstream and/or integrate climate change adoption in oil both upstream and downstream activities of the oil industry.

x. To foster the use of best available practices/technology to minimize impacts of oil activity on the project communities/location most vulnerable to environmental/climate change threat.

xi. To minimize adverse environmental impacts of oil activities on the project communities and locations.

xii. To encourage the full participation of indigenous and foreign companies in both upstream and downstream activities of the oil industry.

xiii. To give indigenous investors a platform for qualitative participation in the development of the nation's marginal fields, and build Nigerian Content capacity.

3.1.3 Action Plan

Table 3 .1: Crude Oil Development Action Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Investing in and intensifying crude oil exploration and production in all Nigerian sedimentary basins and ensuring that acreages put up for bidding rounds are properly pre-estimated with minimal speculations.	(a) Empowering the DPR to provide comprehensive database on upstream oil and gas.	DPR	MPR, NASS, FMJ, NNPC	FGN (MPR, DPR)	*	*	*
	(b) Establishing and maintaining a comprehensive geological and seismic survey program with digitalized maps in order to promote and accelerate the exploration program that will uncover the oil and gas potentials in the entire hydrocarbon bearing zones in various parts of the country and territorial waters.	NGSA	MPR, NNPC, DPR, NBS	FGN (MPR, NGSA)	*	*	*
	(c) Establishing a clearly defined National Reserves Depletion Target based on technical, as well as social, and political optimization taking cognizance that uncontrolled and rapid growth can be damaging to the general economy in the long term.	DPR	MPR, NNPC	FGN (MPR, DPR)	*	*	*
	(d) Establishing a special fund for indigenous upstream operators.	DPR, NCDMB	MPR, FMF, CBN, FMJ, NASS, OPS, NNPC	FGN (MPR, DPR)	*	*	*
	(e) Enforcing the Marginal Fields Law.	DPR	FMJ, MPR	FGN (MPR, DPR)	*	*	*
	(f) Opening up of more blocks for bidding at the Sao Tome and Principe Joint Development Zone.	MPR, JDZA	DPR, NNPC, OPS	JDZA	*	*	*
	(g) Introducing venture capital to finance emerging opportunities in the oil and gas sector.	NNPC	OPS, SEC, FMF, IOCs, IOPs	FGN (NNPC)	*	*	*
	(h) Adhering to the Local Content Principle in the allocation/bidding for oil blocks.	DPR	MPR, NNPC, NCDMB	FGN (MPR, DPR)	*	*	*
	(i) Ensuring achievement of crude oil reserve of 40 billion barrels and production capacity of 4.5 million barrels per day by 2020.	DPR	MPR, NNPC, OPS	FGN (MPR, DPR)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(j) Ensuring national self-reliance through indigenous capacity building so as to ensure full benefits to the country from the petroleum resources.	PTDF, NCDMB	MPR, NNPC, OPS, DPR	FGN (MPR, PTDF, NCDMB)	*	*	*
	(k) Undertaking periodic evaluation of the producing reservoirs in order to prevent reservoir damage, and prescribe optimal production strategies for the fields.	DPR	MPR, NNPC, OPS	FGN (MPR, DPR)	*	*	*
	(l) Maintaining a strategic balance between production from traditional oil fields in onshore terrain, inland basins, continental shelves and offshore on one hand, and the new deepwater offshore fields governed by Production Sharing Contract arrangements.	DPR	NNPC, MPR, OPS	FGN (MPR, DPR), OPS	*	*	*
	(m) Ensuring the application of modern technology and up to date reservoir engineering practices in fields and from time to time recover the underdeveloped fields to Nigerian companies under the classification of marginal fields.	DPR	NNPC, MPR, OPS	FGN(MPR, DPR), OPS	*	*	*
	(n) Ensuring effective petroleum resource management in the oil industry.	DPR	MPR, NNPC	FGN (MPR, DPR)	*	*	*
	(o) Establishing harmonized commercialization plan for the development of the discovered oil and gas resources in the country.	DPR	MPR, NNPC	FGN (MPR, DPR)	*	*	*
	(p) Promoting the use of stratigraphic and strati-structure traps to enhance 3D seismic coverage.	DPR	MPR, NNPC, NGSA	FGN (MPR, DPR)	*	*	*
	(q) Developing of cluster of marginal fields in offshore conditions by creating common facilities/utilizing nearby existing infrastructure.	DPR	NNPC, MPR, OPS	FGN (MPR, DPR), OPS	*	*	*
	(r) Pursuing extensive exploration in non-producing and frontier basins.	DPR	NNPC, MPR, OPS	FGN (MPR, DPR), OPS	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(ii) Investing in exploration, production and refining activities in other countries to promote national development and energy security.	(a) Reviewing modalities for participation in the oil exploration, production and refining activities in other countries.	MPR	DPR, NNPC, PPPRA, ECN	FGN (DPR, MPR)	*	*	*
	(b) Conducting periodic oil market studies.	ECN	NNPC, DPR, PPPRA, IPMAN, MPR	FGN (ECN)	*	*	*
	(c) Developing micro-economic marketing strategies for the emerging oil markets to take advantage of global demand for oil.	ECN	MPR, NNPC, PPPRA, DPR, FMIT&I, CBN	FGN (ECN)	*	*	
	(d) Reviewing modalities of state of the art technology for widening the exploration base in geological areas.	DPR	MPR, NNPC,ECN, NGSA, PTDF	FGN (MPR, DPR)	*	*	*
	(e) Reviewing modalities for equipping domestic refining industry to meet the challenge of producing fuels in an environmentally friendly manner.	NNPC	MPR, DPR, PPPRA, ECN, FMEnv	FGN (MPR, NNPC)	*	*	*
(iii) Maximizing and expanding the refining capacity in the country to cater fully for local *consumption and export of products.*	(a) Reviewing existing modalities to encourage private sector participation in the refining sector.	MPR	NNPC, DPR, OPS PPPRA	FGN (MPR)	*	*	*
	(b) Ensuring refinement of at least 50% of Nigeria's crude oil production by 2020 and 75% by 2025.	NNPC	MPR, DPR, OPS, FMIT&I, PPPRA	FGN (NNPC)	*	*	*
	(c) Ensuring optimal recovery from ageing oil and gas fields	DPR	MPR, NNPC,ECN	FGN (MPR, DPR)	*	*	*
(iv) Expanding and promoting research and development activities in the country.	(a) Identifying R & D priorities that will fast-track local content development.	PTDF	RIs, NNPC, DPR, MPR, NCDMB, FMST, OPS, ECN, TIs,	FGN (MPR, PTDF, NCDMB, DPR)	*	*	*
	(b) Implementing identified R&D priorities.	NNPC	PTDF, NCDMB, NOTAP, DPR, ECN, OPS, MPR, FMST, NNPC, NUC, NBTE, RIs, TIs	FGN (NNPC, PTDF), OPS	*	*	*
	(c) Developing linkages with international institutions for R&D purposes.	ECN	PTDF, NNPC, MPR, MFA, DPs	FGN (ECN, NNPC)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(d) Ensuring major oil companies establish R&D outfits in Nigeria thereby contributing towards the achievement of 45% in short term and 70% in the medium term of the overall studies conducted by all oil companies operating in the country.	NNPC, PTDF	MPR, DPR, RCs, RIs, TIs, FMST	FGN (NNPC, PTDF)	*	*	*
	(e) Strenthening the National Petroleum Research Centre as proposed in the report of the Oil and Gas Sector Reforms and Implementation Committee.	MPR, ECN	PTDF, NNPC, NASS, FMST	FGN (ECN, MPR)	*	*	*
(v) Taking appropriate measures to ensure that Nigerians are adequately involved in all sections of the oil industry.	(a) Reviewing the existing modalities to ensure increase in the number of Nigerians in the oil industry.	NCDMB	MPR, PTDF, ECN, NNPC	FGN (PTDF, NCDMB)	*	*	*
	(b) Reviewing the existing modalities to empower Nigerians to participate as major operators of joint venture agreement.	NCDMB, NNPC	MPR, PTDFOPS, DPR	FGN (NNPC, NCDMB, PTDF)	*	*	*
	(c) Ensuring the implementation of relevant laws in the Nigeria Content Act.	NCDMB	FMJ, NNPC, MPR, OPS, DPR, PTDF	FGN (MPR, NCDMB)	*	*	*
	(d) Building human capacity needed to attract investment in the frontier basins.	NCDMB , PTDF	MPR, NNPC, FMJ, PTI, OPS	FGN (NCDMB, PTDF)	*	*	*
(vi) Providing appropriate incentives to attract investments and ensure reasonable returns.	(a) Reviewing the existing framework of fiscal incentives that will attract investment to accelerate development of deep-water acreages and guarantee equitable benefits to the Nigerian government and the oil companies.	NIPC	MPR, NNPC, OPS FMIT&I, FMF	FGN (MPR, NIPC)	*	*	*
	(b) Ensuring Nigeria maintains a minimum of 51% in JV companies.	NNPC	MPR, DPR, NIPC, OPS	FGN (NNPC), OPS	*	*	*
	(c) Ensuring periodic review of the policy and principles of licensing new exploration acreage such as Production Sharing Contract or Service Contract in line with prevailing international practices and national economic interest.	DPR, MPR	IOPs, IOCs, NNPC, OPS	FGN (DPR, MPR)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(d) Ensuring periodic review and evaluation of the Production Sharing Contract agreement in line with changing technologies to enhance oil recovery and to protect national economic interest.	MPR, DPR	NNPC, OPS	FGN (MPR /DPR)	*	*	*
	(e) Reviewing unfavorable fiscal regime, and uncompetitive legal and regulatory framework that may tend to discourage investment in the industry.	MPR	DPR, NNPC, OPS	FGN (MPR)	*	*	*
(vii) Encouraging local engineering design and fabrication of equipment and spare parts in Nigeria.	(a) Passage of the Petroleum Industry Bill into Law.	NASS	MPR, FMJ, NNPC, DPR, PPPRA, OPS, NCDMB	FGN (MPR)	*	*	*
	(b) Enforcement of the Nigerian Local Content Law.	NCDMB	FMJ, NNPC, DPR, MPR, OPS	FGN (NCDMB)	*	*	*
(viii) Ensuring the use of locally available materials for oil exploration, production and processing including refining.	(a) Identifying, quantifying, and qualifying oil exploration and production materials deposits in Nigeria.	NGSA, RMRDC	MPR, FMJ, NNPC, DPR, PTDF, NNRA, OPS, MMSD	FGN(MMSD, NGSA, RMRDC)	*	*	*
	(b) Conducting studies on national demand and export possibilities for locally produced drilling fluid muds.	DPR, NGSA, NEPC	FMST, NNPC, MPR, NEPC, PTI, FMIT&I, MMSD	FGN (NEPC, DPR)	*	*	*
	(c) Establishing oil exploration, production and refining materials processing plants in Nigeria.	MPR, NNPC	FMIT&I, DPR, BPE	FGN (NNPC,MPR)	*	*	*
	(d) Ensuring 100% local sourcing of materials used for oil exploration, production and refining in Nigeria.	NCDMB, DPR	RMRDC, MMSD, NNPC, OPS, MPR	FGN (NCDMB, DPR)	*	*	*
(ix) Improving the living standards of people in oil producing communities through the provision of socio –economic infrastructure.	(a) Ensuring continuous Environmental Impact Audit of all oil projects.	NESREA, NOSDRA	FMEnv., NNPC, MPR, OPS, NDDC	FGN (NESREA, NOSDRA)	*	*	*
	(b) Provision of adequate socio-economic infrastructure (e.g. schools, motorable roads, health facilities, energy and water services, etc.) in the oil producing communities.	NDDC	NNPC, OPS, IOCs, FMH, FMEd., FMW, FMWR, DPs, NGOs	FGN (NDDC)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(x) Ensuring adequate geographical coverage of oil refining and petroleum products distribution network.	(a) Developing package of incentives to encourage the establishment of private refineries in all parts of the country. Otherwise, government should fund the provision of pipeline network to ensure adequate distribution of products to every part of the country.	MPR, DPR	NNPC, PPPRA,OPS	FGN (MPR, DPR)	*	*	*
	(b) Establishing adequate infrastructure (e. g. rail network, pipelines) for the movement of petroleum products nationwide.	PPPRA, FMT	MPR, NNPC, NRC, OPS	FGN (FMT, PPPRA)	*	*	*
	(c) Sustaining the Petroleum Equalization Fund until nationwide supply and distribution network is achieved.	MPR, PEF	PPPRA, NNPC, IPMAN, DPR	FGN (PEF)	*	*	*
	(d) Fast-tracking the establishment of mini-refineries by NNPC and JV partners.	NNPC, OPS	DPR, MPR, IOCs	FGN (NNPC), OPS	*	*	*
(xi) Ensuring the availability of adequate strategic reserves of storage capacity for refined products for at least 90 days of forward consumption.	(a) Establishing purpose-built 90-day strategic storage facilities across the six geopolitical zones of the country.	NNPC	MPR, DPR, PPPRA, OPS	FGN (MPR), OPS	*	*	*
	(b) Ensuring that the strategic reserve storage facility is operational at all times.	NNPC	MPR, DPR, PPPRA	FGN (MPR)	*	*	*
	(c) Conducting exhaustive studies on utilization of biofuels (bioethanol and biodiesel) in internal combustion engines.	NNPC	PTDF, FMA&RD, FMST, MPR, ECN, DPR, NARICT	FGN (NNPC, PTDF)	*	*	*
	(d) Establishing facilities for local production of biofuels.	NNPC, PTDF	ECN, NARICT, FMA&RD, MPR	FGN (NNPC, PTDF), OPS	*	*	*
	(e) Continuing the establishment of the mega stations.	NNPC	MPR, DPR	FGN (NNPC)	*	*	*
	(f) Establishing medium-sized petrol stations in all LGHQs.	NNPC	DPR, MPR	FGN (NNPC)	*	*	*
	(h) Encouraging increased private sector participation in the establishment of new refined products depots and ensuring that the existing ones are operated on an open access basis to all operators in the downstream sub-sector.	NNPC, BPE	MPR, OPS, DPR	FGN (NNPC), OPS	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(xii) Updating laws and regulations constantly to create the enabling environment for increased private sector participation in the oil industry, especially in the downstream sub-sector.	(a) Reviewing existing laws to further encourage private sector participation in the industry.	MPR	BPE, NNPC, OPS, FMJ, NASS, DPR	FGN (MPR)	*	*	*
	(b) Ensuring intensified implementation of the reviewed laws.	DPR, PPPRA	MPR, NNPC, FMJ	FGN (DPR, MPR, PPPRA)	*	*	*

3.2 NATURAL GAS

3.2.1 Policies

i. The nation's gas resources shall be harnessed and optimally integrated into the national economy, energy mix and industrial processes.

ii. The nation shall intensify in gas exploration and development.

iii. The nation shall put in place necessary infrastructure and incentives for indigenous and foreign investors.

iv. The nation shall put in place necessary infrastructure and incentives for adequate geographical coverage of the gas transmission and distribution network.

v. The nation shall promote a competitive and efficient domestic market for natural gas and establish indigenous-based natural gas facilities.

vi. The nation shall aggressively pursue research and development and human capacity development to derive maximum economic benefit from its gas resources.

3.2.2 Objectives

i. To determine the level of gas reserves available to the nation.

ii. To eliminate the flaring of associated gas.

iii. To expand the utilization of natural gas as industrial and domestic fuel, as well as for power generation.

iv. To increase the use of natural gas as industrial feedstock for petrochemical, pharmaceutical and fertilizer plants, etc.

v. To use gas to diversify the foreign exchange earning base of the nation.

vi. To accelerate the process of technology acquisition and diffusion in the gas industry.

vii. To encourage indigenous entrepreneurial capability in the gas industry including the development of end-use devices.

viii. To ensure reliability of energy supply to all parts of the country.

ix. To support private sector participation in natural gas infrastructure for rapid development of energy intensive industries.

x. To promote efficiency and reliable supply of natural gas.

xi. To mainstream and/or integrate climate change adoption in both upstream and downstream activities of the gas industry.

xii. To minimize adverse environmental impacts of gas activities on the project communities and locations.

3.2.3 Action Plan

Table 3.2: Natural Gas Development Action Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Embarking on deliberate exploration and development of gas reserves in all parts of the country.	(a) Intensifying exploration activities to increase national gas reserves.	NNPC	NLNG, OPS, MPR, DPR	FGN (NNPC, NLNG), OPS	*	*	*
	(b) Developing infrastructure to deliver gas to all parts of the country and beyond.	NNPC	NLNG, PPPRA, OPS, MPR, DPR, FMT	FGN (NNPC, PPPRA), OPS	*	*	*
	(c) Passing the Petroleum Industry Bill into Law.	NASS	FMJ, DPR, NNPC, MPR	FGN (MPR, NASS)	*	*	
	(d) Developing a comprehensive set of technical and safety standards.	NNPC	NLNG, OPS, MPR, DPR	FGN (NNPC), OPS	*	*	*
(ii) Encouraging the oil producing companies to gather and utilize associated gas to eliminate flaring as determined by the government.	(a) Reviewing the existing fiscal regime for the utilization of flared gas.	MPR	NLNG, NNPC, OPS, FMF, DPR, IOCs	FGN (MPR)	*	*	*
	(b) Reviewing existing legislation on gas flaring.	NASS, MPR	NLNG, DPR, NNPC, FMJ	FGN (MPR)	*	*	*
	(c) Ensuring the completion of all on-going gas utilization projects and commencement of the proposed ones.	NNPC, NLNG	MPR, DPR, OPS	FGN (NNPC, NLNG), OPS	*	*	*
(iii) Imposing appropriate and effective penalties to discourage gas flaring.	(a) Increasing the penalty for gas flaring from the current value of ₦10.00/1000 scf to ₦5000.00/1000 scf.	MPR, NLNG	NNPC, OPS, DPR, PPPRA	FGN (MPR, NLNG)	*	*	
	(b) Enacting legislation to back up the penalty.	NASS, MPR	DPR, FMJ, NNPC, NLNG	FGN (NASS, MPR)	*	*	
(iv) Encouraging the establishment of the necessary infrastructure for the effective gathering, transmission and distribution of gas nationwide.	(a) Developing a natural gas gathering and transmission infrastructure to deliver gas across the country.	NLNG, NNPC	OPS, MPR, DPR, PPPRA	FGN (NLNG, NNPC), OPS	*	*	
	(b) Implementing the proposed Trans-National Gas Pipeline (Ajaokuta-Abuja-Kaduna-Kano) project.	NNPC, NLNG	DPR, MPR,PPPRA, OPS	FGN (NNPC, NLNG), OPS	*	*	*
	(c) Developing underground storage of natural gas in Nigeria.	NNPC, NLNG	DPR, MPROPS	FGN (NNPC, NLNG), OPS	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(v) Providing incentives to encourage industrial and domestic consumers to use gas or to convert to gas.	(a) Developing and reviewing price incentives to encourage industrial and domestic consumers to convert to gas usage.	NNPC, MPR	DPR, OPS, FMIT&I, MAN, SON, PPPRA, NIPC	FGN (NNPC, MPR), OPS	*	*	*
	(b) Providing incentives for the manufacture and distribution of gas-based end-use appliances.	NNPC, MPR	DPR, OPS, NIPC, FMIT&I, MAN, SON	FGN (NNPC, MPR), OPS	*	*	*
	(c) Enforcing regulations on retail outlets and marketing service obligations.	DPR, Weight & Measure	MPR, OPS, FMT&I, MAN, SON, NNPC, PPPRA, NLNG	FGN (DPR, FMIT&I), OPS	*	*	*
(vi) Providing incentives to encourage the introduction and use of LPG appliances in the areas not accessible to natural gas so as to encourage consumer preference for gas.	(a) Reactivating the existing butanization programme of the NNPC.	NNPC	DPR, MPR, OPS	FGN (NNPC), OPS	*	*	
	(b) Providing incentives for the manufacture and distribution of LPG end-use appliances.	NNPC, MPR	DPR, MPR, OPS, FMT, SON, FMF	FGN (NNPC, MPR), OPS	*	*	*
	(c) Intensify public awareness to encourage consumers' preference for LPG.	NNPC	DPR, MPR, OPS, FMIT&I, MAN, SON, PPPRA	FGN (NNPC), OPS	*	*	*
(vii) Establishing suitable infrastructure for the export of natural gas.	(a) Ensuring speedy completion of the ongoing LNG and West African Gas Pipeline projects.	NNPC, WAPCO	DPR, MPR, OPS, DPs, NLNG	FGN (NNPC), OPS	*	*	
	(b) Establishing other suitable infrastructure for the export of natural gas.	NNPC	MPR, OPS, DPR, DPs, NLNG	FGN (NNPC), OPS	*	*	
	(c) Building indigenous capacity to enhance export of Natural Gas.	NNPC, PTDF	MPR, OPS, DPR, DPs	FGN (NNPC, PTDF), OPS	*	*	*
(viii) Expanding and promoting gas related R&D outfits in the country.	(a) Instituting more professorial chairs for natural gas R & D in Nigerian universities.	PTDF	OPS, FMEd, DPs, TIs	FGN (PTDF), OPS	*	*	*
	(b) Identifying and focusing gas-based R&D priorities.	PTDF	MPR, DPR, NNPC, RIs, ECN	FGN (PTDF)	*	*	*
	(c) Establishing gas research centres in the country.	PTDF	FMEd, ECN, DPR, NNPC	FGN (PTDF)	*	*	*
	(d) Undertaking periodic reviews of the manpower requirements in the gas industry.	PTDF, MPR	DPR, NNPC, ECN	FGN (PTDF, MPR)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(ix) Formulating suitable urban and regional planning regulations needed for the effective distribution of natural gas to, and its utilization by, domestic and industrial consumers.	(a) Reviewing existing urban and regional planning regulations with a view to incorporating gas utilization infrastructure.	FMLH&UD, FCDA, SGs	COREN, NSE, TOPREC, NITP, NIA, ARCON, NNPC, DPR, MPR, OPS	FGN (FMLH&UD), SGs	*	*	*
	(b) Developing incentives for estate developers to incorporate gas-consuming facilities into their new estates.	FMLH&UD	SGs, COREN, NSE, TOPREC, NITP, NIA, ARCON, NNPC, DPR, MPR, OPS	FGN (FMLH&UD), SGs	*	*	*
	(c) Developing and enforcing National Gas Safety Codes and Standards.	SON, DPR	FMLH&UD, FMIT&I,MPR	FGN (SON, MPR)	*	*	*
	(d) Sensitizing industrial and domestic end-users on safe utilization of gas.	FMIT&I, NOA	SGs, LGCs, NGOs, CBOs, DPs, SON, DPR, Community Leaders, NESREA	FGN (FMIT&I, NOA, MPR)	*	*	*
(x) Providing necessary incentives to indigenous and foreign entrepreneurs to facilitate their participation in the gas industry.	(a) Developing appropriate incentives to attract Foreign Direct Investment in the gas industry.	DPR, MPR	NNPC, MPR, FMF, OPS, FMIT&I	FGN (MPR, DPR)	*	*	*
	(b) Investing in gas delivery infrastructure.	NNPC	DPR, MPR, OPS	FGN (NNPC), OPS	*	*	*
	(c) Providing necessary security to natural gas infrastructure.	MPR	NNPC, DPR, MPR, OPS, MoD	FGN (MPR)	*	*	*
(xi) Ensuring that the price of natural gas is cost effective.	(a) Periodic review of Natural Gas price regime.	MPR	NNPC, MPR, DPR, OPS, UCC,PPPRA	FGN (MPR)	*	*	*
	(b) Maintaining database on the supply and demand of natural gas.	DPR	MPR, NNPC, PPPRA, ECN	FGN (MPR, DPR)	*	*	*
(xii) Developing gas reserves in all parts of the country.	(a) Establishing natural gas storage facilities across the six geopolitical zones of the country.	NNPC	MPR, DPR, NLNG	FGN (NNPC)	*	*	*
	(b) Ensuring that the strategic reserve storage facility is operational at all times.	NNPC	MPR, DPR	FGN (NNPC)	*	*	*
	(c) Fast-tracking the establishment of mini-gas production plants by NNPC and JV partners.	NNPC	DPR, MPR, OPS	FGN (NNPC), OPS	*	*	*
	(d) Encouraging increased private sector participation in the establishment of natural gas depots.	DPR	NNPC, MPR, OPS	FGN (DPR), OPS	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(xiii) Implementing suitable urban and regional planning regulations needed for the effective distribution of natural gas to, and its utilization by, domestic and industrial consumers.	(a) Reviewing existing urban and regional planning regulations with a view to incorporating gas utilization infrastructure.	FMLH&UD, FCDA, SGs	COREN, NSE, TOPREC, NITP, NIA, ARCON, NNPC, DPR, MPR, OPS	FGN (DPR), OPS	*	*	*
	(b) Developing incentives for estate developers to incorporate gas-consuming facilities into their new estates.	FMLH&UD	SGs, COREN, NSE, TOPREC, NITP, NIA, ARCON, NNPC, DPR, MPR, OPS	FGN (DPR), OPS	*	*	*
	(c) Developing and enforcing National Gas Safety Codes and Standards.	SON, DPR	FMLH&UD, DPR, Relevant Professional Associations	FGN (DPR), OPS	*	*	*
	(d) Sensitizing industrial and domestic end-users on safe utilization of gas.	FMIT&I, NOA	SGs, LGCs, NGOs, CBOs, DPs, SON, DPR, Community Leaders, NESREA	FGN (DPR), OPS	*	*	*
	(e) Monitoring transportation rates charged by natural gas distribution companies to prevent profiteering.	MPR, DPR	SGs, LGCs, NGOs, CBOs, DPs, SON, Community Leaders, NNPC	FGN (MPR, DPR), OPS	*	*	*

3.3 SHALE HYDROCARBON

3.3.1 Policies

i. The nation shall encourage co-ordinated baseline studies and research on shale hydrocarbon resources.

ii. The nation shall put in place the mechanism for development of appropriate legal, fiscal, environmental and other regulations for the guidance and operation of the shale gas/oil industry.

iii. The nation shall encourage indigenous and foreign companies to participate in exploration and exploitation of shale oil/gas when the necessary laws and regulations have been put in place.

3.3.2 Objectives

i. To encourage geological studies of Nigerian sedimentary basins for shale hydrocarbon resources.

ii. To increase the national oil and gas reserves base and production capacity.

iii. To expand the national energy mix.

iv. To put in place the appropriate regulatory framework for safe and orderly operation of shale gas/oil industry in accordance with global best practices.

v. To encourage technology acquisition and capacity development for local content value addition.

vi. To gather relevant information on shale gas/oil prospectively in all sedimentary basins in the country.

3.2.3 Action Plan

Table 3.3: Shale Hydrocarbon Development Action Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Encouraging and promoting research and development by both public and private institutions for focused studies and geological mapping of shale gas/oil–rich zones in all the sedimentary basins.	(a) Identifying R & D priorities that will fast-track local content development.	DPR, RCs, RIs, PTDF	NUC, NNPC, FMST, OPS, ECN	FGN (PTDF)	*	*	*
	(b) Developing linkages with international institutions for R&D purposes.	MPR, FMST, RCs, RIs, TIs, PTDF	FMEd., ECN, NNPC, MFA, DPs	FGN (PTDF), OPS	*	*	*
	(c) Incorporating shale hydrocarbon research activities into the activities of the existing petroleum research centres.	PTDF	FMEd., ECN, NNPC, MFA, DPs, MPR, FMST, RCs, RIs, TIs	FGN (PTDF)	*	*	
	(d) Carrying out feasibility studies on the potential of shale oil and gas in the country.	RCs, RIs, MPR	NUC, NNPC, PTDF, FMST, OPS, ECN, DPR	FGN (MPR, DPR)	*	*	*
(ii) Setting in motion appropriate legal and regulatory framework for creating enabling environment for exploration and exploitation of shale hydrocarbons in line with international best practices.	(a) Developing and enacting appropriate law for the exploration of shale oil and gas resources.	NASS, MPR	MPR, ECN, FMJ	FGN (MPR)	*	*	
	(b) Developing comprehensive database on shale oil and gas resources.	DPR, PTDF	MPR, ECN, OPS	FGN (MPR, DPR, PTDF,)	*	*	
	(c) Undertaking periodic evaluation of the producing reservoirs, and prescribe optimal exploration and production strategies.	DPR	MPR, NNPC, OPS	FGN(MPR, DPR)	*	*	*
	(d) Establishing and maintaining comprehensive geological and seismic survey programme.	DPR, NGSA	MPR, NNPC, NBS, MMSD	FGN (MPR, MMSD, DPR, NGSA)	*	*	
	(e) Undertaking periodic reviews of the manpower requirements in the shale oil and gas industry.	PTDF, MPR	FMEd., ECN, NNPC, MFA, DPs, DPR, FMST, RCs, RIs, TIs	FGN (MPR, PTDF)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(iii) Ensuring land reclamation and zero environmental degradation, including pollution of ground-water resources from chemicals or other materials utilized in shale oil/gas production.	(a) Ensuring continuous Environmental Impact Audit of all shale oil and gas projects.	FMEnv.	OPS, NNPC, OPS, NDDC, NOSDRA, NESREA	FGN (FMEnv.)	*	*	*
	(b) Ensuring implementation of the reviewed laws.	DPR	MPR, NNPC, FMJ	FGN (MPR, DPR)	*	*	*
(iv) Delimiting, charting and leasing prospective blocks of sedimentary basins for shale oil and gas exploration and exploitation by indigenous and foreign entrepreneurs as well as the national oil petroleum corporation.	(a) Encouraging exploration and exploitation of shale oil and gas resource base in the country.	MPR	DPR, NNPC	FGN (MPR)	*	*	*
(v) Making adequate provision to improve the living standards of people in shale gas/oil producing areas through provision of appropriate socio-economic infrastructure and other amenities.	(a) Provision of adequate socio-economic infrastructure (e.g. schools, motorable roads, health facilities, energy and water services, etc.) in the producing communities.	MPR, SGs, OPS	DPR, LGCs, NNPC	FGN (MPR, SGs), OPS	*	*	*
	(b) Sensitizing and creating awareness on the benefits of shale oil and gas.	MPR, PTDF	NNPC, DPR, PPPRA, NOA	FGN (MPR, PTDF)	*	*	*
(vi) Leasing prospective blocks of sedimentary basins for shale gas exploration and exploitation by indigenous and foreign entrepreneurs as well as the national oil petroleum corporation.	(a) Opening up of blocks for bidding.	MPR	NNPC, OPS,DPR	FGN (MPR)	*	*	*
	(b) Adhering to the Local Content Principle in the allocation/bidding for oil blocks.	DPR, NCDMB	MPR, NNPC	FGN (MPR, DPR, NCDMB)	*	*	*
	(c) Introducing venture capital to finance emerging opportunities in the oil and gas sector.	FMF	OPS, SEC, NNPC, IOCs, IOPs, MPR, NIPC	FGN(FMF), OPS	*	*	*
(vii) Encouraging domestication of the technology for production, processing and utilization of shale hydrocarbon resources.	(a) Encouraging investors to establish heavy oil upgrading facilities within their blocks of interest.	DPR	MPR , NNPC	FGN (MPR, DPR), OPS	*	*	*
	(b) Ensuring technology acquisition and adoption to fast-track local content development.	NOTAP	DPR, PTDF, NCDMB, FMST	FGN (NCDMB, PTDF, NOTAP), OPS	*	*	*

CHAPTER FOUR

COAL AND TAR SANDS/BITUMEN

4.0 Intoduction

Tar Sands/Bitumen

Nigerian Tar Sands deposits are estimated to contain a total reserve of about 30 billion barrels of oil equivalent. When exploitation commences, the heavy crude from the tar sands among others will serve as feedstock for the Lube Plants of the heavy-end refinery.

Bitumen, which is derived from tar sands, is used in road construction and it is also used in electrical, chemical, petrochemical and other industries.

If properly harnessed, the tar sand resources in the country would contribute immensely to the nation's energy resource base. In its drive to open up the tar sands sub-sector, government has set up the Bitumen Implementation Committee to facilitate private sector participation.

Coal

Available data show that coal of sub-bituminous grade occurs in about 22 coal fields spread in over 13 States of the Federation. The proven coal reserves so far in the country are about 639 million tonnes while the inferred reserves are about 2.75 billion tonnes.

Coal mining in Nigeria started in 1906 and recorded an output of 24,500 tons in 1916. Production rose to a peak of 905,000 tonnes in 1958/59 with a contribution of over 70% to commercial energy consumption in the country. Following the discovery of crude oil in commercial quantities in 1958 and the conversion of railway engines from coal to diesel, production of coal fell from the beginning of the sixties to only 52,700 tonnes in 1983. This excludes the civil war years and the period of 1970 and 1971 during the reconstruction years, when there was little or no production. Production rose to about 14,390 tonnes in 2000. In 2001, coal contributed about 0.02% to commercial energy consumption in the country, as compared to 31.9% for oil, 61.9% for natural gas and about 6.2% for hydropower.

Nigeria's coal can be utilized for power generation, steam production, cement production and brick making. It is also applicable as a heat source, reducing agent for steel production, domestic fuel, and as feedstock for the production of chemicals. Other areas of application are as liquid fuels, gaseous fuels, in batteries, carbon electrodes, etc. These potentials of coal need to be effectively

harnessed into the country's energy delivery system and export commodity mix through the development of a vibrant coal industry.

From the onset of coal exploration and exploitation in Nigeria, the Nigerian Coal Corporation had been the only institution operating in the coal industry. In 1990, the Federal Government approved the full commercialization of the Corporation, which led to joint venture arrangements with foreign partners for the exploitation of some of the coal deposits. However, with the country's return to democracy in 1999, government has initiated a reform in the mineral sector which has transformed the nature of her participation from Owner-Operator to Administrator-Regulator. However, there is still the need for increased private sector participation in the activities of the coal industry.

The nation's coal industry faces some daunting challenges, which need to be addressed if the potential for coal resource is to be optimally exploited. These include creating and finding markets for the coal, increasing the productivity of the coal mines, reducing cost of production through mechanization and establishing a cost-effective transportation system through an expansion of the rail system and port facilities for the export of coal.

4.1 TAR SANDS/BITUMEN

4.1.1 Policies

i. The nation shall encourage tar sands/bitumen exploration, exploitation.

ii. The nation shall actively promote private sector as well as local content input through small scale ventures in theexploitation of the tar sands/bitumen resources..

iii. The nation shall encourage the adoption of environmentally friendly approach for exploration and exploitation of Tar sands.

4.1.2 Objectives

i. To extract heavy oil from the tar sands for refineries.

ii. To conserve foreign exchange used in importing heavy crude oil and also produce heavy crude for export.

iii. To acquire the technology for developing and harnessing the tar sands/bitumen.

iv. To ensure adequate financing, efficient operation and management of the sub-sector.

v. To encourage the local content input in the sub-sector from the early stages of its development.

vi. To minimize adverse environmental impacts associated with Tar Sands/Bitumen exploration.

4.1.3 Action Plan

Table 4.1: Tar Sands/Bitumen Development Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Undertaking detailed geological exploration activities for tar sands/bitumen deposits in the country.	(a) Authenticating existing information on tar sands/bitumen deposits through detailed geological programme.	NGSA	MMSD	FGN (MMSD)	*	*	
	(b) Concessioning of the tar sands/bitumen deposits into blocks and calling for bids.	BPIC	NGSA, MMSD	FGN (BPIC)	*	*	*
	(c) Evaluating and monitoring of exploration programs as spelt out in investor's work program during bid submission.	BPIC	NGSA, MMSD, OPS, NASRDA	FGN (BPIC)	*	*	*
	(d) Ensuring adequate compensations are paid to land/farm owners by investors.	BPIC	MMSD, FMJ, FMLH&UD, SGs, LGCs, CBOs	FGN (BPIC), OPS	*	*	*
	(e) Ensuring appropriate resettlement of the affected communities.	BPIC	MMSD, FMJ, FMLH&UD, SGs, LGCs, CBOs	FGN (BPIC), OPS	*	*	*
	(f) Ensuring exploitation method is most environmentally friendly.	FMEnv.	BPIC, FMA&RD, NASRDA, FMEnv.	FGN (FMEnv.)	*	*	*
	(g) Ensuring that excavated lands are restored.	FMLH&UD, FMEnv.	MMSD, BPIC, FMA&RD, OPS	FGN (BPIC)	*	*	*
(ii) Providing appropriate incentives to facilitate investment in the exploration and exploitation of tar sands/bitumen resources.	(a) Providing adequate fiscal incentives (such as tax holidays, profit repatriation, deduction before taxes, etc.).	BPIC, MMSD	FMF, NGSA, MMSD, OPS, NASS, FMJ	FGN (BPIC)	*	*	*
	(b) Establishing Bitumen Project Implementation Committee (BPIC) as a legal entity	BPIC, MMSD	FMF, NGSA, MMSD, OPS, NASS, FMJ	FGN (BPIC)	*	*	*
(iii) Establishing an appropriate regulatory framework for the tar sands/bitumen sub-sector.	(a) Empowering BPIC as the regulatory body for the bitumen sub-sector.	MMSD	NASS, FMJ, FMLH&UD	FGN (MMSD)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(iv) Providing an appropriate financing facility to support indigenenous investments in tar sand/bitumen development.	(a) Developing appropriate strategies to encourage financial institutions to support investors in the sector.	CBN	MMSD, FMF, BPIC, NGSA, OPS, BOI, NRDF	FGN (CBN, BOI)	*	*	*
	(b) Establishing a specialised funding window for the mining sector	CBN	MMSD, FMF, BPIC, NGSA, OPS, BOI, NRDF	FGN (CBN, BOI)	*	*	*
(v) De- emphasizing the importation of heavy crude oil as a way of encouraging the utilization of heavy oils from tar sands.	(a) Fast tracking development of the bitumen project.	BPIC	MMSD, NGSA, OPS	FGN (BPIC)	*	*	
	(b) Ensuring complete utilization of the heavy oil from the tar sands/bitumen as feedstock to local refineries.	BPIC	DPR, NNPC, OPS	FGN (BPIC), OPS	*	*	*
(vi) Establishing heavy oil upgrading facilities near the tar sands/bitumen deposits.	(a) Encouraging investors to establish heavy oil upgrading facilities within their blocks of interest.	BPIC	MMSD, OPS, NGSA	FGN (BPIC), OPS	*	*	*
	(b) Providing enabling environment for laying pipeline network to convey upgraded bitumen to refineries.	BPIC	DPR, MMSD, OPS, FMLH&UD, NASRDA	FGN (BPIC)	*	*	*
(vii) Intensifying R&D in the production of lubricants and other heavy oil products from tar sands/bitumen.	(a) Developing incentives to encourage significant contribution from the private investors in funding research and development on processing and upgrading tar sands/bitumen resources.	BPIC	MMSD, OPS, FMF FMIT&I	FGN (BPIC)	*	*	*
	(b) Funding research on bitumen technology.	PTDF	NGSA, BPIC, FMST, MMSD, FMEd.	FGN (PTDF)	*	*	*
(viii) Establishing infrastructural facilities for the acquisition of the technology for harnessing tar sands/bitumen.	(a) Ensuring the provision of basic physical infrastructural facilities (such as field operational base, stores, laboratories, etc.)	MMSD	NGSA, OPS, BPIC	FGN (MMSD)	*	*	*
	(b) Establishing linkages with relevant tertiary and vocational educational institutions for human resource development in tars sands technology.	BPIC	MMSD, TIs, OPS	FGN (BPIC), OPS	*	*	*

4.2 COAL

4.2.1 Policies

i. The nation shall pursue vigorously a comprehensive programme of resuscitation of the coal industry.

ii. The nation shall carry out extensive exploration activities to maintain a high level of coal reserves.

iii. The nation shall actively promote private sector as well as local content input in the coal industry.

iv. The nation's exploitation and utilization of the coal shall be in line with global best practices.

v. The nation shall explore the techno-economic feasibility of new coal technology such as coal gasification and coal-to-liquid conversion.

vi. The nation shall ensure adequate supply of coal to meet the energy requirements of the country in a cost effective and sustainable manner.

4.2.2 Objectives

i. To promote production of coal to meet domestic needs and for export

ii. To promote effective utilization of coal for complementing the nation's energy needs and as industrial feedstock.

iii. To attract increased investment into, and promote local content input, in the industry.

iv. To utilize coal in the form of coal briquette

v. To increase the contribution of coal by 30% to the national energy mix by 2020.

vi. To minimize environmental pollution arising from the utilization of coal.

vii. To support increased environmental monitoring, including air quality monitoring for existing and/or proposed mines and power stations in the country.

viii. To establish an emissions performance standard that will guide the construction of coal-fired power station in the country.

4.2.3 Action Plan

Table 4.2: Coal Development Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Intensifying the drive for coal exploration and production activities.	(a)Authenticating existing information on coal deposits through detailed geological programme.	NGSA	MMSD	FGN (MMSD)	*	*	*
	(b) Completing the privatization of the coal sector.	BPE	MMSD, NGSA, FMJ, NCC, BPIC	FGN (BPE)	*	*	*
	(c) Creating awareness both locally and internationally on the potentials of the Nigerian coals for energy generation.	NCC	MMSD, NGSA, MFA, FMIT&I	FGN (NCC)	*	*	*
	(d) Continuing the exploration and concessioning of the coal deposits for open competitive bidding to investors.	NCC	NGSA, BPE, MMSD, FMJ, NSRMEA	FGN (NCC)	*	*	*
(ii) Providing adequate incentives to indigenous and foreign entrepreneurs so as to attract investments in coal exploration and production.	(a) Ensuring compliance with the provisions of the Mining Act and Regulations.	MMSD	MMSD, NCC, NGSA, FMJ	FGN (NASS)	*	*	*
	(b) Ensuring openness and transparency in acquisition of mining titles.	MCO	MMSD, NGSA	FGN (NCC)	*	*	*
	(c) Developing adequate incentives to cater for pre- and post- exploration periods (e.g. tax holidays, etc).	NCC	NGSA, FMIT&I, OPS	FGN (NCC)	*	*	*
	(d) Ensuring adequate stakeholder participation of the host communities.	NCC	MMSD, NGSA, OPS, Host Communities, SGs, LGCs	FGN (FCC), SGs, LGCs, OPS	*	*	*
	(e) Ensuring that the Nigerian Geological Survey Agency acquires and provides up-to-date and quality geoscience data.	NGSA	NCC, MMSD, RCs, RIs, TIs, NASRDA	FGN (NGSA)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(iii) Organizing awareness programmes for the use of smokeless coal briquettes as an alternative to fuelwood.	(a) Organizing sensitization end-user workshop on the use of coal briquettes.	ECN	FMIT&I, OPS, NGOs, CBOs, FMWA&SD, FME, FMI, MM&SD	FGN (ECN)	*	*	*
(iv) Providing adequate incentives for large-scale production of coal stoves at affordable prices.	(a) Quantifying and characterizing of Nigeria's coal deposits.	NGSA	NCC, MMSD, RCs, RIs, TIs	FGN (NGSA)	*	*	*
	(b) Encouraging tertiary institutions and research institutes & centres to carry out research into coal briquetting & coal stove technology.	NMDC	MMSD, RCs, RIs, TIs, OPS	FGN (NGSA)	*	*	*
	(c) Identifying and establishing a coal briquetting plant for mass production of coal briquettes.	NCC	NGSA, MMSD, RCs, RIs, TIs, OPS	FGN (NCC)	*	*	
	(d) Organizing a national programme for selecting efficient coal briquette burning stoves for adoption as national models for mass production.	ECN, NCC	NCC, NGSA, MMSD, RCs, RIs, TIs, OPS	FGN (ECN)	*	*	*
(v) Providing adequate incentives to indigenous and foreign entrepreneurs for establishment of coal-based industries.	(a) Revamping ailing cement factories and the Ajaokuta steel plant by granting incentives such as capital subsidies, preferential loans and tax privileges.	FMIT&I, MPR	CBN, MMSD, NGSA, OPS, FMF, FMIT&I, NIPC, OPS	FGN (FMIT&I, MPR), OPS	*	*	*
	(b) Developing investor-friendly legal framework for setting up new coal-based industries.	NCC	FMJ, MMSD, NGSA, FMIT&I, NIPC	FGN (NCC)	*	*	
(vi) Encouraging R & D in the production, processing and utilization of coal	(a) Embarking on R & D activities in coal production, processing and utilization.	NCC	FCC, FMST, ECN, NGSA, MMSD, FMEd., RCs, RIs, TIs	FGN (ECN, MMSD)	*	*	*
	(b) Establishing programmes for training of middle level manpower for the coal industry in Polytechnics, Technical Colleges and Vocational Schools. .	MMSD, FMEd.	NGSA, ECN, NCC, NBTE	FGN (FMEd., MMSD)	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(vii) Developing adequate infrastructure for handling and transportation of coal within and out of the country.	(a) Continuing the on-going revamping and modernization of the nation's railway system.	NRC	FMT, FMLH&UD, SGs, NASRDA	FGN (NRC)	*	*	*
	(b) Continuing the on-going dredging of the inland.	FMT, NIWA	SEPA, FMLH&UD, OPS, DPs	FGN (NRC)	*	*	*
	(c) Reactivating the NCC coal washing plant at Ogbete.	NCC	MMSD, OPS, FMIT&I	FGN (NCC)	*	*	*
(viii) Undertaking more detailed geological exploration for coal deposits in the country.	(a) Concessioning of the coal deposits and calling for bids.	NCC, BPE	NGSA, MMSD	FGN (NCC)	*	*	
	(b) Evaluating and monitoring of exploration programs as spelt out in investor's work program during bid submission.	NCC	NGSA, MMSD, OPS, NASRDA	FGN (NCC)	*	*	
	(c) Ensuring adequate compensations are paid to land/farm owners by investors.	NCC, MMSD	MMSD, FMJ, FMLH&UD, SGs, LGCs, Community Leaders	FGN (NCC), OPS	*	*	
	(d) Ensuring appropriate resettlement of the affected communities.	NCC	MMSD, FMJ, FMLH&UD, SGs, LGCs, CBOs,	FGN (NCC), OPS	*	*	
	(e) Ensuring exploitation method is most environmentally friendly.	FMEnv., MMSD	NCC, FMA&RD, NASRDA	FGN (FMEnv.)	*	*	
	(f) Ensuring that excavated lands are restored.	FMEnv., FMLH&UD	MMSD, BPIC, FMA&RD, OPS	FGN (NCC, FMLH&UD)	*	*	
(ix) Introducing clean coal technologies into coal utilization.	(a) Establishing linkages between existing institutions and relevant foreign centres of excellence in clean coal technologies.	ECN	FMEd., FMST	FGN (ECN)	*	*	*
(x) Re-introducing the use of coal for power generation.	(a) Reactivating Oji River coal fired power plant .	FMP	NERC, REA, IPP, NCC, SEPA, MMSD	FGN (FMP)	*	*	
	(b) Continuing the on-going drive for establishing coal-fired power plants.	FMP	NERC, REA, IPP, NCC, MMSD, SEPA, FMIT&I, NIPC	FGN (FMP)	*	*	

CHAPTER FIVE

NUCLEAR ENERGY

5.0 Introduction

Nuclear energy has been and continues to be a very attractive option in the socio-economic development of nations because of the positive role it plays in electric power generation, food and agriculture, animal production, water supply, health care delivery, petroleum exploration, solid mineral exploration and environmental protection.

In this regard, Nigeria took the first step in 1976 through the creation of the Nigeria Atomic Energy Commission (NAEC) by Act 46 as a specialised agency to promote and streamline the implementation of nuclear energy in the country. However, NAEC was not activated and inaugurated until 2006. In 1976, two nuclear research centres, namely, Centre for Energy Research and Training (CERT) and Centre for Energy Research and Development (CERD) were established in Zaria and Ile-Ife respectively. The Energy Commission of Nigeria (ECN) was also established, by Act 62 of 1979 as amended by Act 32 of 1988 and Act 19 of 1989, with the statutory mandate for the strategic planning and co-ordination of National Energy Policies in all its ramifications. The two university-based research centres at Zaria and Ile-Ife were later brought under the supervision of the ECN. Furthermore, the Sheda Science and Technology Complex (SHESTCO) Abuja, was established in 1991, with the mandate to, among others, conduct research for the development of nuclear energy. The Nigerian Nuclear Regulatory Authority (NNRA) was established by Act 19 of 1995 and inaugurated in 2001.

these research centres maintain various nuclear research and development facilities including neutron generators, isotopic neutron sources, X-ray Fluorescence facilities, a neutron source reactor, a gamma irradiation facility and a linear accelerator (under construction). These facilities have impacted positively on the socio-economic development of the nation and contributed significantly in creating and promoting awareness in the peaceful uses of nuclear energy in the country.

The current installed electricity grid capacity is about 6,000 MWe with a maximum output of about 4,000 MWe , with a mix of 36% hydro and 64% thermal. Government is currently investing heavily in expanding the generation capacity and is encouraging investments in power generation through joint ventures and IPPs, which is projected to be 28,261 MWe by 2020, but subject to the completion of the IPPs, high water level in the hydro dams and less activities of gas pipelines vandalisation.

Studies on electricity demand, especially by the ECN, have shown that even with the on-going efforts of expanding generation and grid capacity, it , will not be able to meet the requirements of the projected growth rate in the country for attaining the Millennium Development Goals (MDGs) by 2020. Indeed, a shortfall of between 9,000 – 17,000 MWe will be recorded between 2010 and 2015 based on current energy usage and the projected growth rate in industrial development and the population. The projected peak national energy demand is put at between 28,000 – 31,000 MWe by 2015. Revised demand projections by the ECN using MAED Model indicated that the growth rate of 10% annual GDP is required to meet the MDGs. Nigeria's peak demand will be in the range of 175,000 – 192,000 MW by 2030.

At present, nuclear energy resources are not being used for electricity generation in Nigeria. However, an Inter-Ministerial Committee on energy resources in Nigeria set up in April 2004 by Government concluded that nuclear power should be introduced into the national electric power generation mix. ECN supply studies using MESSAGE Model for the contribution of nuclear energy to the national electricity grid is projected to start with 1000MWe by 2025 and to be increased within an interval of five years to 4000MWe by 2030

Notable progress has also been made in the Nigeria NPP especially, the attainment of IAEA Milestone 1 in 2009, conducting of preliminary site selection and the signing and ratification of two agreements by the Nigeria Federal Government with the Russian Federation for Cooperation in the development of nuclear energy for peaceful purposes in 2007.

However, the successful introduction of nuclear power technology that will allow the spin-offs from such technology to be efficiently maximized demands a critical mass of professionals in the various fields of nuclear science and technology. Although an initial pool of nuclear scientists and engineers exist in the country, there are currently not enough professionals in these fields. In order to achieve the required critical mass of professionals, the current effort must be intensified.. Additionally, necessary incentive should be put in place to retain and attract nuclear science and technology professionals.

It is also important to strengthen and increase the requisite infrastructure for research and manpower development. In fact, the first step towards the use of nuclear energy for power generation entails operating nuclear research reactors and other ancillary facilities to gain mastery of the requisite technology. Currently, there are limited research activities in some areas of nuclear science and technology at CERT-ABU, Zaria; CERD-OAU, Ile-Ife; and SHESTCO, Abuja. These

must be coordinated and further developed and strengthened to facilitate the attainment of government directive on electricity generation from nuclear power technology by 2025.

Other issues that must be addressed, among others, include public concerns, regulatory environment, and international cooperation. Adequate government funding and private sector investment are requisite to translating pertinent government directives into tangible results.

5.1 NUCLEAR ENERGY

5.1.1 Policies

i. The nation shall promote the development of nuclear energy, and undertake all activities related to peaceful uses of nuclear energy in its entire ramification.

ii. The nation shall pay adequate attention to safety, security and safeguard issues in the pursuit and operation of its nuclear programmes.

iii. The nation shall strengthen all institutional and legal/legislative frameworks, and ensure their operations.

iv. The nation shall encourage and fund the development of the requisite manpower, and provide the enabling environment for the acquisition of competencies and skills needed for the design, construction and operation of the nation's nuclear facilities.

v. The nation shall support research and infrastructural development necessary to enable rapid domestication, and encourage intellectual property right.

vi. The nation shall cooperate with the International Atomic Energy Agency and other international organizations involved in the peaceful use of nuclear energy.

vii. The nation shall ensure that storage and disposal of nuclear waste is done in an environmentally friendly and sustainable manner.

5.1.2 Objectives

i. To promote nuclear energy, as an important electricity component in the nation's energy mix.

ii. To promote the development and application of nuclear science and technology in industry, agriculture, medicine and water resources management, as well as other socio-economic aspects.

iii. To pursue the exploration of nuclear mineral resources in the country.

iv. To develop national capability in the deployment of nuclear energy to all areas of socio-economic development of Nigeria and ensure that spin-off benefits are derived within the shortest possible time.

v. To design and implement the strategy for the integration of nuclear energy into Nigeria's programme of accelerated development as contained in the approved nuclear power roadmap.

vi. To institute the necessary nuclear safety, security and safeguard in the exploitation of nuclear energy.

vii. To promote the development of appropriate framework necessary to ensure adequate environmental protection and minimize adverse environmental impacts associated with nuclear materials.

viii. To promote the development of appropriate framework necessary to attain self-reliance in nuclear matters in the long term.

ix. To ensure that adequate resources are made available for the provision of safe and sustainable management of spent fuel and radioactive waste.

x. To enhance commitment and speedy development of nuclear science and technology in the country.

xi. To ensure that all nuclear facilities are operated in transparent manner and in line with international best practices.

xii. To support all operational service delivery or for research to the extent that localization of all industrial/service operations are achieved.

5.1.3 Action Plan

Table 5.1: Nuclear Energy Development Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Strengthening the institutional framework for the operational and regulatory aspects of the nuclear industry.	(a) Reviewing the existing institutional framework with the view to harmonizing and strengthening them.	FMST, OSGF, MPR	ECN, NAEC, NNRA, SHESTCO, FMEd., NASENI, CERT, CERD	FGN (FMST)	*	*	*
	(b) Assessing and upgrading the existing nuclear facilities.	NAEC	ECN, CERT, CERD, NNRA, SHESTCO	FGN (NAEC)	*	*	*
	(c) Evaluating the level of implementation of the nuclear energy development plan.	ECN	NAEC, NNRA, SHESTCO, FMST, NASENI, CERT, CERD	FGN (ECN)	*	*	*
(ii) Developing all necessary legal/legislative frameworks necessary for the smooth operation of nuclear facilities.	(a) Reviewing the existing legal/legislative framework.	NNRA	ECN, NAEC, FMST, NASS, FMEnv., NESREA, FMJ	FGN (NNRA)	*	*	*
	(b) Domesticating relevant international laws and treaties.	NNRA	FMJ, MFA, NASS NAEC, ECN, FMP, MPR	FGN (NNRA)	*	*	*
(iii) Developing national capacity in all areas related to the use of nuclear energy and attaining self-sufficiency in human capacity development.	(a) Conducting a survey of the available research and technical manpower in the country.	NAEC, ECN	CERT, NUC, CERD, SHESTCO, NASENI, NBTE, NNRA, NCCE	FGN (NAEC, ECN)	*	*	*
	(b) Reviewing periodically the nation's nuclear energy manpower development plan.	NAEC, ECN	FMST, NERC, NAEC, NNRA, SHESTCO, NASENI, CERT, CERD	FGN (ECN)	*	*	*
	(c) Developing appropriate framework to attain self-reliance in nuclear energy activities.	NAEC, ECN	FMST, NNRA, CERT, CERD, SHESTCO	FGN (NAEC, ECN)	*	*	*
	(d) Assessing the manpower requirement for nuclear electricity generation.	NAEC	ECN, NNRA, FMP, SHESTCO, CERT, CERD	FGN (NAEC)	*	*	*
	(e) Developing and implementing structured training programmes.	NAEC	CERT, CERD, NNRA, SHESTCO, NASENI, NUC, NBTE, NCCE, DPs	FGN (NAEC)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(iv) Carrying out research into all areas of peaceful uses of nuclear energy.	(a) Maintaining and upgrading existing R & D facilities.	NAEC	NNRA, ECN, SHESTCO, CERT, CERD, NIRPR, FMA&RD, DPs	FGN (NAEC)	*	*	*
	(b) Assessing the manpower requirement for adequate research and training efforts in nuclear science and technology.	NAEC	NNRA, ECN, SHESTCO, CERT, CERD, NIRPR, FMA&RD, DPs	FGN (NAEC)	*	*	*
	(c) Encouraging collaboration among nuclear research centres and industries.	FMST & NAEC	ECN, OPS, SHESTCO, CERT, CERD, FMA&RD, DPs, DPR, PTDF	FGN (FMST)	*	*	*
	(d) Encouraging the establishment of professorial chairs in nuclear science and technology at universities and research centres.	NAEC	ECN, SHESTCO, CERT, CERD, FMA&RD, DPs, DPR, PTDF, OPS	FGN (NAEC)	*	*	*
(v) Ensuring that adequate sites are made available for the construction of nuclear facilities.	(a) Identifying and selecting suitable sites for the construction of nuclear facilities.	NAEC	NNRA, ECN, NGSA, NESREA, FME, FMST, FMWR, OSGF FMLH&UD, SGs, LGCs, Community Leaders	FGN (NAEC)	*	*	*
	(b) Ensuring appropriate resettlement plans are put in place for affected communities.	NAEC	MMSD, FMJ, FMLH&UD, SGs, LGCs, Community Leaders	FGN (NAEC)	*	*	*
(vi) Instituting adequate measures to ensure safety, security and safeguards.	(a) Ensuring all nuclear materials and facilities are not used or diverted for other non-peaceful applications.	NNRA	NAEC, ECN, SHESTCO, DPR, FMH, CERT, CERD, NCS, NPF, DSS	FGN (NNRA)	*	*	*
	(b) Developing and implementing environmental radiation monitoring strategy for the whole country.	NNRA	NAEC, ECN, SHESTCO, DPR, FMH, CERT, CERD, NIRPR	FGN (NNRA)	*	*	*
	(c) Encouraging continuous training and retraining of radiation workers in all nuclear related establishments.	NNRA	NAEC, ECN, SHESTCO, DPR, FMH, CERT, CERD	FGN (NNRA)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(vii) Making arrangements with institutions or individuals in Nigeria for the conduct of research into all aspects of nuclear energy.	(a) Encouraging collaboration with the relevant institutions and individuals for the development of nuclear science and technology programmes in Nigeria.	NAEC	ECN, FMEnv., NNRA, CERT, CERD, SHESTCO, NASENI	FGN (NAEC)	*	*	*
	(b) Encouraging the optimal use of all nuclear science and technology facilities in solving problems in industry, agriculture, medicine and water resources management.	NAEC	ECN, SHESTCO, CERT, CERD, FMA&RD, DPs	FGN (NAEC)	*	*	*
(viii) Creating incentives for career progression in nuclear research, nuclear industry or areas of associated spin-off benefits.	(a) Ensuring that the conditions of service of personnel engaged in the development of nuclear science and technology is at par with international best practice.	NAEC	FMST, ECN, NSIWC, FMF, CERT, CERD, SHESTCO, NNRA	FGN (NAEC)	*	*	*
	(b) Providing internship job opportunities at research Centres and industries.	NAEC	FMST, ECN, NSWC, FMF, CERT, CERD, SHESTCO, NIRPR	FGN (NAEC)	*	*	*
	(c) Establishing fellowships and scholarship programmes in nuclear science and technology.	NAEC	FMST, ECN, NSWC, FMF, CERT, CERD, SHESTCO, NNRA	FGN (NAEC)	*	*	*
	(d) Establishing international linkages for research and training.	NAEC	ECN, MFA, DPs, FMST, CERT, CERD, NPC, NNRA, SHESTCO	FGN (NAEC)	*	*	*
	(e) Establishing a nuclear energy fund as a component of the national energy fund.	ECN	SHESTCO, NAEC, NNRA, CERD, NASS, CERT	FGN (ECN)	*	*	*
(ix)Developing appropriate framework and mechanism necessary for environmental protection and management of wastes and spent fuel.	(a) Providing radioactive waste management facilities.	NAEC	CERT, CERD, SHESTCO, ECN, NNRA, FMST	FGN (NAEC)	*	*	*
	(b) Undertaking regular review of all nuclear waste management laws and regulations.	NNRA	FMJ, NASS, ECN NAEC, NESREA	FGN (NNRA)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(x) Developing appropriate mechanism that will ensure adequate compensation for victims of nuclear accidents.	(a) Establishing a nuclear energy fund.	NAEC, NNRA	SHESTCO, NAEC, NNRA, CERD, NASS, CERT	FGN (ECN)	*	*	*
	(b) Undertaking regular review of compensation packages of all nuclear accidents.	NAEC	FMST, ECN, NSIWC, FMF, CERT, CERD, SHESTCO	FGN (NAEC)	*	*	*
	(c) Developing and implementing national policy on civil nuclear liability and damages.	NNRA, NAEC	FMJ, ECN, NAICOM	FGN (NNRA, NAEC)	*	*	*
(xi) Undertaking public outreach and enlightenment campaigns on the applications and benefits of the various nuclear application programmes, and how safety security and safeguards issues are being addressed.	(a) Organizing public awareness programs (such as seminars, workshops, lectures, etc.) on applications of nuclear technology, nuclear safety and radiation protection.	NAEC, ECN	NNRA, FMI, CERD, CERT, SHESTCO, FMH, NGOs, Community Leaders	FGN (NAEC, ECN)	*	*	*
(xii) Collaborating with the International Atomic Energy Agency (IAEA), other development partners and friendly countries to develop nuclear energy for peaceful benefits.	(a) Maintaining good relationship with the IAEA.	NAEC	ECN, FMEnv., NNRA, CERT, CERD, SHESTCO	FGN (NAEC)	*	*	*
	(b) Ensuring continuous and prompt payment of Nigeria's contribution to the IAEA.	NAEC	FMEd., ECN, MFA, FMF, SHESTCO, NNRA	FGN (NAEC)	*	*	*
	(c) Enforcing relevant international laws and treaties.	NNRA	ECN, FMEd., NNRA, CERT, CERD, SHESTCO, FMH	FGN (NNRA)	*	*	*
	(d) Collaborating with the IAEA in our nuclear science and technology programme.	NAEC	ECN, FMEnv., NNRA, CERT, CERD, SHESTCO, NASENI	FGN (NAEC)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(xiii) Prospecting for and mining radioactive minerals.	(a) Fast-tracking the passage of the new Minerals and Mining Bill.	NASS	MMSD, NGSA, NNRA, ECN, NAEC, MPR	FGN (MMSD, NNRA), OPS	*	*	*
	(b) Ensuring compliance with radiation protection and safeguards requirements in mining radioactive minerals.	NNRA	MCO, FMM & SD	FGN (NNRA)	*	*	*
	(b) Ensuring openness and transparency in acquisition of mining titles.	MCO	MMSD, NGSA, NNRA, ECN, NAEC, MPR, OPS	FGN (MMSD, NAEC), OPS	*	*	*
(xiv) Establishing appropriate mechanism for local participation in the supply of nuclear energy equipment.	(a) Developing appropriate modalities to ensure increase in indigenious participation especially, as major operators in the sector.	NCDMB, NAEC	FMJ, MMSD, NNRA, ECN, MPR, NASENI	FGN (NCDMB, NAEC)	*	*	*
	(b) Enforcement of the Nigerian Local Content Law.	NCDMB, NAEC	FMJ, MMSD, NNRA, ECN, MPR, NASENI	FGN (NCDMB)	*	*	*
(xv) Constructing and maintaining nuclear facilities for the purpose of generating electricity and for other peaceful applications.	(a) Fast tracking the on-going process of building nuclear power plants for electricity generation.	NAEC	CERD, CERT, SHESTCO, NNRA, OPS, ECN, FMP, NERC, NIPP, BPE	FGN (NAEC, NIPP), OPS	*	*	*
	(b) Establishing advanced equipment maintenance facilities for nuclear science and technology.	NAEC	CERD, CERT, SHESTCO, NNRA, OPS, ECN, FMP, NERC, NIPP, BPE	FGN (NAEC, NIPP), OPS	*	*	*
	(d) Encouraging the optimal use of all nuclear science and technology facilities in solving the challenges in the power sector.	NAEC, ECN	FMP, NNRA	FGN (NAEC, ECN, FMP)	*	*	
	(e) Designing, constructing and commissioning of research and materials testing research reactors at SHESTCO Abuja.	NAEC	ECN, NNRA, FMST, DPs	FGN (NAEC)	*	*	
	(f) Providing research reactor simulators at CERT, CERD and SHESTCO.	NAEC	CERT, CERD, FMST, SHESTCO, ECN, NNRA	FGN (NAEC)	*	*	
	(g) Providing a heat transfer laboratory at CERD Ile-Ife.	NAEC	ECN, NNRA, FMST	FGN (NAEC)	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(h) Providing facilities for reactor design neutronics and safety analysis at CERT, Zaria.	NAEC	ECN, NNRA, FMST	FGN (NAEC)	*	*	
	(j) Providing facilities for Health physics and Dosimetry studies at CERT, Zaria.	NAEC	ECN, NNRA, SHESTCO	FGN (NAEC).	*	*	
	(k) Establishing a radiochemistry laboratory at CERT, Zaria.	NAEC	ECN, NNRA, SHESTCO	FGN (NAEC)	*	*	
	(l) Completing the installation and commissioning of the tandem accelerator at CERD Ile-Ife.	NAEC	SHESTCO, NNRA, DPs, ECN	FGN (NAEC)	*	*	
	(m) Completing and commissioning of the proposed radiotherapy centers at Port Harcourt, Gombe and Maiduguri.	FMH	ECN, NNRA, DPs	FGN (FMH)	*	*	
	(n) Completing and commissioning the national isotope hydrology laboratory at CERT, Zaria.	FMH	CERD, ECN, ABU, DPs, NAEC	FGN (FMH)	*	*	
(xvi) Producing, acquiring, treating, storing, transporting and disposing of any radioactive substances.	(a) Develop an adequate radioactive waste management system.	NAEC	ECN, NNRA	FGN (NNRA)	*	*	*
	b) Design and construct LLW and MLW disposal facilities	NAEC	NNRA		*	*	*
	(c) Periodically reviewing the existing laws and regulations for the use, storage, transport and disposal of nuclear materials and facilities.	NNRA	NNRA, FME, ECN, NASS, NAEC, FMJ	FGN (NAEC)	*	*	*

CHAPTER SIX

RENEWABLE ENERGY

6.0 Introduction

Environmental concerns are alerting the world on the imminent dangers of over dependence on fossil based energy sources, oil, gas, coal etc as the main driver of industrialization. Global warming has steadily emerged from the realm of speculative science to the reality of definitive global concern in the form of rising water levels with consequent flooding and weather vagaries. Oil spillage and the loss of arable and habitable land areas are fuelling community disenchantment with oil exploration activities. These have forced a rethink by world leaders on the dominant role of oil and indeed other fossil fuels as the driver of modern industrialization. There is now a global consensus for alternative driver of future industrialization. Renewable energy sources have emerged as the most favoured prospective driver .

Nigeria is endowed with abundant renewable energy resources, the significant ones being solar energy, biomass (crop residues, animal wastes, municipal wastes, etc), wind, small and large hydropower , geothermal, ocean energies as well as potentials for hydrogen fuel. The estimated capacity of the main renewable energy resources is given in Table 6.1.

Table 6.1: Nigeria's Renewable Resource Estimates

ENERGY SOURCE	CAPACITY
Large Hydropower	11,250 MW
Small Hydropower	3,500 MW
Fuelwood	13,071,464 Hectares
Animal Waste	61 million tonnes/yr
Crop Residue	83 million tonnes/yr
Solar Radiation	3.5 – 7.0 k Wh/m2-day
Wind	2 – 4 m/s (annual average) at 10m height

Source: Energy Commission of Nigeria;, REMP 2nd Ed 2012

Except for large scale hydropower, which serves as a major source of electricity, the current state of exploitation and utilization of the renewable energy resources in the country is very low; limited largely to pilot and demonstration projects developed by the two research centres: Sokoto Energy Research Centre located at the Usman Danfodiyo University, Sokoto and National Centre for Energy Research and Development located at University of Nigeria, Nsukka. The Centres, which are under the supervision of the Energy Commission of Nigeria, have developed renewable energy

systems such as solar dryers, solar chick brooders, solar distillers, solar water heaters, solar cookers, biogas digesters and efficient woodstoves. These are all ready for large-scale production and commercialization, which calls for the participation of private entrepreneurs. Other institutions include Solar Panel Manufacturing Plant at Karshi, Small Hydropower (SHP). The Centres and other renewable energy companies also provide services in the installation and maintenance of solar photovoltaic systems for power supply and refrigeration. It is pertinent to point out that the systems mentioned above are a limited part of a wide spectrum of renewable energy systems and appliances in the global market.

The main constraint in the rapid development and diffusion of technologies for the exploitation and utilization of renewable energy resources in the country are the lack of appropriate policy, regulatory and institutional framework to stimulate demand and attract investors. The comparative low quality of the systems developed and the high initial upfront cost also constitute barriers to the development of markets. Therefore, if the country is to unleash the enormous potential of its renewable energy resources on its drive towards achieving sustainable energy for all (SE4All), these barriers must be eliminated through significant investment in critical areas of R&D, building of indigenous human and manufacturing capacities and the intensification of the on-going economic reform to create investor friendly environment.

Based on a 7% economic growth rate, and the corresponding ECN's projected electricity supply profiles of about 26,000MW, 52,000MW and 160,000MW in the short, medium and long terms in the country. It is envisaged, as shown in Table 6.2, that renewable energy (RE) would contribute about 17%, 19% and 20% in meeting the total electricity demand of the nation in the short, medium and long terms, respectively.

Table 6.2: Summary of Renewable Energy Targets

(i) Renewable Electricity Supply Projection in MW (7% GDP Growth rate)

S/N	System	Short Term	Medium Term	Long Term
1	Hydro (LHP)	3,000	6,000	6,000
2	Hydro (SHP)	43	533	533
3	Solar PV	1,400	3,000	20,000
4	Solar Thermal	-	45	6,000
5	Biomass	5	16	50
6	Wind	20	22	30
	All Renewable (MW)	4,468	10,026	32,613
	All Energy Resources (MW)	26,000	52,000	160,000
	% RE	17%	19%	20%

Source: Energy Commission of Nigeria

(ii) Renewable Electricity Supply Projection in MW (10% GDP Growth rate)

S/N	System	Short Term	Medium Term	Long Term
1	Hydro (LHP)	4,000	8,000	8,000
2	Hydro (SHP)	350	1,332	1,332
3	Solar PV	2,000	4,000	25,000
4	Solar Thermal	-	936	12,000
5	Biomass	5	23	77
6	Wind	28	32	42
	All Renewable (MW)	6,383	14,323	46,451
	All Energy Resources (MW)	32,000	72,000	230,000
	% RE	20%	20%	20%

Source: Energy Commission of Nigeria

(iii) Renewable Electricity Supply Projection in MW (13% GDP Growth rate)

S/N	System	Short Term	Medium Term	Long Term
1	Hydro (LHP)	11,207	12,132	12,132
2	Hydro (SHP)	320	760	2,600
3	Solar PV	2,500	5,000	30,000
4	Solar Thermal	-	1,400	18,132
5	Biomass	5	30	100
6	Wind	36	41	54
	All Renewable (MW)	14,068	19,363	63,018
	All Energy Resources (MW)	48,000	90,000	315,000
	% RE	29%	22%	20%

Source: Energy Commission of Nigeria

If however, the contribution of large hydropower is discounted, the contribution of RE declines to about 5.6%, 7.7% and 16.6%, respectively in meeting the national electricity demand under the 7% growth scenario. Moreover, renewable energy resources are envisaged to contribute an average of about 80% to the non-electricity energy demand in the country as shown in Table 6.3. The contribution is, however, expected to decline over the years due to planned decreases in the consumption of fuelwood.

Table 6.3: Targets for Non-Electricity (Thermal) Energy Production

S/N.	ITEM	SHORT	MEDIUM	LONG
1.	Total Thermal Energy Production (GWh)	193,789	202,128	248,869
2.	Renewable Energy Share (%)	85	80	79
3.	Other non-renewable energy share (%)	15	20	21

Source: Energy Commission of Nigeria, REMP 2nd Ed 2012

The projected contribution of biofuels in meeting the demand for automotive fuels in the country is shown in table 6.4.

Table 6.4: Targets for Bio-Fuel for Automotive Use in Nigeria, 7% Growth Scenario

Biofuel Type		**Time Frame**		
		Short	**Medium**	**Long**
Bio-ethanol	Demand (billion litres / annum)	1.446	2.817	5.646
	% contribution to motor spirit	10	10	10
Bio-diesel	Demand (billion litres / annum)	0.460	0.835	1.780
	% contribution to diesel fuel	20	20	20

Source: Energy Commission of Nigeria, REMP 2nd Ed 2012

6.1 HYDROPOWER

6.1.1 Policies

i. The nation shall fully harness the hydropower potential in the country for electricity generation.

ii. The nation shall pay particular attention to the development of the small, mini and micro hydropower schemes for the growth of the rural economy.

iii. The nation shall exploit hydropower resources in an environmentally sustainable manner.

iv. The nation shall actively promote private sector and indigenous participation in hydropower development.

v. The nation shall support Research and Development activities for local adaptation of hydropower plant technologies.

6.1.2 Objectives

i. To increase the contribution of hydropower to the total electricity supply mix.

ii. To extend electricity to rural and remote areas, through the use of small, mini and micro hydropower schemes to promote economic activities.

iii. To pursue hydropower production in an environmentally friendly and sustainable manner that minimizes the adverse impacts on the environment, ecosystem and population.

iv. To attract private sector investments into the hydropower sub- sector**.**

v. To develop local manufacturing capabilities for hydropower technologies.

6.1.3 Action Plan

Table 6.5: Hydropower Development Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Promoting and supporting research and development activities on hydropower exploitation for increased indigenous participation in the planning, design and construction of hydropower projects.	(a) Identifying and embarking on R & D priorities that will fast - track local content development.	ECN, FMST	NCDMB, NASENI , FMWR, RCs, RIs, TIs	FGN (ECN), OPS, DPs	*	*	*
	(b) Fast tracking the establishment of R & D centres on hydropower for electricity generation.	ECN, FMST	FMP, NUC, NBTE, NCCE, FMIT&I, NCDMB, NASENI FMWR, TIs	FGN(ECN), OPS	*	*	
	(c) Organizing sensitization workshops, seminars, conferences, lectures etc.	ECN, FMST	FMP, NUC, NBTE, NCCE, FMT&I, NCDMB, , NASENI FMWR, RCs, RIs, TIs	FGN (ECN)	*	*	*
	(d) Establishing linkages/collaboration between Universities, Research Institutes and Centres with OPS and the relevant International Centres of Excellence.	ECN, FMST	FMIT&I, NCDMB, NASENI, FMWR, RCs, RIs, TIs, DPs	FGN (ECN, FMST), DPs, OPS	*	*	
	(e) Introducing competitive research grants based on the best hydropower R&D adoption design and proposals.	ECN, FMST	FMP, FMF, NUC, NBTE, NCCE, FMIT&I, NCDMB, NASENI, FMWR, RCs, RIs, TIs, ETF, NAS, NAE, DPs,OPS	FGN (ECN), OPS	*	*	*
	(f) Supporting the endowment of professorial chairs in hydropower technologies in the universities, research institutes and centres.	ECN/ FMST	NUC, NBTE, NCCE, FMT&I, NCDMB, NASENI, OPS FMWR, RCs, RIs, TIs, ETF, NAS, NAE	FGN (ECN)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(ii) Establishing more hydro-meteorological stations across river basins.	(a) Conducting comprehensive survey of existing infrastructural facilities across the river basins in the country.	FMWR	FMP, NIHSA, NIMET, NASENI, ECN, NWRI, RBDA, OPS, FMST	FGN (FMWR)	*	*	
	(b) Building the capacity of indigenous manpower in the planning, design, and construction of hydro meteorological stations.	FMWR, NIMET	NIHSA, FMP, FMST, ECN, OPS,RCs, RIs, TIs, NERC, NSE, NAS, NWRI, NAE	FGN (FMWR, NIMET), OPS	*	*	*
	(c) Creating enabling environment for indigenous participation in the establishment and operation of the stations.	FMWR, NIMET	ECN, FMF, CBN, NIPC, OPS, NERC, FMJ, FMAv., FMST	FGN (FMWR, FMAv.)	*	*	
(iii) Generating and updating data on all rivers, identifying possible locations for hydropower projects and facilitating detailed survey of the potential SHP sites.	(a) Conducting a national survey of hydropower potentials.	ECN, FMST	NBS, FMWR, NIHSA, RCs, RIs, TIs, OPS, DPs, NGSA	FGN (ECN)	*	*	*
	(b) Strenghtening the RBDAs to provide data on small hydropower potentials of sites within the basin.	FMWR	NIHSA, ECN, FMST	FGN(FMWR)	*	*	
(iv) Organizing sensitization workshops, seminars and enlightenment programmes on the roles of SHP in rural development.	(a) Sensitizing the Federal, State and LGAs' rural electrification agencies on the potential of SHP as source of electricity.	ECN, FMST, REA	NIHSA, SGs, OPS, NGOs, FMIT&I, FMP	FGN (ECN, FMST, REA), SGs, OPS	*	*	
	(b) Introducing legislation that will ensure the incorporation of SHP in the development plans of the federal, state and local governments.	ECN, FMST, REA	NASS, FMJ, OPS, SASS, FMP, SGs, LGCs	FGN (ECN, FMST, REA)	*	*	
(v) Introducing tax reductions, soft loans, grants, bilateral concessional funding to encourage private investments and public-private partnerships in the development of hydropower projects.	(a) Providing low interest soft loans for hydropower projects.	BOI	CBN, FMF, OPS, FMP, FMWR	FGN (BOI, FMF, CBN)	*	*	*
	(b) Providing market incentives such as fixed price, fixed payment, competitive license biding etc.	NERC	FMP, FMF, ECN, MAN, FMIT&I, NIPC	FGN (NERC)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(c) Lowering profit tax for corporate organizations that are involved in hydropower development.	FIRS	CBN, FMF, NIPC, NERC	FGN (FIRS)	*	*	*
	(d) Reducing import duty for the importation of materials, components and equipment by bona fide manufacturers of hydropower equipment.	NCS, FMF	CBN, FIRS, NERC, SON, NASENI	FGN (NCS)	*	*	
(vi) Putting in place a framework for power purchase agreement between owners of SHP, the grid and users.	(a) Introducing legislation that will ensure the incorporation of power purchase agreement in the development of SHP in Nigeria.	NERC, NBET	NASS, FMJ, FMP, ECN, FMWR, BPE, CPC, FMST	FGN (NERC)	*	*	
	(b) Developing codes and standards for SHP.	SON	NERC, ECN, FMIT&I, FMWR, FMST, FMP, NASENI	FGN (SON)	*	*	
(vii) Exploiting the multifunctional use of hydropower infrastructure (e.g. flood control, water supply, electricity generation, recreation, etc.).	(a) Establishing small hydropower pilot schemes in each geopolitical zone.	FMP, FMWR	ECN, NERC, FMIT&I, FMWR, IPPs, FMF, FMST	FGN (FMP, ECN, FMST), DPs	*	*	
	(b) Incorporating, where appropriate, hydro electricity generation into water management programmes.	FMWR, FMP	ECN, FMST, FMF, DPs, IPPs, RBDA, NASENI, NWRI, NIHSA	FGN (FMWR, FMP), OPS	*	*	
	(c) Implementing existing Memorandum of Understanding between relevant agencies.	FMWR	NERC, ECN, FMP, DPs, IPPs, NIHSA, NWRI, FMEnv.	FGN (FMWR, NERC, ECN)	*	*	
	(d) Managing water resources for effective water supply and flood control.	FMWR	NERC, FMP, ECN, IPPs, RBDA, FMEnv.	FGN (FMWR)	*	*	*
	(e) Incorporating where appropriate recreational facilities into water management programmes.	FMWR, FMTC&NO	NTDC, NIHSA, NIHOTOUR	FGN (FMWR, FMTC&NO)	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(viii) Ensuring that State Rural Electricity Boards incorporate small-scale hydropower projects in their agricultural, industrial and economic development plans.	(a) Establishing and maintaining linkages/collaboration between REA & the State Rural Electricity Boards.	REA, SGs	FMP, NERC, ECN, IPPs, FMWR, FMA&RD, FMIT&I, FMST	FGN (REA, FMP), SGs	*	*	*
(ix) Supporting cutting-edge research and the development of mitigation techniques and technologies to reduce or eliminate adverse impact of hydropower development and operation on the ecosystem.	(a) Identifying and embarking on R & D priorities to mitigate the adverse impact of hydropower development.	FMEnv., FMST	ECN, NIHSA, FMWR, RCs, RIs, TIs, FMP	FGN (FMEnv., FMST), OPS, DPs	*	*	
	(b) Strenthening the existing R & D centres and institutes on hydropower development.	ECN, FMST	FMWR, FMP, RCs, RIs, TIs, NASENI	FGN(ECN, FMP)	*	*	
	(c) Establishing linkages/collaboration between Universities, Research Inst. & Centres with OPS and relevant International Centres of Excellence.	ECN, FMST	FMEd., NUC, NBTE, NCCE, FMIT&I, NASENI, RCs, RIs, TIs	FGN (ECN), DPs, OPS	*	*	*
(x) Establishing local training institutions to produce skilled manpower in hydropower technology.	(a) Strenthening the local training institutions on hydropower technology.	NAPTIN, NASENI	FMP, ECN, FMST, TIs, RCs, RIs, NBTE	FGN (NAPTIN, NASENI), OPS	*	*	
(xi) Integrating capacity building in the procurement of hydropower projects to encourage technology transfer to indigenous personnel.	(a) Building indigenous manpower capacity in the planning, design, and construction of hydropower stations .	ECN, NASENI, NAPTIN	FMST, FMWR, FMP, RCs, RIs, TIs, NERC, NSE, NAS, NWRI, NIHSA, NAE, NOTAP, NBTI	FGN (ECN, FMST, NAPTIN, NASENI), OPS	*	*	*
	(b) Increasing progressively indigenous participation in the planning, design and construction of hydropower plants in a ratio that ensures full benefits to the country.	FMP, ECN, FMST	NASENI, NAPTIN, FMWR, RCs, RIs, TIs, NERC, NSE, NAS, NWRI, NAE, NOTAP, NBTI	FGN (ECN, FMST, FMP), OPS	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(xii) Encouraging the private sector establishment of Indigenous Manufacturing Industries for hydropower equipment and accessories.	(a) Creating enabling environment for attracting FDI and indigenous participation in the local production of hydropower plants, equipment and accessories.	NIPC	FMP, FMIT&I, ECN, FMF, CBN, FMWR, BPE, OPS, FMST, NASENI, NOTAP	FGN (NIPC, NOTAP, FMIT&I)	*	*	*
	(b) Developing and promoting market for both small and large hydropower manufacturers.	NIPC	FMP, FMIT&I, ECN, FMF, CBN, FMWR, BPE, OPS , FMST, NASENI, REA, SMEDAN	FGN (NIPC)	*	*	*
	(c) Building indigenous entrepreneurial capacity.	SMEDAN	FMP, FMIT&I, ECN, FMF, CBN, FMWR, BPE, OPS, NIPC, NAPTIN, NASENI	FGN (SMEDAN)	*	*	*

6.2 SOLAR

6.2.1 Policies

i. The nation shall aggressively pursue the integration of solar energy into the nation's energy mix, which should be based on the established potentials and available technologies nationwide.

ii. The nation shall keep abreast of worldwide developments in solar energy technology and utilization to adopt global best practices.

iii. The nation shall utilize solar energy resources where it is more cost effective and advantageous.

iv. The nation shall support the establishment of local manufacturing industries for solar energy conversion technologies and applications.

6.2.2 Objectives

i. To develop the nation's capability and capacity in the utilization of solar energy.

ii. To use solar energy as the main energy option in the ruraland peri-urban areas with higher solar energy potential.

iii. To develop the market for solar energy technologies and services.

iv. To develop local manufacture capabilities for solar energy conversion technologies.

6.2.3 Action Plan

Table 6.6: Solar Development Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Intensifying research and development in solar energy technology and applications.	(a) Identifying and developing indigenous capacities in the design, development, installation and maintenance of solar energy technologies.	FMST, ECN, NASENI	FMP, NAPTIN, OPS, RCs, RIs, TIs, DPs	FGN(ECN, FMST, NASENI), OPS	*	*	*
	(b) Instituting periodic international fairs on solar energy innovative design and development models.	ECN, FMST	FMP, OPS, RCs, RIs, TIs, DPs	FGN(ECN, FMST), OPS, DPs	*	*	*
(ii) Intensifying human and institutional capacity building in solar energy technologies and applications.	(a) Encouraging linkages/collaboration between Universities, Research Institutes and Centres with relevant International Centres of Excellence.	ECN, FMST	FMP, NASENI, OPS, RCs, RIs, TIs, DPs, ETF, NGOs, NUC, NBTE	FGN (ECN, ETF), OPS	*	*	*
	(b) Introducing competitive research grants on the solar proposals/designs.	ECN, FMST	FMP, OPS, RCs, RIs, TIs, DPs, ETF, NGOs, NUC, TETFUND	FGN (ECN, ETF, TETFUND), OPS	*	*	
	(c) Establishing professorial chairs in solar energy technologies in the universities, research institutes and centres.	ECN, OPS, NUC	FMP, FMST, , RCs, RIs, TIs, DPs, ETF, NGOs, NASENI	FGN (ECN, ETF), OPS	*	*	*
	(d) Organizing national and international conferences, workshops and short-courses.	ECN, FMST	FMP, FMEdu, OPS, RCs, RIs, TIs, DPs, ETF, NGOs	FGN (ECN, FMST, ETF), OPS	*	*	*
	(e) Encouraging collaboration between tertiary institutions, research centres and industries.	ECN, FMST	FMP, NASENI, OPS, RCs, RIs, TIs, ETF, NUC, FMIT&I	FGN (ECN, ETF), OPS	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(iii) Providing adequate incentives to suppliers of solar energy products and services.	(a) Developing and promoting market for solar energy appliances.	ECN, FMST	FMF, OPS, DPs, FMT&I, NBTI, BOI, NIPC	FGN (ECN, FMST), OPS	*	*	*
	(b) Developing market incentives such as adequate feed in tariffs for solar energy.	NERC	FMF, FMIT&I, NBTI, OPS	FGN (NERC)	*	*	*
	(c) Assessing national demand for solar energy systems.	ECN	NBS, RCs, RIs, TIs, NASENI, FMP, FMST, NERC	FGN (ECN)	*	*	
	(d) Developing and signing legally binding Power Purchase Agreements with utilities.	NERC, NBET	ECN, FMP, FMF, FMJ, BPE, OPS, NNPC	FGN (NERC)	*	*	
(iv)Providing adequate incentives to local manufacturers for the production of solar energy systems and accessories.	(a) Providing fiscal incentives such as suspension of import duty.	NCS, FMF	NIPC, FMP, NERC	FGN (FMF, NIPC), OPS	*	*	
	(b) Providing investment grants, operational grants, etc. to encourage local production of solar energy systems.	BOI	NIPC, FMP, FMF, NERC, NCS, FMIT&I	FGN (BOI), OPS	*	*	
	(c) Providing tax holiday for companies involved in solar energy technology development.	FIRS, FMF	CBN, FMIT&I, ECN, OPS	FGN (FIRS), OPS	*	*	*
	(d) Establishing solar PV and solar thermal production plants.	NASENI, ECN	FMST, OPS, FMIT&I	FGN (NASENI, ECN), OPS	*	*	
	(e) Encouraging local and foreign investors to establish factories for the production of major components, (such as inverters, deep cycle batteries, charge controllers, etc).	NIPC	ECN, FMF, FMST, OPS, DPs	FGN (NIPC), OPS, DPs	*	*	*
	(f) Establishing Renewable Energy Fund.	ECN	FMST, OPS, DPs, FMF	FGN (ECN, FMST), OPS, DPs	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(v) Introducing measures to fast-track the local solar energy industry.	(a) Introducing legislation to encourage hotels, estates and government agencies use solar energy for water heating and electricity backup.	ECN, FMST	NASS, FMJ, SGs, LGCs, OPS, FMIT&I, SMEDAN	FGN (ECN, FMST)	*	*	
	(b) Establishing a Renewable Energy Development Commission.	FMST	NASS, FMP, FMF, FMEnv., ECN, NASENI, OPS	FGN (FMST)	*	*	
	(c) Introducing appropriate Policy, Legal and Regulatory framework to support the local solar energy industry.	ECN, FMST	FMP, NASS, FMF, FMJ, OPS, NERC, NASENI	FGN (ECN, FMST)	*	*	
(vi) Setting up extension programmes to popularise solar energy technology and solutions to the rural and peri-urban communities.	(a) Developing and siting of appropriate pilot and demonstration schemes.	ECN, FMST	FMIT&I, OPS, DPs	FGN (ECN, FMST), OPS, DPs	*	*	
	(b) Training extension workers on the applications, installation and maintenance of solar energy systems.	ECN, NASENI, NAPTIN	FMST, RCs, RIs, TIs, DPs	FGN (ECN, NASENI, NAPTIN)	*	*	*
(vii) Providing fiscal incentives for the installation of solar energy systems.	(a) Introducing tax incentives such as suspension of import duty, tax holiday etc.	NCS, FIRS, FMF	FMST, OPS, DPs, CBN, NIPC	FGN (FIRS, NCS), OPS	*	*	
	(b) Introducing credit facilities, investment grant, operational grant, long term loans etc.	BOI	FMST, FMF, OPS, DPs, CBN, NIPC	FGN (BOI), OPS	*	*	*
(viii) Pursuing aggressive mass campaign and advocacy on the use of RE as alternative energy sources.	(a) Sensitizing the general public on the potential of solar energy as a source of electricity.	ECN, FMST	FMP, REA, NERC, OPS, NGOs, FMIT&I	FGN (ECN, FMST), OPS	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(ix) Setting up and maintaining a comprehensive information system on available solar energy resources and technologies.	(a) Conducting survey to acquire comprehensive information on solar energy resources, technologies, systems, end-use appliances, market etc.	ECN, FMST	NBS, NGOs, OPS, NIMET, NASENI	FGN (ECN, FMST), OPS	*	*	
	(b) Acquiring appropriate ICT facilities for processing, documenting and disseminating solar energy information.	ECN, FMST	NITDA, NBS, FMCT, CBN	FGN (ECN)	*	*	
	(c) Developing national data base on the acquired information on solar energy resources and systems.	ECN, FMST	, NITDA, NBS, CBN, FMCT	FGN (ECN, FMST)	*	*	
(x) Developing and enforcing standards for solar energy technologies, products, services and processes.	(a) Assessing global and proven successful standards, codes of practice on solar energy technologies.	SON	ECN, FMST, OPS, DPs, FMP, NASENI, RCs	FGN (SON)	*	*	*
	(b) Developing and enforcing standards and codes for all solar energy systems imported into the country.	SON	FMST, ECN, OPS, DPs, FMP, NASENI, RCs	FGN (SON)	*	*	*
	(c) Enforcing safety standards for the production and installation of solar energy systems.	SON	ECN,FMST, OPS, DPs, FMP, NASENI, RCs	FGN (SON)	*	*	*
(xi) Putting in place measures to leverage funding from international agencies and countries that promote the use of solar energy.	(a) Identifying and establishing linkages/collaboration with OPS and the relevant International Donor Agencies.	ECN, FMST	FMF, FMIT&I, MFA, RCs, RIs, TIs, DPs	FGN (ECN, FMST), DPs, OPS	*	*	

6.3 WIND

6.3.1 Policies

i. The nation shall commercially develop its wind energy resource and integrate this with other energy resources into a balanced energy mix.

ii. The nation shall take necessary measures to ensure that this form of energy is harnessed at sustainable costs to both suppliers and consumers in the rural areas.

iii. The Nation shall apply global best practices in the exploitation of wind energy resources.

5.3.2 Objectives

i. To develop wind energy as an alternative energy resource.

ii. To develop local capability in wind energy technology.

iii. To use wind energy for provision of power to rural areas and remote communities far removed from the national grid.

iv. To apply wind energy technology in areas where it is technically and economically feasible.

6.3.3 Action Plan

Table 6.7: Wind Energy Development Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Encouraging research and development in wind energy utilization.	(a) Identifying and embarking on appropriate R&D activities.	ECN, FMST	RCs, RIs, TIs, NIMET, DPs, NASENI	FGN (ECN, FMST)	*	*	*
	(b) Introducing competitive research grants based on the best innovative wind energy technology proposals/designs.	FMST, ECN	ETF, FMEd., OPS, FMP, FMIT&I, FMF, RCs, RIs, TIs, DPs, NUC	FGN (PTDF, ETF, TETFUND), OPS	*	*	
	(c) Organizing national and international conferences, workshops and short courses.	ECN, FMST, NASENI	FMP, NASENI, NIMET, OPS	FGN (ECN, FMST)	*	*	
(ii) Developing skilled manpower for provision of basic engineering infrastructure for the local production of components and spare parts of wind power systems.	(a) Building indigenous capacity in design and development of turbines, blades, towers etc.	NASENI, ECN, FMST	ECN, NBTE, FMP, DICON, RCs, RIs, TIs OPS, DPs	FGN(ECN, FMST, NASENI), OPS	*	*	*
	(b) Identifying and assessing existing infrastructure, skills and knowledge gaps.	ECN, FMST	NASENI, FMP, RCs, RIs, TIs, OPS, DPs	FGN (ECN, FMST)	*	*	
	(c) Introducing appropriate programmes in existing national energy institutions to address identified infrastructure, skills and knowledge gaps in (b) above.	NAPTIN, ECN, FMST	FMEd., NUC, NBTE, RCs, RIs, TIs, OPS, NASENI	FGN (NAPTIN)	*	*	
	(d) Encouraging linkages between tertiary institutions, research institutes and centres with excellence in wind energy technologies.	ECN, FMST	FMEd., RCs, RIs, TIs, OPS, NASRDA, NASENI	FGN (ECN, FMST)	*	*	
(iii) Intensifying work in wind data acquisition and development of wind maps.	(a) Establishing more Meteorological stations across the country.	NIMET	OPS, DPs, FMST, ECN, RCs, RIs, TIs	FGN (NIMET) DPs, OPS	*	*	*
	(b) Expanding the on-going national wind mapping programme to cover the whole country.	ECN, FMST	NIMET, FMP, DPs, OPS, NBS	FGN (FMST), OPS, DPs	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(c) Acquiring appropriate ICT facilities for processing and documenting wind energy information system.	ECN	FMST, NIMET, NBS, FMCT, FMP, DPs, OPS	FGN (ECN), OPS, DPs	*	*	
	(d) Developing national data base on the acquired information on wind energy resources and systems.	ECN, FMST	NIMET, NBS, FMP, DPs, OPS	FGN (ECN), OPS, DPs	*	*	
(iv)Training of skilled local craftsmen to ensure the operation and maintenance of wind energy systems.	(a) Training local experts on fabrication, installations, utilization, maintenance and safety of wind energy systems.	ECN	NASENI, FMST, TIs, RIs, RCs, NAPTIN	FGN (ECN), OPS, DPs	*	*	*
	(b) Executing and commissioning of wind energy pilot projects.	ECN, FMST	FMP, NASENI, TIs, RIs, RCs	FGN (ECN, FMST)	*	*	
(v) Providing appropriate incentives to producers, developers and consumers of wind power systems.	(a) Providing fiscal incentives such as suspension of import duty, tax holiday, investment grants, operational grants, etc.	NCS, FIRS, BOI	NIPC, FMP, FMIT&I, FMF, OPS, CBN, NERC	FGN (FIRS, BOI), OPS	*	*	*
	(b) Encouraging local and foreign investors to establish factories for production of major components of wind energy systems (e.g. wind turbines, blades, deep cycle batteries, charge controllers).	NIPC	ECN, FMST, BOI, NASENI, FMP, FMIT&I, FMF, OPS	FGN (NIPC, ECN), OPS	*	*	*
	(c) Providing market incentives for wind energy systems.	NIPC	ECN, FMST, FMP, REA, OPS, FMF, FMIT&I, NERC	FGN (NIPC), OPS	*	*	*
	(d) Establishing Renewable Energy Fund.	FMST, ECN	OPS, DPs, FMF, FMP, NERC	FGN (FMST)	*	*	*
(vi) Developing extension programmes to facilitate the general use of wind energy technology.	(a) Conducting public enlightenment through workshops, seminar, lectures etc.	ECN, FMST	DPs, FMP, REA, NGOs, CBOs, FMWA&SD, NASENI, FMA&RD	FGN (ECN, FMST), OPS, DPs	*	*	
	(b) Designing and sponsoring publicity through the print and electronic media.	ECN, FMI	NOA, FMST, DPs, NGOs, CBOs	FGN (ECN, FMI), OPS, DPs	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(c) Training extension workers on the installation, utilization, maintenance and safety of wind energy systems.	ECN, NASENI, NAPTIN	FMST, FMP, RCs, RIs, TIs, FMWA&SD	FGN (ECN, NASENI, NAPTIN), OPS, DPs	*	*	*
(vii) Developing local capability through the establishment of local manufacturing in the area of wind energy technology.	(a) Identifying and developing indigenous capacities in the design, development, installation and maintenance of wind energy technologies.	FMST, ECN, NASENI	FMP, NAPTIN, OPS, RCs, RIs, TIs, DPs	FGN(ECN, FMST, NASENI), OPS	*	*	*

6.4 HYDROGEN

6.4.1 Policy

i. The nation shall integrate hydrogen as an energy source in the energy mix of the country.

6.4.2 Objectives

i. To keep abreast of international trends in hydrogen production and application.

ii. To develop local production capacity for hydrogen.

iii. To ensure hydrogen utilization as a preferred energy source, where possible, on account of its high environmental friendliness.

6.4.3 Action Plan

Table 6.8: Hydrogen Development Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Encouraging research and development in hydrogen energy related technologies.	(a) Identifying existing hydrogen fuel technologies in the world.	ECN, FMST	RCs, RIs, TIs	FGN (ECN, FMST)	*	*	
	(b) Establishing focal points for Hydrogen fuel R&D within existing institutions.	ECN, FMST	RCs, RIs, TIs	FGN (ECN, FMST)	*	*	*
	(c) Identifying and embarking on appropriate R&D in hydrogen technologies in the country.	ECN, FMST	RCs, RIs, TIs	FGN (ECN, FMST)	*	*	*
	(d) Introducing competitive research grants based on the best hydrogen R&D design and proposals.	ECN, FMST	FMEd., NUC, NBTE, NCCE, FMST, RIs, RCs, TIs, DPs, ETF	FGN (ECN, FMST)	*	*	
(ii) Developing domestic capacity in hydrogen production and application technologies.	(a) Organizing and participating at national and international workshops, conferences and short courses.	ECN	FMST, RCs, RIs, TIs, OPS, DPs	FGN (ECN), OPS, DPs	*	*	
	(b) Encouraging post-graduate training at national and international institutions specializing in hydrogen and fuel cell technologies.	FMEd.	ECN, NUC, FMST, RCs, RIs, TIs, OPS, DPs	FGN (ECN, FMEd.), DPs	*	*	*
	(c) Developing and creating market for hydrogen energy.	NIPC	FMST, ECN, OPS, DPs, NBTI	FGN (NIPC), DPs OPS	*	*	
	(d) Acquiring and installing state of the art training facilities for the production of hydrogen and fuel cells at the focal centres.	ECN	FMST, RCs, RIs, TIs, ETF, DPs, OPS, NOTAP,	FGN (ECN), ETF, OPS, DPs	*	*	
(iii) Providing incentives to popularize the use of hydrogen as an energy source.	(a) Estimating hydrogen energy resource base.	ECN, FMST	FMIT&I, NBS, RCs, RIs, TIs, DPs	FGN (ECN, FMST), DPs	*	*	
	(b) Estimating the percentage of energy demand that can be met through Hydrogen fuel and fuel cells.	ECN	RCs, RIs, TIs, FMST, DPs	FGN (ECN), DPs	*	*	
	(c) Developing and promoting market for hydrogen energy systems.	NIPC, ECN	FMST, OPS, DPs, NOTAP, NBTI	FGN(ECN, NIPC)	*	*	*
	(d) Providing market incentives, such as tax holidays, duty waivers, pioneer status, for hydrogen energy systems and fuel cells.	NCS, FIRS, NIPC	OPS, NOTAP, FMF, CBN	FGN (FMF, NCS, CBN)	*	*	*

6.5 Other Renewables (Geothermal, Ocean, Tidal, Wave, etc.)

6.5.1 Policies

i. The nation shall maintain an interest in other emerging sources of renewable energy.

6.5.2 Objectives

i. To develop a database on the potentials of these emerging energy resources.

ii. To keep abreast of international trends in energy technology development.

iii. To ensure incorporation of any new proven cost-effective energy resource into the energy mix.

6.5.3 Action Plan

Table 6.9: Other Renewable Energy Sources Development Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Gathering and disseminating information on the development of these emerging technologies.	(a) Identifying emerging renewable energy technologies both nationally and international.	ECN, FMST	DPs, NASENI, RCs, RIs, TIs, RMRDC	FGN (ECN, FMST)	*	*	
	(b) Identifying and quantifying the national resource base for each other renewable energy source.	ECN, FMST	FMP, OPS	FGN (ECN, FMST)	*	*	
(ii) Encouraging research and development in the technologies of the exploitation of these emerging energy resources.	(a) Establishing focal points for R&D for identified viable emerging technologies within existing institutions.	ECN, FMST	NASENI, RCs, RIs, TIs	FGN (ECN)	*	*	
(iii) Prioritizing the level of need, level of technological development and viability of emerging renewable energy resources.	(a) Assessing the potentials of emerging technologies and prioritizing them according to national energy needs.	ECN, FMST	NASENI, RCs, RIs, TIs	FGN (ECN, FMST)	*	*	

CHAPTER SEVEN

BIO-ENERGY

7.0 Introduction

The abundant energy available from bio-energy can be meaningfully introduced into the nation's energy mix through the development of a comprehensive programme. The programme should encompass fully supported research, development, demonstration and manpower training components.

Biomass is a non-fossil material of biological origin. The biomass resources of Nigeria can be identified as wood, forage grasses and shrubs, animal wastes and wastes arising from forestry, agricultural, municipal and industrial activities, as well as aquatic biomass. The biomass energy resources of the nation have been estimated to be significant.

Fuel wood is solid plant biomass that is used for household heating and cooking. Plant biomass can be used as fuel in thermal power plants or converted to produce solid briquettes, which can then be utilized as fuel for small-scale industries. Biogas digesters of various designs are capable of sustaining household, industrial and institutional energy needs. It has indeed been shown that the remaining biomass material after digestion is a better fertilizer than the original waste. The intensive application of this will reduce the existing heavy reliance on chemical fertilizers.

7.1 BIOMASS

7.1.1 Policies

i. The nation shall effectively harness non-fuel wood biomass energy resources and integrate them with other energy resources.

ii. The nation shall promote the use of efficient biomass conversion technologies.

iii. The nation shall improve measures required to support initiatives aimed at reducing forest thinning, and to enhance collection and use of forest residue.

iv. The nation shall enhance the demand side measures that support the use of biomass for the production of renewable energy.

v. The nation shall set a limit on the amount of biomass used for energy, to ensure that the overall demand can be accomodated alongside other demands for land, for example, food production on biodiversity conservation.

vi. The nation shall undertake the life cycle analysis of all biomass feedstock to determine their relative climate change benefits.

vii. The nation shall undertake a comprehensive mapping of agro-ecological suitability for energy crops for the purpose of obtaining a regional view of production potentials and contribute to decision making on support for handling and/or processing facilities.

viii. The nation shall incorporate waste-to-energy strategy in its overall waste management framework.

7.1.2 Objectives

i. To promote biomass as an alternative energy resource especially in the rural areas.

ii. To promote efficient use of agricultural residues, animal and human wastes as energy sources.

iii. To reduce health hazards arising from combustion of biomass fuel.

iv. To focus biomass utilization close to production, for community heating schemes and domestic heating, particular off the national grid network.

7.1.3 Action Plan

Table 7.1: Biomass Development Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Developing extension programmes to facilitate the general use of new biomass energy technologies.	(a) Developing and siting of appropriate pilot and demonstration schemes.	ECN, FMST	NGOs, DPs, RCs, RIs, TIs, FMEnv., OPS	FGN (ECN, FMST), OPS, DPs	*	*	*
	(b) Conducting public enlightenment through workshops, seminar, lectures etc.	ECN, FMST	NGOs, DPs, RCs, RIs, TIs, FMEnv.	FGN (ECN)	*	*	
	(c) Designing and sponsoring publicity through the print and electronic media.	ECN, FMST	NOA, NGOs, DPs, RCs, RIs, TIs, FMEnv.	FGN (ECN)	*	*	
	(d) Training extension workers on the applications, installation, and maintenance of biomass energy technologies.	ECN, PRODA	FMST, RCs, RIs, TIs, SGs, LGCs, DPs, OPS, NGOs, FMEnv.	FGN (ECN, PRODA)	*	*	
(ii) Promoting research and development in biomass energy technology.	(a) Assessing and reviewing available biomass technologies in the world.	ECN, FMST, PRODA	RCs, RIs, TIs, FMA&RD, FMWA&SD, OPS, DPs, FMP, NNPC	FGN (ECN, FMST, PRODA)	*	*	
	(b) Identifying suitable technologies and embarking on intensive R&D activities on same.	ECN, FMST	NASENI, TIs, RIs, RCs, OPS	FGN (ECN, FMST), OPS	*	*	
	(c) Instituting national and international fairs on innovative designs and models.	ECN, FMST	NASENI, FMEd., RCs, RIs, TIs, OPS, MFA, FMP, NNPC, FMEnv.	FGN (ECN, FMST), OPS	*	*	*
	(d) Encouraging collaboration between tertiary institutions, research institutes and centres with OPS.	ECN	FMEd., RCs, RIs, TIs, OPS, FMEnv., FMST	FGN (ECN, FMST)	*	*	
	(e) Producing and field-testing of R & D results on biomass technologies.	ECN, PRODA	RCs, RIs, TIs, OPS, NOTAP, FMA&RD, FMST	FGN (ECN, PRODA)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(f) Encouraging commercialization of biomass R & D results.	FMST, NOTAP	RCs, RIs, TIs, OPS, NBTI, FMIT&I, FMA&RD, SMEDAN	FGN (ECN, NOTAP)	*	*	*
(iii) Establishing pilot projects for the production of biomass energy conversion devices and systems.	(a) Identifying and selecting appropriate sites for biomas briquette pilot projects.	ECN, FMST	RCs, RIs, NGOs, FMA&RD, FMEnv., OPS, NARICT	FGN (FMST, ECN), OPS	*	*	
	(b) Executing and commissioning of the pilot projects.	ECN, FMST	RCs, RIs, NGOs, FMEnv.	FGN (FMST, ECN), OPS	*	*	
	(c) Establishing local management and maintenance strategies for the pilot projects.	ECN, FMST	SGs, LGCs, CBOs, NGOs, DPs, RIs, RCs, TIs	FGN (FMST, ECN)	*	*	*
(iv) Providing adequate incentives to local entrepreneurs for the production of biomass energy conversion systems.	(a) Providing fiscal incentives to encourage local production of biomass energy systems.	FIRS, NIPC	FMIT&I, ECN, SMEDAN, NGOs, FMF, OPS	FGN (NIPC, ECN)	*	*	*
	(b) Providing value chain financial products and services for the scaling up of viable biomass businesses.	BOI, BOA	FMA&RD, FMF, FMIT&I, OPS, FMEnv.	FGN (BOI, BOA, CBN)	*	*	
(v)Training of skilled manpower for the maintenance of biomass energy conversion systems	(a) Identifying and assessing existing infrastructure, skills and knowledge gaps.	ECN	RCs, RIs, TIs , FMST, NBS	FGN (ECN) OPS, DPs	*	*	
	(b) Introducing appropriate programmes in existing national energy institutions to address identified infrastructure, skills and knowledge gaps in (a) above.	ECN, NAPTIN	FMEd., RCs, RIs, TIs, OPS, DPs , FMST	FGN (ECN)	*	*	
	(c) Training local personnel and end users on installation, utilization, maintenance and safety of biomass systems.	ECN, PRODA	NGOs, DPs, OPS, NDE, FMST, NAPTIN	FGN (ECN, PRODA, NAPTIN)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(vi) Developing skilled manpower and providing basic engineering infrastructure for the local production of components and spare parts for biomass systems.	(a) Building indigenous capacity in the design, development, and fabrication of biomass systems.	ECN, PRODA, NAPTIN	FMIT&I, FMF, FMST, FMA&RD, FMEnv., NCAM	FGN (ECN, PRODA), OPS	*	*	*
	(b) Encouraging local investors to establish small and medium scale industries for manufacturing efficient burners, briquetting machines, etc.	NIPC	SMEDAN, FMIT&I, OPS, ECN, FMEnv.	FGN (NIPC)	*	*	
	(c) Establishing linkages between tertiary institutions, research institutes and centres of excellence (national and international) on biomass technologies.	ECN, MFA, FMEd.	DPs, FMST, RCs, RIs, TIs, FMA&RD, NOTAP, FMEnv.	FGN (ECN, MFA)	*	*	
	(d) Encouraging graduate and postgraduate training in national and international energy institutions on RET.	ECN, FMEd.	NUC, NBTE, OPS, FMST, RCs, RIs, TIs, FMA&RD	FGN (ECN, FMEd.)	*	*	*
	(e) Encouraging the use of recycled materials for the production of components and spare parts for biomass systems.	ECN, FMEnv.	SMEDAN, SON, FMIT&I	FGN (ECN, FMEnv.), OPS	*	*	
(vii) Promoting electricity and heat generation from biomass waste.	(a) Reviewing periodically feed in tariff for biomass based electricity.	NERC	FMP, ECN, NARICT	FGN (NERC)	*	*	*
	(b) Putting in place regulation and standards on biomass technology for energy generation.	ECN, FMST, SON	FMP, ECN, OPS	FGN(ECN, SON)	*	*	
	(c) Installing suitable biomass conversion technologies at waste disposal sites.	ECN, FMENv	FMEnv., OPS	FGN (FMEnv.)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(viii) Mainstreaming waste-to-energy strategy in the overall waste management framework,.	(a) Conducting waste to energy technology needs assessment.	FMST, ECN	FMEnv., OPS, ARCN	FGN (FMST, ECN), OPS	*	*	*
	(b) Promoting the adoption of appropriate waste to energy technologies .	ECN, FMST	FMEnv., FMP, OPS, FMA&RD	FGN (FMST, ECN), OPS	*	*	*
	(c) Creating awareness on the potential of waste as an energy resource through workshops, conferences etc .	ECN, FMST	FMEnv., FMP, OPS, CSOs, NGOs	FGN (ECN)	*	*	*
	(d) Promoting waste sorting programmes in major cities.	FMEnv.	NESREA, SGs, EPAs, LGAs, OPS, NGOs	FGN(FMEnv.), SGs	*	*	*

7.2 FUELWOOD

7.2.1 Policies

i. The nation shall promote the use of alternative energy sources to fuelwood.

ii. The nation shall promote improved efficiency in the use of fuelwood.

iii. The nation shall de-empasize the use of wood as a fuel shall in the nation's energy mix.

iv. The nation shall intensify efforts to increase the percentage of land mass covered by forests in the country.

v. The nation shall ensure that harvested areas are regenerated.

vi. The nation shall promote the commercial growing of fuel wood and improve energy efficiency in the use of fuel wood.

vii. The nation shall promote energy conservation, efficiency and use of alternative energy source to fuel wood.

7.2.2 Objectives

i. To conserve the forest resources of the nation.

ii. To greatly reduce the percentage contribution of fuelwood consumption in the domestic, agricultural and industrial sectors of the economy.

iii. To arrest the ecological problems of desert encroachment, soil erosion and deforestation.

iv. To facilitate the use of alternative energy resources to fuelwood.

v. To reduce health hazards arising from fuelwood combustion.

vi. To significantly reduce the quantity of particulate matter and gases emitted from fuel wood utilization, whilst of maintaining the benefit of woodfuel to ensure sustainability of natural resources.

vii. To invest in community education/sensitization regarding benefit and disadvantages of using wood for energy.

viii. To ensure that forest green house gas balance is maintained.

7.2.3 Action Plan

Table 7.2: Fuelwood Development Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Cultivating fast growing tree species needed to accelerate the regeneration of forests.	(a) Identifying non-invasive fast growing indigenous tree species.	ECN, NIFOR, RRIN, CRIN	FMST, FMA&RD, ARCN, FMEnv.	FGN (ECN, FMA&RD)	*	*	*
	(b) Identifying & sourcing suitable foreign fast growing tree species.	RRIN, CRIN, NIFOR	FMA&RD, FMST, FMEnv., ARCN.	FGN (ECN, FMA&RD, NARIs)	*	*	*
	(c) Developing nurseries and intensifying the cultivation of plantation of fast growing trees/plants.	NABDA, RRIN, CRIN	FMST, RCs, RIs, TIs, FMA&RD, FMEnv., ARCN	FGN (FMA&RD, FMEnv., NABDA, NARIs)	*	*	*
	(d) Developing indigenous human and institutional capacities in the genetic manipulation of fast growing tree/plantspecies.	FMEnv., RRIN, NIFOR, CRIN, NABDA	FMST, FMA&RD, ARCN, RCs, NARIs, TIs	FGN (FMEnv, NABDA), DPs	*	*	*
	(e) Establishing more shelter belts in the semi-arid frontal states and woodlots in the buffer states.	FMEnv., SGs	FMST, FMA&RD, DPs, RCs, RIs, TIs	FGN(FMEnv.), SGs, DPs	*	*	*
(ii) Developing appropriate technologies for the utilization of alternative energy sources to fuelwood.	(a) Developing indigenous capacity in the design, development, installation and maintenance of Renewable Energy Technologies.	ECN, NOTAP, NASENI	FMP, FMEnv., FMST, RCs, RIs, TIs, FMWA&SD, NGOs	FGN (ECN, NOTAP, NASENI), OPS	*	*	*
	(b) Identifying and developing appropriate R&D activities.	FMST, ECN	FMEnv., FMWA&SD, NASENI, NABDA, RCs, RIs, TIs	FGN (FMST, ECN), OPS	*	*	*
(iii) Developing appropriate efficient wood stoves in the short term.	(a) Building indigenous capacity in the design, development, installation and maintenance of efficient wood stoves and briguetting machines.	ECN	FMST, NGOs, FMWA&SD, FMEnv., NAPEP, SGs, RCs, RIs, TIs, NBTE	FGN (ECN, NAPEP)	*	*	*
	(b) Identifying, and embarking on relevant R&D activities.	ECN	FMEd., FMST, NGOs, FMWA&SD, FMEnv., NAPEP, SGs, TIs, RIs, RCs,	FGN (ECN, NAPEP)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(iv) Encouraging the establishment of private and community woodlots for supply of fuelwood in the short term.	(a) Developing and siting of woodlot Pilot schemes.	ECN, FMA&RD, FMEnv.	SGs, LGCs, CBOs	FGN (ECN, FMA&RD)	*	*	
	(b) Sensitizing and mobilizing CBOs and NGOs.	ECN	FMEnv., SGs, LGCs, FMA&RD, DPs , CBOs, NGOs	FGN (ECN, FMA&RD)	*	*	
(v) Establishing micro-credit facilities for entrepreneurs, especially for women groups, for the establishment and operation of commercial fuelwood lots and the production of renewable energy devices and systems.	(a) Encouraging the establishment of CBOs and NGOs, especially women-based.	FMEnv.	NPC, SGs, LGCs, FMA&RD, ECN, DPs, CBOs, NGOs, SMEDAN, NDE	FGN(FMEnv.), DPs	*	*	*
	(b) Establishing adequate and appropriate micro-credit facilities.	SMEDAN, FMWA&SD	SGs, LGCs, FMA&RD, ECN, FMEnv., DPs, CBOs, NCWS	FGN (SMEDAN, FMWA&SD), DPs	*	*	*
	(c) Ensuring easy and regular access to micro-credit facilities.	SMEDAN, FMWA&SD	SGs, LGCs, FMA&RD, ECN, FMEnv., DPs, CBOs, NCWS	FGN (FMWA&SD)	*	*	*
	(d) Building indigenous women capacity in the design, development and fabrication of RET devices and systems.	ECN, FMWA&SD	FMST, OPS, SGs, LGCs, FMA&RD, FMEnv., DPs, CBOs, NCWS	FGN(ECN, FMWA&SD), DPs	*	*	*
	(e) Sensitizing the public especially women on available relevant micro credit facilities.	ECN, FMWA&SD	NCWS, CBOs, NGOs, DPs, SMEDAN	FGN (ECN, FMWA&SD), DPs	*	*	*
	(f) Encouraging local entrepreneurship in RET.	ECN, SMEDAN	FMWA&SD, NCWS, CBOs, NGOs, DPs	FGN (ECN, SMEDAN), DPs	*	*	*
(vi) Ensuring the availability and effective distribution of alternative energy sources to fuelwood at all times.	(a) Identifying viable RE alternatives.	ECN	OPS, DPs, FMST, RCs, RIs, TIs	FGN (ECN)	*	*	
	(b) Ensuring mass Production and diffusion of the identified alternative RET.	ECN	FMIT&I, SMEDAN, OPS, TIs, RCs, RIs, DPs, FMST	FGN (ECN, FMIT&I)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(vii) Establishing training programmes on the use, maintenance and fabrication of efficient woodstoves and other alternative technologies.	(a) Conducting training and sensitization workshops with appropriate monitoring & evaluation mechanism to assess effectiveness.	ECN	NDE, FMST, FMWA&SD, RCs, RIs, TIs	FGN (ECN), OPS	*	*	*
	(b) Incorporating RET into the educational curricula at all levels.	FMEd., ECN, NERDC	NUC, NBTE, NCCE	FGN (FMEd., ECN)	*	*	*
(viii) Organizing systematic public enlightenment campaigns on the problems of desertification and soil erosion arising from deforestation.	(a) Conducting public awareness workshops, seminars, lectures etc.	ECN, FMEnv.	FMA&RD, FMWA&SD, NGOs, CBOs, RCs, RIs, TIs, FMI, NOA	FGN (FMEnv., ECN)	*	*	*
	(b) Designing and sponsoring publicity in electronic and print media.	FMEnv., ECN	FMA&RD, FMWA&SD, NOA, NGOs, CBOs, OPS, DPs, SGs, LGCs	FGN (FMEnv., ECN)	*	*	*
	(c) Continuing the national tree planting campaign.	FMEnv.	ECN, SGs, LGCs, NGOs, CBOs, DPs	FGN (FMEnv.), DPs	*	*	*
(ix) Ensuring the existence of effective forestry laws to stop the willful felling of trees.	(a) Reviewing and strengthening the relevant forestry laws.	FMEnv.	FMA&RD, LGCs, FMWA&SD, FMJ, ECN, NASS, SGs	FGN (FMEnv.)	*	*	
(x) Ensuring effective enforcement of the forestry laws.	(a) Providing adequate facilities and motivation for relevant forestry personnel for effective enforcement of the laws.	FMEnv.	FMA&RD, FMJ, NGOs, CBOs, SGs, LGCs, DPs	FGN (FMEnv.)	*	*	*
(xi) Disseminating the alternative technologies to fuelwood through extension programmes, pilot plants, etc.	(a) Developing and siting of appropriate pilot and demonstration schemes.	ECN	FMA&RD, FMEnv., FMWA&SD, NGOs, CBOs, DPs, OPS	FGN (ECN), OPS, DPs	*	*	*
	(b) Conducting public enlightenment workshops, seminar, lectures etc.	ECN	FMA&RD, FMEnv., NOA, NGOs, CBOs, FMWA&SD, DPs	FGN (ECN), DPs	*	*	*
	(c) Designing and sponsoring Publicity through the print and electronic media.	ECN	FMA&RD, FMEnv., FMWA&SD, NOA, NGOs, CBOs, DPs	FGN (ECN), DPs	*	*	*
	(d) Training extension workers on the applications, installation, and maintenance of RET.	ECN	FMA&RD, FMEnv., FMWA&SD, NGOs, CBOs, DPs	FGN (ECN), DPs	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(xii) Increasing the area covered by forest reserves.	(a) Creating nurseries across the country.	FMEnv., FMA&RD, NARIs	DPs, RCs, RIs, TIs, Ecological Fund, LGCs	FGN (FMEnv., FMA&RD), OPS, DPs	*	*	*
(xiii) Setting up an effective system of forest regeneration.	(a) Creating and maintaining nurseries.	FMEnv., FMA&RD, NARIs	DPs, RCs, RIs, TIs, Ecological Fund, LGCs	FGN (FMEnv., FMA&RD), OPS, DPs	*	*	*
	(b) Replacing aging trees regularly.	FMEnv.	FMA&RD, DPs, RCs, RIs, Ecological Fund, LGCs	FGN (FMEnv.), OPS, DPs	*	*	*
(xiv) Developing an appropriate pricing structure to encourage substitution from fuelwood to alternative fuel types.	(a) Developing and promoting Market for RET.	ECN	NIPC, SMEDAN, FMEnv., FMF, FMWA&SD	FGN (ECN)	*	*	*
	(b) Providing appropriate incentives for the utilization of alternative fuel types.	ECN, NIPC	FMEnv., FMF, FMWA&SD, DPs	FGN (ECN), DPs	*	*	*

7.3 BIOFUELS

7.3.1 Policies

i. The nation shall improve on the link between the agricultural sector and the energy sector.

ii. The nation shall promote the blending of biofuels as a component of fossil-based fuels in the country as required for all automotive use. The blend shall involve the process of upgrading fossil-based fuels.

iii. The nation shall promote investments in the biofuels industry.

iv. The nation shall grant biofuels pioneer status for an initial 10-year period with the possibility of additional 5-year extension.

v. The nation shall support the emergence of an industry in which substantial portion of feedstock used by biofuel plants will be produced by large – scale producers and out growers.

vi. The nation shall ensure that biofuel industry benefit from carbon credit.

7.3.2 Objectives

i. To gradually reduce the nation's dependence on fossil fuels while at the same time creating a commercially viable industry that can precipitate sustainable domestic job.

ii. To gradually reduce environmental pollution.

iii. To firmly establish a thriving biofuel industry utilizing agricultural products as a means of improving the quality of automotive fossil-based fuels in Nigeria.

iv. To promote job creation, rural and agricultural development, and technology acquisition and transfer.

v. To provide a framework capable of attracting foreign investment in the biofuels industry.

vi. To streamline the roles of various tiers of government in order to ensure an orderly development of the biofuels industry in Nigeria.

vii. To involve the oil and gas industry in the development of biofuels in Nigeria.

7.3.3 Action Plan

Table 7.3: Biofuels Development Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Encouraging integrated (plants and plantations) biofuels operators to set up agricultural service companies to support out – growers scheme.	(a) Collaborating with farmers associations/ cooperatives to set up agricultural service companies.	ECN, FMA&RD	NNPC, NGOs, CBOs, DPs, RCs, RIs, TIs, FMEnv., OPS, BPE, AFAN	FGN (ECN, FMA&RD), OPS, DPs	*	*	*
	(b) Providing incentives for agricultural service companies eg soft loans, tax holidays, duty waivers etc.	FMA&RD, BOA, NIPC	OPS, NNPC, FMF, NCS, FIRS, FMIT&I	FGN (BOA, FMA&RD, NIPC)	*	*	*
(ii) Mandating biofuel producers to establish public private patnership with biofuels feedstock out – growers.	(a) Registering all feedstock outgrowers as a means of enhancing partnership.	ECN, FMA&RD	FMST, AFAN, NGOs, RCs, RIs, TIs, FMEnv., OPS, NIPC, BPE, NNPC	FGN (ECN, FMA&RD), OPS	*	*	*
	(b) Setting minimum technical know-how for due diligence on potential Biofuel partners.	FMIT&I, ECN, SON	FMST, NGOs, RCs, RIs, TIs, FMEnv, OPS, NIPC, BPE, FMA&RD, NNPC	FGN (ECN, FMIT&I, SON)	*	*	*
	(c) Ensuring regulatory / legal safeguards for PPP and equitable level of profit repatriation.	FIRS, CBN	FMJ, FMST, ECN, OPS, NIPC, BPE, FMA&RD, FMF, NOTAP	FGN (FIRS, CBN)	*	*	
(iii) Facilitating easy market entry for intending biofuel operators through supportive regulations on biofuel activities.	(a) Implementing policy guidelines , procedures and regulating the supply, distribution and use of biofuels for automotive consumption.	DPR, NNPC	ECN, OPS, SON	FGN (NNPC), OPS	*	*	*
	(b) Initiating the Bill for Biofuels use mandate in Nigeria.	ECN, FMST, NNPC	NASS, FMJ, MPR, PPPRA, DPR, SON	FGN (ECN, FMST)	*	*	
	(c) Supporting land acquistion and utilization.	ECN, FMST	FMA&RD, FMLH&UD, SGs	FGN (ECN, FMST)	*	*	
	(d) Enacting and enforcing Biofuels usage Act Mandate on use of E5, E10, B10 and B20 in Nigeria.	DPR, FMJ, NNPC	NASS, SON, ECN	FGN (DPR, FMJ)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(e) Developing appropriate pricing mechanism for biofuels and biofuels blended petroleum liquid fuels.	PPPRA	NNPC, OPS, MPR, DPR, FMF	FGN (MPR, PPPRA)	*	*	
	(f) Preparing biofuels purchase agreement framework to ensure fair margin to producers and blenders.	PPPRA	NNPC, OPS, MPR, DPR, FMF	FGN (MPR, PPPRA)	*	*	
	(g) Creating awareness on the benefits of biofuels to the economy.	ECN, NNPC	MPR, FMST, NASS, MDAs	FGN (ECN, NNPC)	*	*	
(iv) Granting pioneer status-tax holiday to all registered businesses engaged in biofuels related activities.	(a) Identifying all registered businesses engaged in activities related to biofuels production.	MPR, FMA&RD, ECN	SMEDAN, OPS, FMF, NNPC, FMIT&I, NIPC	FGN (MPR, ECN, FMA&RD)	*	*	*
	(b) Maintaining a database of all registered biofuel companies.	DPR, ECN	NBS, SMEDAN, OPS, CAC, NNPC, FMIT&I	FGN (DPR, NBS, ECN)	*	*	
	(c) Developing simplified procedures for granting pioneer status to biofuel companies.	NIPC, FIRS	ECN, OPS, FMF, NNPC, FMIT&I	FGN (NIPC, FIRS)	*	*	*
(v) Granting 10 – year import duty waiver for biofuels equipment not produced locally.	(a) Granting waivers on import duties to all identified biofuel companies.	NCS, FIRS	ECN, OPS, FMF, NNPC, DPR, FMIT&I	FGN (FIRS, NCS)	*	*	
(vi) Exempting biofuel companies from taxation, withholding tax and capital gains tax in respect of interest on foreign loans, dividends and services rendered from outside Nigeria to biofuel companies by foreigners.	(a) Registering and licencing of all identified biofuel companies with the relevant agency.	DPR	FIRS, ECN, OPS, FMF, NNPC, FMIT&I, SMEDAN	FGN (DPR, NNPC)	*	*	*
	(b) Providing Tax waivers on expatriate services.	FIRS	ECN, OPS, FMF, NNPC, FMIT&I, NIPC	FGN (FIRS)	*	*	*
	(c) Developing criteria, required to qualify as biofuel company.	DPR, ECN	FIRS, ECN, OPS, FMF, NNPC, FMIT&I, NIPC	FGN (DPR, ECN)	*	*	
	(d) Providing waivers on capital gains taxes on foreign loan interests.	FIRS	ECN, OPS, FMF, NNPC, FMIT&I, NIPC	FGN (FIRS, FMF)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(vii) Granting a single digit interest on a prefential loan to be made available to investors in the biofuels industry to aid the development of large-scale out-growers schemes and co-located power generating plants.	(a) Establishing and supporting outgrowers associations.	FMA&RD, BOA	ECN, NGOs, OPS, FMF, NNPC, FMIT&I	FGN (BOI, BOA, CBN)	*	*	*
	(b) Putting in place guidelines for qualification of preferential loan.	BOI, BOA, CBN	ECN, NNPC, FMF, NIPC	FGN(BOA, BOI, CBN)	*	*	
	(c) Enlightening and training of staff of identified financial institutions to facilitate domestic financing of biofuel Industry.	ECN, BOA	BOI, CBN, NEXIM, FMIT&I	FGN(ECN, BOA)	*	*	
	(d) Reviewing existing framework for agricultural sector, and agriciulture related risk hedging.	NDIC, BOA, FMA&RD	FMF, BOI, CBN	FGN (NDIC, BOA, FMA&RD)	*	*	*
(viii) Establishing agro-allied industries capable of benefiting from incentives put in place to foster the development of the agro-allied industry in addition to other incentives.	(a) Formulating and implementing appropriate policy guidelines, regulatory and incentive regimes in the agricultural sector to support the biofuels industry.	FMA&RD, NIPC, ECN	OPS, FMF, NNPC, FMIT&I, BOA	FGN (FMA&RD, BOA), OPS	*	*	
	(b) Creating one stop shops on biofuels business registration, incentives access, and entrepreneurship.	ECN, FMIT&I	ECN, OPS, FMF, NNPC, NIPC, BOA, SMEDAN, FMA&RD, CBN	FGN (ECN, FMIT&I, BOA, CBN), OPS	*	*	
	(c) Developing a monitoring framework for the administration of out-growers schemes.	FMA&RD	ECN, OPS, FMF, NNPC, FMIT&I, NIPC, BOA, CBN	FGN(FMA&RD)	*	*	*
(ix) Establishing a research and development fund to encourage synergy between the private and public sectors in R and D in which all biofuel companies shall contribute 0.25% of their revenue for research in feedstock production, local technology development and improved farming practices.	(a) Developing guidelines on R&D Fund Modalities and Procedures.	ECN	FMST, NNPC, DPs, RCs, RIs, TIs, OPS, FMA&RD, FMF, FMIT&I	FGN (ECN), OPS, DPs	*	*	
	(b) Establishing legislation and legal framework for setting up of the R&D fund.	ECN, FMST, FMJ	NASS, FMF, FMIT&I, FMA&RD, OPS, NNPC	FGN (ECN, FMST, FMJ)	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(x) Persuading biofuel producers to use auditable feedstock weighing equipment and methodologies as may be prescribed.	(a) Coordinating the activities of Agricultural Research Institutes in the country for the development of improved feedstock seed varieties and modern farming practices.	FMA&RD, ARCN	FMST, RCs, RIs, TIs, OPS, FMT&I, NABDA	FGN (FMA&RD, ARCN), OPS, DPs	*	*	*
	(b) Coordinating the activities of relevant research institutes on the development of appropriate technology for the industry.	FMA&RD, ARCN	ECN, FMST, RCs, RIs, TIs, OPS, FMIT&I	FGN(FMA&RD, ARCN)	*	*	*
	(c) Developing methodologies and standard procedures for feedstock weighing.	SON, FMA&RD, Weight & Measure	ECN, OPS, FMIT&I	FGN (SON, FMA&RD), OPS	*	*	*
	(d)Providing guidelines and specifications for feedstock weighing equipment.	SON, FMA&RD, Weight & Measure	OPS, FMST, ECN	FGN (SON, FMA&RD)	*	*	*
	(e) Ensuring technical audit of feedstock weighing equipment and processes.	SON, Weight & Measure	OPS, FMST, ECN, FMA&RD	FGN (SON)	*	*	*
	(f) Encouraging compliance to standards through, compliance checks, awards, ISO certifications etc.	SON	FMA&RD, OPS, FMST, ECN	FGN (SON)	*	*	*

CHAPTER EIGHT

ELECTRICITY

8.0 Introduction

The Electricity Supply Industry (ESI) in Nigeria dates back to 1866 when two small generating sets were installed to serve the Colony of Lagos. In 1951, the electricity Corporation of Nigeria (ECN) was established through an Act of Parliament to cater for all the power supply systems in the country. The Niger Dam Authority (NDA) was subsequently established for the development of hydroelectric power project at Kainji on the River Niger. The two establishments were merged to form the National Electric Power Authority (NEPA) in 1972. The total installed capacity rose from a mere 30MW in 1956 to about 6,000MW in 2006 with a thermal to hydro mix of about 70:30. However, the functioning power stations had a combined installed capacity of about 4,680MW, which is about 70% the total installed capacity.

By the year 2005, the transmission network consisted of 5000km of 330kV lines and 600km of 132kV lines. The 330kV lines fed 23 substations of 330/132kV rating with combined capacity of 6,000MVA or 4,600MVA at utilization factor of 80%. In turn, the 132kV lines fed 91 substations of 132/33kV rating with a combined capacity of 7,800MVA or 5,800MVA at utilization factor of 75%. The distribution grid consisted of 23,753km of 33kV lines and 19,226km of 11kV lines. In turn, these fed 679 substations of 33/11kV rating and 20,543 substations of 33/0.415 and 11/0.415kV ratings. In addition, there were 1,790 distribution transformers and 680 injection transformers.

The per capita consumption of Nigeria ranged from 68 to 95 kWh between 1980 and 1997, which was about 17% of the African average and 2% of that of South Africa. Moreover, only 34% and 45% of the population had access to electricity in 1998 and 2003 respectively. Furthermore, as at the year 2006, 661 (85%) of the 774 Local Government Headquarter (LGHQs) towns were connected to the national grid. Only four (4) of the 36 states plus FCT, namely, FCT, Ekiti, Lagos and Osun states had 100% grid electricity connectivity of their LGHQs while Bayelsa state had none of its LGHQs connected to the national grid. To increase access to electricity by the rural dwellers, the Federal Government under the on-going reform in the electricity sector, has established a Rural Electrification Agency (REA). The reform also makes provision for a Rural Electrification Fund for adequate funding of rural electrification projects in the country.

The fundamental objective of the electricity reform is to “ensure that Nigeria has an electricity supply industry that can meet the needs of its citizens in the 21st century”. Others are to

"modernize and expand electricity coverage" and "support national economic and social development".

The National Electric Power Policy (NEPP, 2002) forms the basis of the provisions of the Electric Power Sector Reform Act (EPSR), which was enacted in March 2005. The Act provides for, among others, the unbundling of the public power sector, the development of a competitive electricity market and the establishment of the Nigerian Electricity Regulatory Commission (NERC) as an independent regulatory agency.

To give effect to its reforms, the Federal Government has invested heavily in the electricity sector and the envisaged deliverables on the investment include an unbundled public power sector resulting in multiple competitive generation and distribution companies; three (3) new gas power plants (of 1,034MW total capacity) already completed; ten (10) new NIPP gas plants in the Niger Delta (of 4,790MW total capacity) with some already completed while others are ongoing. There are two new hydro plants namely Zungeru Hydro Power Plant (700MW) under development and Mambila Hydro Power Plant (3,050MW) under study.There are also about seven (7) new gas plants (of about 2,600 MW total capacity), which are of Joint Venture/IPP category some of which are under construction while others are at an advanced stage of planning.

In a study conducted by the Presidential Advisory Committee on 25-year Power Development Plan, the electricity demand projection for a 10% annual growth of the GDP was given as 16,000 MW, 30,000 MW and 192,000 MW for the years 2010, 2015 and 2030 respectively. The same study also suggested an energy source mix of Nuclear (2%); Hydro (7%); Renewables (10%); Coal (11%) and Natural Gas (70%).

The following section gives the strategies and activities for the realization of the targets envisaged in these studies.

8.1 ELECTRICITY

8.1.1 Policies

i. The nation shall make steady and reliable electric power available at all times, at economic rates, for industrial, economic and social activities of the country.

ii. The nation shall continue to engage intensively in the development of electricity sub – sector, and ensure availablity of local capability along the electricity value chain.

iii. The nation shall continue to promote private sector participation in the electricity sub-sector, while ensuring broad-based participation of Nigerian investors.

iv. The nation shall pursue measures to diversify energy sources for electricity generation.

v. The nation shall encourage the state and local governments to provide access to electricity to the rural areas through off – grid and other rural electrification programmes.

vi. The nation shall continue to engage intensively in the development of the subsector alignment along the electricity supply chain.

vii. The nation shall ensure a sustainable supply of gas for electricity generation.

8.1.2 Objectives

i. To provide electricity to all state capitals, local government headquarters as well as other major towns by the year 2020.

ii. To stimulate industrialization in the rural areas in order to minimize rural-urban migration.

iii. To provide reliable and stable power supply to consumers, especially to industries.

iv. To ensure the removal of bottlenecks militating against the utilization of the full capacity of the existing electric power plants and building of new capacities.

v. To broaden the energy options for generating electricity.

vi. To attract adequate investment capital, both foreign and domestic, for the development of the electricity industry.

vii. To maximize access by Nigerians to the investment opportunities in the electricity industry.

viii. To ensure electric power security.

ix. To make reliable electricity available to 75% of the population by the year 2020 and 100% by 2030.

x. To provide enabling environment for the local manufacture of electrical components within the country.

8.1.3 Action Plan

Table 8.1: Action Plan in the Electricity Sector

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Strengthening the institutional framework for the operational and regulatory aspects of the electricity industry.	(a) Periodic review of the electricity laws and guidelines.	NERC, FMP	NASS, ECN	FGN (FMP)	*	*	*
	(b) Promote an efficient market structure in the electricity industries.	NERC	GENCOs, DISCOs, TCN, FMP, FMF	FGN (NERC)	*	*	*
(ii) Establishing a viable cost reflective tariff that will encourage the private power sector.	(a) Periodic review of the exisiting Multi-Year Tariff Order (MYTO).	NERC	FMP, GENCOs, DISCOs, TCN, NBET, FMF	FGN (NERC)	*	*	*
(iii) Rehabilitating existing power plants in order to derive optimum power from the installed capacity.	(a) Regular evaluation of the performance of power generating plants.	NERC	FMP, GENCOs, DISCOs, TCN, ECN	FGN (NERC)	*	*	*
	b) Total overhauling of power plants for greater efficiency	GENCOs	NERC, FMP, **NDPHCN**	GENCOs, DISCOs, TCN	*	*	*
	(c) Carry out preventative and turn around maintenance schedules.	GENCOs, DISCOs, TCN	NNPC, OPS, NERC	GENCOs, DISCOs, TCN	*	*	*
	(d) Organise regular specialised trainings for all staff in the electricity industries.	NAPTIN	FMP, GENCOs, DISCOs, TCN	FGN (NAPTIN)	*	*	*
(iv) Completing on-going projects designed to enable the Nigerian Electricity Supply Industry satisfy the national demand.	(a) Fast-tracking the completion of all on-going Government funded generation, transmission and distribution projects.	FMP	NERC, ECN, BPE, REA, GENCOs, DISCOs, TCN, NIPPs	FGN (FMP)	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(b) Encouraging the IPPs to fast track the completion of their on-going projects on schedule.	FMP, NBET	NERC, OPS, DPs, NIPPs	FGN (FMP)	*	*	
	(c) Ensuring the fast tracking of the commencement of all proposed electricity projects.	FMP	NERC, GENCOs, DISCOs, TCN, BPP NIPPs, FMF	FGN (FMP)	*	*	
(v) Reinforcing the transmission network and supporting the development of the distribution network expansion necessary to allow consumers to enjoy steady and reliable supply of electricity.	a) Rehabilitating, upgrading and continuous expansion of the national grid for a steady and reliable power supply.	TCN	FMP, NERC, OPS, ECN, FMF, REA	FGN (TCN)	*		
(vi) Encouraging research and development in the generation, transmission and distribution of electricity.	(a) Designing research and development portfolio for the Electricity Supply Industry.	FMP	NAEC, ECN, FMST, MAN, NERC, TIs, RIs	FGN (FMP)	*	*	*
	(b) Establishing Electricity Research and Development Fund.	FMP	NASENI, FMJ, REA, ECN	FGN (FMP)	*	*	*
	(c) Continuous funding and patenting of relevant research outputs.	FMP	NERC, OPS, RCs, RIs, TIs, NAPTIN, OPS, DPs, ECN, FMIT&I, FMF	FGN (FMP), OPS	*	*	*
(vii) Regulating import duties to be paid on generation, transmission and distribution materials/equipments utilized in the whole electricity supply chain, to encourage investment and local production of power components.	(a) Reviewing existing duties and taxes on ESI equipment with a view to making them more investor-friendly	FMF, FMIT&I	NERC, ECN, FIRS, BPE, NIPC, OPS, FMP, SMEDAN	FGN (FMF)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(viii) Encouraging onshore training facilities as a primary source of human capital capacity development in the power sector.	(a) Fast tracking the commencement and completion of legal and administrative work on the setting up of of various Electricity Supply Training Institutes in each geopolitical zone.	FMP	ECN, FMEd., TCN, GENCOs, DISCOs, , NERC, NAPTIN, DPs	FGN (FMP)	*	*	*
	(b) Providing the legal, fiscal, administrative and regulatory environment for the setting up of small scale foundries and machine shops dedicated to the ESI within the various Electricity Supply Training Institutes in each geopolitical zone.	FMP	ECN, FMJ, FMEd., OPS, NERC, NAPTIN, NASENI, DPs	FGN (FMP)	*	*	
(ix) Ensuring the participation and involvement of indigenous engineers and applied research groups in the execution of on-going and future projects right from feasibility studies, with the objective of establishing local capacity in the long term.	(a) Involving the various relevant professional bodies in the ESI projects by alerting them on all tender adverts and work plans.	FMP	ECN, BPE, BPP, OPS, RCs, RIs, TIs, NERC, TCN, GENCOs, DISCOs, Relevant Professional Bodies	FGN (FMP)	*		
	(b) Designing and implementing regular training programmes for the indigenous private sector to enable their full participation in the ESI.	NAPTIN	ECN, NASENI, OPS, TCN, GENCOs, DISCOs, FMP	FGN (NAPTIN)	*		
(x) Developing a bankable feasibilty studies for development of Renewable, coal, nuclear and large hydropower sources for power generation.	(a) Reviewing existing information on hydropower, gas- and coal- plants potentials.	ECN, FMP	REA, FMP, NIPPs, GENCOs, TCN, DISCOS, RCs, RIs, TIs	FGN (ECN)	*	*	
	(b) Conducting feasibility studies for already identified potential sites for hydro, gas and coal-fired plants.	FMP, ECN	REA, NIPPs, OPS, RCs, RIs, TIs	FGN (FMP, ECN), OPS	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(xi) Creating enabling environment, such as Feed –in - Tariff and Model PPP that will encourage power system development in renewable, coal, nuclear and large hydropower sources for power generation.	(a) Ensuring an adequate Feed-in-Tariff that encourage power system development in renewable, coal, nuclear and large hydropower sources for power generation.	NERC	REA, FMP, NIPPs, GENCOs, TCN, DISCOS, RCs, RIs, TIs	FGN (NERC)	*	*	*
	(b) Creating enabling environment through an adequate PPP model that will encourage power system development in renewable, coal, nuclear and large hydropower sources for power generation.	FMP, ICRC	REA, NIPPs, GENCOs, TCN, DISCOS, RCs, RIs, TIs	FGN (FMP)	*	*	*
	(c) Establishing dedicated institutions for renewable energy, coal, nuclear and hydropower sources for planning.	ECN	FMWR, FMP, NNRA, NAEC, MMSD FMEnv.	FGN (ECN, NNRA)	*	*	
	(d)Establishing R&D and testing facilities for Renewable energy.	ECN	FMWR, FMP, NNRA, NAEC, MMSD, TIs, RIs, RCs, NNPC	FGN (ECN)	*	*	
	(e) Providing adequate grid capacity for connection to RE power plants.	TCN	FMP, ECN, NERC, FMWR, OPS	FGN (FMP), OPS	*	*	*
(xii) Intensifying national effort in training, research and development in using nuclear, solar, wind and other renewable resources for electricity generation.	(a) Ensuring the setting up of a national S & T Coordinating body with set objectives, goals, and targets, to oversee Federal government-sponsored R & D efforts.	ECN	FMST, FMP, NAEC, NNRA, RCs, RIs, TIs, FMWR	FGN (ECN), OPS	*	*	*
	(b) Reviewing R&D activities for RE and identifying opportunities for further R&D.	ECN	FMST, FMP, NAEC, NNRA, RCs, RIs, TIs, FMWR, NAPTIN	FGN (ECN), OPS	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(c) Increasing progressively the proportion of RE thereby addressing the problem of global warming.	ECN	FMST, FMP, NAEC, NNRA, RCs, RIs, TIs, FMWR, NAPTIN, FMEnv.	FGN (ECN), OPS	*	*	*
	(d) Ensuring the use of nuclear energy for power production to encourage optimum mix thereby increasing national energy.	NAEC	FMST, ECN, FMP, NERC, NNRA, FMEnv., MMSD	FGN (NAEC)	*		
(xiii) Taking effective measures to ensure the security of electricity supply components within the value chain.	(a) Reviewing and enforcing the existing laws on vandalization of public utility infrastructure.	FMP	NASS, NPF, AF, NGOs, OPS, Community Leaders, FMJ	FGN (FMP), OPS	*	*	*
	(b) Sensitizing the general public on the ills of vandalizing public utility infrastructure.	NOA	ECN, FMP, FRCN, NTA, FMI, OPS, NPF, Community Leaders, AF, FMJ	FGN (NOA)	*	*	*
(xiv) Providing appropriate incentives and support to entrepreneurs to ensure adequate returns on investment.	(a) Ensuring provision of the legal, fiscal, administrative and regulatory environment to entrepreneurs.	NIPC	ECN, NERC, BPE, FMIT&I, OPS, FMP, FMF	FGN (NIPC)	*	*	*
(xv) Providing enabling environment and encouraging financial institutions to support indigenous investments in the electricity industry.	(a) Reviewing and updating existing facilities and providing new ones as necessary to support indigenous investments in the ESI.	NIPC	ECN, OPS, FMF, CBN, BOI, FMP	FGN (NIPC)	*	*	*
(xvi) Encouraging off-grid generation and supply of power in remote or isolated areas.	(a) Designing & implementing a long-term coordinated programme for rural electrification based on distributed decentralized generation.	REA	FMP, ECN, NERC, OPS	FGN (REA), OPS	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(xvii) Operating the Rural Electrification Fund to facilitate electrification in the rural areas.	(a) Ensuring effective administration of Rural Electrification Fund.	REA	NERC, FMP, FMF, DPs, ECN	FGN (REA, FMF)	*	*	*
	(b) Periodic review of regional/rural electricity policies.	FMP	REA, NERC, NPC, ECN	FGN (FMP)	*	*	
	(c) Upgrading of existing rural power grids to meet the technical standards.	FMP	REA, NERC, ECN	FGN (FMP)	*	*	*
	(d) Exploring new and renewable energy sources to supply electricity to the remote communities.	FMP	ECN, RIs, TIs, FMEnv., REA	FGN (FMP)	*	*	*
(xviii) Establishing a reduced tariff regime for low income and especially physically challenged electricity consumers and a mechanism for funding the subsidy within the cost reflective tariff structure.	(a) Reviewing the implementation strategy of the existing mechanism for lifeline tariff as in the rural electrification section of the ESPR Act.	NERC	REA, FMF, ECN, OPS, CBOs, NGOs, Community Leaders	FGN (NERC)	*		
	(b) Making available and periodic review of the lifeline tariffs and cross-subsidies to all stakeholders, particularly at the local government level.	NERC	NBET, FMP, FMF, OPS, ECN, NOA, REA	FGN (NERC)	*		
(xix) Carrying out as necessary, the National Electricity Demand Study, to cover 20 to 25 years, and to be updated every 5 years.	(a) Embarking on annual electricity demand survey exercises to capture total electricity supply viz – a – viz electricity consumed at the sectorial level.	TCN	ECN, FMP, NERC, GENCOs, DISCOs, NBS, NPC	FGN (TCN)	*	*	*
	(b) Compiling, documenting and periodic update of the National Electricity Demand Study findings.	FMP, TCN	ECN, NERC, GENCOs, DISCOs, NBS, NPC	FGN (FMP)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(xx) Ensuring a balanced electricity supply mix.	(a) Reviewing, collating and updating electricity grid and off - grid systems sites within the country.	ECN, TCN	FMP, NERC, GENCOs, DISCOs, REA, NBS	FGN (ECN)	*	*	*
	(b) Monitoring future Power projects to achieve balanced electricity supply mix as well as meeting technical standards.	FMP, TCN	NERC, ECN, NBET, BPP	FGN (FMP)	*	*	*
(xxi) Establishing commercial bankable agreement, within the chain.	(a) Strenghting the mandates and activities of relevant institutions such as the Nigerian Bulk Electricity Trading (NBET) Plc.	FMP	NBET, NERC, ECN OPS, FMF	FGN (FMP)	*	*	*
(xxii) Establishing and strenghtening basic engineering infrastucture for the local manufacture of power systems components.	(a) Setting up R&D centres' facilities for Power components design and fabrication.	FMP	ECN, NERC, NASENI, FMWR, DISCOs, GENCOs, TCN, TIs, RIs, FMST, NOTAP, NAPTIN	FGN (FMP)	*	*	*
	(b) Incoporating curricula/subjects that covers the area of power components design and fabrication to train electrical engineering students whithin the Higher Institutions.	FMP	NUC, FMEd., FMST, NAPTIN, ECN, COREN, NSE, TIs, RIs	FGN (FMP)	*	*	*
	(c) Designing and implementing a regular training programmes in areas of Power components design and fabrication in recognized training outfits like NAPTIN.	NAPTIN	FMP, COREN, NSE	FGN (NAPTIN)	*	*	*

CHAPTER NINE

ENERGY UTILIZATION

9.0 Introduction

Nigeria is endowed with enormous energy resources ranging from the established ones such as oil, gas, coal, large hydro and biomass to the potential ones such as solar, small hydro, wind, nuclear, ocean, hydrogen fuel and geothermal. However, the exploitation and utilization of the established energy sources and the development of the potentials ones have remained intractable national challenge due to grossly inadequate indigenous technical capacity and prohibitive cost of foreign expertise.

Commercial production of crude oil started in December 1957, with the first exports in 1958. Coal production peaked in 1959 and has experienced continued decline since then, due in part to the dieselization of the railways in the 1960s and to the decline and eventual stoppage of power production from coal. The first gas turbine power plant was built at Afam, near Port-Harcourt, in 1965 with an initial capacity of 56MW. The first domestic refinery with a capacity of 60,000 bpd was also commissioned in Port-Harcourt in 1965,while the first hydroelectric power plant at Kainji, with an initial capacity of 320MW, started operations in 1968. These developments signalled the beginning of the change in the structure of the energy sector from coal to petroleum dominance of commercial energy. They also signalled the beginning of the eventual dominance of the economy by the energy sector, especially by the oil and gas sub-sector.

Prior to the 1960s, energy utilization constituted, very predominantly, of non-commercial energy, namely, fuelwood, charcoal, agricultural wastes and residues as well as solar radiation. The major commercial fuel was coal, which was used by the railways and for power generation. Modest contributions came from petroleum products (petrol and diesel) and electricity (from coal and diesel generators). The structure of energy utilization has drastically changed since then. By 2013, out of total primary energy consumption of 81.92Mtoe, natural gas accounted for 10.38%, fuelwood (21.49%), petroleum products (22.29%) and hydropower (0.72%), while coal contribution had declined to an insignificant level 0f 0.03% as shown in Table 9.1 and Figure. 9.1.

TABLE 9.1 Total Primary Energy Consumption in Nigeria (2013)

Energy Form	Consumption (TOE)	%
Hydropower	588,384.97	0.72
Fuelwood	54,539,027.42	66.58
Petroleum Products	18,258,605.52	22.29
Coal	28,132.48	0.03
Natural Gas	8,502,790.95	10.38
Total	**81,916,941.34**	**100**

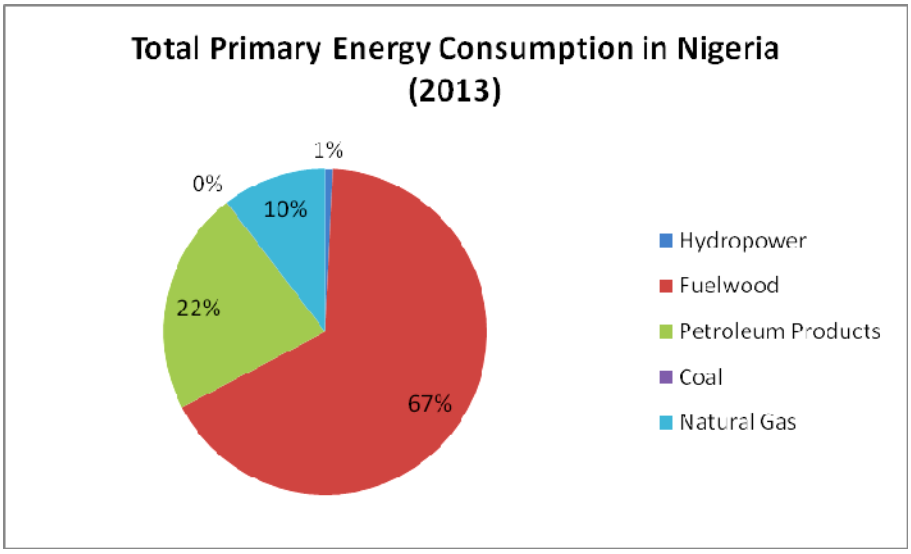

Figure 9.1: Total Primary Energy Consumption in Nigeria (2013)

9.1 INDUSTRY

9.1.1 Policies

i. The nation shall ensure that an adequate supply of energy is made available.

ii. The nation shall place emphasis on local sourcing of all the energy types to be used by industries.

iii. The nation shall pursue the optimal utilization of its available energy types for the various industrial activities shall be pursued in an environmentally sustainable manner.

iv. The nation shall ensure energy efficiency and conservation in industry.

v. The nation shall enhance the growth of cottage and small-scale industries through adequate supply of energy for the production processes.

9.1.2 Objectives

i. To encourage maximum capacity utilization by industries.

ii. To remove the burden of capital investments in energy supply infrastructure from the industries.

iii. To ensure national security and self-reliance.

iv. To ensure a balanced mix in the use of the nation's energy resources in the industrial sector.

v. To ensure long term availability of the nation's energy resources through the encouragement of energy conservation practices.

vi. To ensure the efficient utilization of all energy types in industrial activities.

vii. To use energy in such a manner as to ensure minimal negative environmental impact as a result of industrial activities.

viii. To ensure the development of adequate energy management capabilities (human and equipment) in the industrial sector.

ix. To meet the full requirements of industrial activities.

9.1.3 Action Plan

Table 9.2: Action Plan for Energy Utilization in the Industry Sector

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Establishing a data bank on energy supply, demand and consumption in the industrial sector.	(a) Enacting a law mandating industries to provide energy and allied data on their energy supply, demand and consumption on a quarterly basis to the ECN.	ECN	FMIT&I, ND, OPS, MAN, NBS, CBN, CAC, NASS, FMJ	FGN (ECN)	*	*	
	(b)Developing a database on energy supply, demand and consumption in the industrial sector.	ECN	FMIT&I, OPS, ND, MAN, NBS, CBN, CAC	FGN (ECN)	*	*	*
	(c) Sensitizing the industrial sector on the need for an industrial energy database.	ECN	NBS, CAC, OPS , FMIT&I, DPs, FMI	FGN (ECN)	*	*	
	(d) Demarcating industrial from residential areas for proper distribution of electricity.	FMLH&UD	FMP, ECN, MAN, NBS, CAC, OPS , FMIT&I, DPs	FGN (FMLH&UD)	*	*	*
(ii) Intensifying research and development efforts to determine the appropriate energy types for different industrial applications.	(a) Conducting studies and surveys on energy utilization in industry with emphasis on energy efficiency.	ECN	FMST, OPS, DPs, FMIT&I, NBS, FMP	FGN (ECN)	*	*	
	(b) Funding energy management R & D adequately with well-enunciated deliverables and targets.	ECN	FMST, OPS, DPs, FMIT&I, TIs, RIs, FMF	FGN (ECN)	*	*	*
	(c) Encouraging collaborative R & D between tertiary institutions, research centres & institutes, and industries.	ECN	FMST, OPS, FMIT&I, RCs, TIs, RIs, DPs, MFA	FGN (ECN), OPS	*	*	*
	(d) Designing and sponsoring publicity through the print and electronic media on industrial energy management R & D results.	ECN	FMI, NOA, FMST, RCs, RIs, TIs, OPS, DPs	FGN (ECN), OPS, DPs	*	*	*
(iii) Strenghtening institutional arrangements to ensure energy conservation and efficient use of energy in industries.	(a) Designing a National Programme on Industrial Energy Efficiency and Conservation with cooperation of MAN and experts in higher institutions and research centres.	ECN	FMST, OPS, FMIT&I, DPs, MAN, RIs, Tis	FGN (ECN)	*		

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(b) Introducing an industrial energy equipment labelling programme indicating the efficiency of energy consumed (metering).	ECN	OPS, MAN, FMST, DPs, FMIT&I, SON	FGN (ECN), DPs	*	*	
	(c) Encouraging large and medium scale industries to establish energy management units.	ECN	OPS, MAN, FMST, DPs,	FGN (ECN)	*	*	
(iv) Providing adequate incentives to encourage industries to switch over to more appropriate energy types through import custom waivers, for example .	(a) Reviewing existing energy pricing & electricity tariffs mechanisms to accommodate internalizing externalities such as environmental factors.	NERC, NNPC	FMP, FMIT&I, DPs, OPS, MAN, PPPRA, FMF, ECN	FGN (NERC, NNPC)	*	*	*
	(b) Providing adequate & necessary incentives in the energy pricing mechanisms thereby encouraging industries to make the switch over to more appropriate and/or environmentally friendly energy types for their production processes.	FMF	FMIT&I, NERC, OPS, MAN, DPs, PPPRA, NNPC, ECN	FGN (FMF)	*	*	
(v) Ensuring strict compliance with energy related environmental pollution standards.	(a) Reviewing and updating all existing energy-related pollution Codes and Standards for industries.	NESREA	SON, MAN, FMH, FMST, DPs, OPS, ECN, FMEnv., FMIT&I	FGN (NESREA), DPs	*	*	*
	(b) Ensuring strict compliance with all energy related environmental pollution Codes and Standards by industries.	FMEnv., NESREA	SON, FMH, FMST, DPs, OPS, FMEnv., FMIT&I, MAN	FGN (NESREA)	*	*	*
(vi) Ensuring the development of appropriate energy inputs for small scale rural industries.	(a) Developing appropriate and optimal energy inputs for small scale industries in a holistic manner, by industry type, location relative to nearest energy sources, energy source prospecting and processing facilities, etc.	ECN	SMEDAN, FMST, FMP, FMIT&I, NASENI, MAN	FGN (ECN)	*	*	*
(vii) Encouraging industries to sell excess electricity generated to other users.	(a) Sensitizing stakeholding industries on energy efficiency conservation and its implications with respect to excess electricity being generated by such industries.	ECN	FMIT&I , NOA, MAN, FMP, NERC, FMST, FMF	FGN (ECN)	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(b) Encouraging the use of Energy Storage Technologies for easy and accounted transmission.	ECN	FMP, FMIT&I, MAN, SON, NOTAP, FMST, DISCOs, NERC, FMF	FGN (ECN)	*	*	*
	(c) Developing and regularly updating a harmonized electricity tariff plan that will guide industries on sale and/or purchase of excess electricity such as feed – in - tariff.	NERC	ECN, FMP, FMF, MAN, FMIT&I	FGN (NERC)	*	*	*
	(d) Developing an interface for the Management of the industries to access reporting tools.	ECN	NERC, MAN, NPC, NOA	FGN (ECN)	*	*	
(viii) Providing adequate incentives to encourage industries to develop energy management capabilities.	(a) Creating and updating a database carrying detailed information on available energy efficient machineries including comparative technical specifications.	ECN	FMST, MAN, ND	FGN (ECN)	*	*	*
	(b) Sensitizing key players in the industrial sector on the benefits/merits on the use of more energy efficient machineries.	ECN	NOA, MAN, FMST, FMIT&I	FGN (ECN)	*	*	
	(c) Developing Key Performance Indicators (KPIs) guiding energy management capabilities in the industrial sector.	ECN	MAN, NPC,	FGN (ECN)	*	*	
(ix) Implementing energy audits in the industrial sector to identify and quantify the structure of energy supply, demand, utilization patterns, efficiencies and substitution potentials etc., for both the small scale and large-scale industrial enterprises.	(a) Continuous development of efficient energy consumption and supply patterns through comprehensive energy analysis and planning of the nation's energy resources.	ECN	MAN, FMIT&I	FGN (ECN)	*	*	

9.2 TRANSPORTATION

9.2.1 Policies

i. The nation shall vigorously pursue the development of an optimal energy mix for the transport sector with particular attention to gas.

ii. The nation shall ensure regular and adequate availability of all commercially viable fuel types for the transport sector.

iii. The nation shall ensure the use of energy efficient and environmentally friendly technologies in the transport sector.

iv. The nation shall vigourously promote the develpoment of mass transit systems.

v. The nation shall pursue the development of an integrated transportation system through inter-modal transportation systems.

9.2.2 Objectives

i. To establish a rational utilization of available energy types for various transport applications.

ii. To promote a reliable and efficient use of energy with minimal negative environmental impact.

iii. To promote adaptive technology in energy utilization in the transport sector.

iv. To promote efficient and reliable operation of the transport sector so as to enhance economic growth.

v. To promote effective and efficient public transit systems.

vi. To promote inter-modal integration so as to enhance rational and efficient utilization of energy.

vii. To ensure that urban and commercial development planning takes into account the likely implications for transport and energy demand.

9.2.3 Action Plan

Table 9.3: Action Plan for Energy Utilization in the Transportation Sector

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Establishing a databank on the energy consumption pattern of the transport sector.	(a) Enacting a law mandating petroleum marketers/dealers to supply data to the ECN on the fuel sold monthly.	ECN, OPS	FMT, NBS, DPs, OPS, DPR, FMIT&I, NNPC, IPM	FGN (ECN)	*	*	*
	(b) Conducting relevant studies to extract transport fuel consumption from above data which would normally include fuel sold to standby generator owners, grinding/milling machines, construction plants, and other stationary equipment such as compressors, pumping machines, etc.	ECN	FMT, NBS, FMIT&I	FGN (ECN)	*	*	*
(ii) Maintaining adequate stocks of the various transport fuels at levels that will ensure internal fuel security.	(a) Establishing National 90-day Strategic Fuel Depots in each of the six geopolitical zones for stockpiles of transport fuel and other petroleum products.	NNPC	MPR, FMST, FMT, FMF, DPR, OPS	FGN (NNPC)	*	*	*
(iii) Encouraging the development and use of mass transit systems.	(a) Providing adequate mass transit buses.	FMT	FMF, OPS, NAC	FGN (FMT)	*	*	*
(iv) Pursuing and encouragimg the establishment and use of inter – modal system that will ensure rational utilization of energy resources.	(a) Developing the ongoing inter – modal system in the major cities of the Nation.	FGN, SG, FMT	FMF, OPS, NAC	FGN (FMT)	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(v) Using more stingent traffic management and speed limits to reduce travelling speeds on motor ways and there by cutting fuel consumption and transport emissions.	(a) Improving on existing public sensitization programmes on the ills of over speeding and other traffic related offences.	FRSC	FMT, OPS, NOA	FGN (FMT)	*	*	*
	(b) Reviewing, strenghtening and modifying existing laws on speed limits as well as penalties.	FRSC	FMT, FMJ	FGN (FMT)	*		
(vi) Encouraging the use of gas for commercial tri – cycles and private transportation, petrol for private cars and low – powered commercial transportation, electricity, gas, and diesel for commercial mass transit (road and rail), and diesel for inland water, sea and oher heavy powered engines.	(a)Encouraging the present national rail programme for large haulage with emphasis on dieselized and electric train engines.	FMT	ECN	FGN (FMT), OPS, DPs	*	*	*
	(b) Developing a modern urban transportation development plan to phase out environmentally unfriendly motorcycles and their single cylinder, 2-stroke cycle engines, replacing them with large urban transportation buses that are a mix of electric drives, CNG, diesel engines, tramways, railways, subways, etc.	FMT	ECN, FMST, OPS, SGs, FCT, DPs	FGN (FMT), OPS, DPs	*	*	*
(vii) Pursuing vigourously the introduction of compressed natural gas in to general use in the rail and road transport systems.	(a)Fast-tracking the establishment of the proposed Institute of Gas for studies into general use of Compressed Natural Gas (CNG) in the rail and road transport systems.	MPR	ECN, FMST, FMT, OPS, DPs, SON, PTDF, FMEnv., NNPC, NLNG, PTI	FGN (MPR)	*	*	*
	(b) Intensifying R & D into conversion technologies for petrol carburetors & diesel injectors to CNG fuel.	NAC	ECN, FMST, FMT, OPS, SON , PTDF, FMEnv., TIs, RCs, RIs, DPs, NNPC, NLNG, PTI	FGN (NAC)	*	*	*
(viii) Encouraging a shift towards more energy-efficient transportation systems like electric cars.	(a) Re-designing our cities for present day transportation realities, with sufficient space for roads which will take care of pedestrians, cyclists, large urban bus lanes, etc.	FMLH&UD	FMT, DPs, SGs, LGCs, OPS, FMEnv., FMW	FGN (FMLH&UD)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(b) Introducing subways and tramways into city transportation systems with electric drives, diesel, biofuel, CNG & hydrogen fuelled engines.	FMT, FMEnv.	FMT, DPs, SGs, LGCs, , OPS	FGN (FMT, FMEnv.)	*	*	*
	(c) Designing and sponsoring publicity in electronic and print media on the benefits of more energy-efficient vehicles to the corporate health, environment, climate change issues, etc.	FMEnv.	ECN, FMI, NOA, OPS, DPs	FGN (FMT)	*	*	*
	(d) Introducing fuel efficiency labelling programme in the transportation sector for various vehicle types.	SON	ECN, FMIT&I, FMT	FGN (SON)	*	*	*
	(e) Encouraging R&D into more energy efficient air and water transport systems.	ECN	RCs, RIs, TIs, DPs, OPS, FMT	FGN (ECN)	*	*	*
	(f) Introducing the sustainable urban mobility programme of the UN Habitat to address the urban mobility problem.	FMEnv.	FMT, SGs, LGCs, DPs, OPS	FGN (FMEnv.)	*	*	*
	(g) Intensifying the involvement of the OPS in the mass transit programme of the Federal & State Governments.	FMT	SGs, LGCs, OPS	FGN (FMT), OPS	*	*	*
(ix) Maintaining an active interest in emerging and potentially more energy-efficient transport technologies, such as electric trains and buses for mass transit.	(a) Transforming the Nigerian Institute of Transport Technology, Zaria into a more vibrant institution capable of meeting the challenges of the modern-day transport sector demand.	FMT	ECN, DPs, OPS, NITT, RIs	FGN (FMT)	*	*	*
	(b) Intensifying indigenous R & D in biofuels technology.	ECN	NNPC, DPs, OPS, FMST, PTDF, RIs, TIs	FGN (ECN, PTDF), OPS, DPs	*	*	*
	(c) Discouraging importation of energy inefficient vehicles through fiscal and regulatory measures.	FMT, FMF	ECN, OPS	FGN (ECN)	*	*	*
	(d) Initiating a National CNG transportation fuel programme.	FMT	FMF, ECN, OPS, DPs, MPR	FGN (FMT)	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(e) Intensifying the phasing out of leaded gasoline in the nation's fuel mix.	FMIT&I	ECN, DPR, NNPC, OPS, MPR, NAC	FGN (FMT), OPS	*	*	
	(f) Intensifying R & D into conversion and adaptation of automobile engines to biofuels in concert with the on-going NNPC ethanol project.	ECN	NNPC, RCs, RIs, Tis, NAC	FGN (FMIT&I), OPS, DPs	*	*	*
	(g) Conducting R & D in hybrid vehicles in Nigeria, e.g. electric and petrol or electric and diesel or solar PV and petrol for optimal fuel efficiency.	ECN	FMT, OPS, NNPC, RCs, RIs, TIs, FMST, PTDF, NAC	FGN (ECN), OPS, DPs, PTDF	*	*	*
	(h) Conducting R&D into train transport technologies, tramways, ect.	ECN	FMT, OPS, NNPC, RCs, RIs, TIs, FMST, PTDF, NAC	FGN (ECN), OPS, DPs, PTDF	*	*	*

9.3 HOUSEHOLDS

9.3.1 Policies

i. The nation shall vigorously pursue the development of an optimal energy mix for the household sector.

ii. The nation shall ensure regular and adequate availability of all fuel types for the household sector.

iii. The nation shall ensure the use of energy efficient and environmentally friendly technologies in the household sector.

9.3.2 Objectives

i. To establish a sustainable consumption pattern of available energy sources.

ii. To promote adaptive technology in energy utilization in the household sector.

iii. To promote extensive use of renewable energy in both urban and rural households.

9.3.3 Action Plan

Table 9.4: Action Plan for Energy Utilization in the Household Sector

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Strenghtening and populating the databank on the energy consumption pattern of the household sector taking in to consideration both urban and rural household sub – sectors.	(a) Designing and regularly updating an information system indicating recommended consumption pattern/rate of typical households both in the rural and urban areas.	ECN	OPS, DISCOs, FMP	FGN (ECN)	*	*	*
	(b) Encouraging the use of energy saving light fixtures through periodic sensitizations and awareness.	ECN	NOA, SON	FGN (ECN)	*	*	
	(c) Supporting and subsidizing energy efficient modernization of residential buildings built by industrialized technologies.	FMLH&UD	NBBRI, ECN, SON, FMF, FMP	FGN (FMLH&UD)	*	*	
(ii)Establishing an energy appliance labelling scheme.	(a) Embarking on sensitization exercises to elighten citizens on the implications of energy appliance labelling scheme.	SON	NOA, ECN	FGN (SON)	*	*	
	(b) Phasing out less energy efficient appliances from the country.	SON	ECN, NCS, FMP, CPC	FG (SON)	*	*	
(iii) Encouraging the use of liquiefied petroleum gas (LPG) or cooking gas as well as solar water heating systems in households.	(a) Creating public awareness on the use of LPG for cooking as well as solar water heating systems.	ECN	NOA, NNPC, MPR, FMLH&UD	FGN (ECN)	*	*	
	(b) Setting subsidies on LPG for the general household cooking to achieve affordability.	PPPRA	NNPC, MPR, ECN, DPR	FGN (PPPRA)	*	*	
	(c) Building more gas production plants to meet up with the increasing demand.	MPR	NNPC, ECN, FMF, FMST, NLNG, OPS	FGN (MPR)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(iv) Discouraging heating and cooking with electricity in households.	(a) Embarking on awareness campaigns and programmes that focus on the implications of heating and cooking with electricity on energy conservation.	ECN	FMP, NERC, DISCOs, MPR, NOA	FGN (ECN)	*	*	
	(b) Providing more efficient gas boilers and solar water heating systems for household use at subsidized rates.	ECN	FMP, NNPC, MPR, NOTAP, FMST, FMLH&UD, NASENI	FGN (ECN)	*	*	*
(v) Pursuing vigourously the electrification programme for both urban and rural households.	(a) Encouraging the use of RE sources for the purpose of supplying electricity to residential buildings.	ECN	NASENI, FMI, FMP, FMLH&UD, NBRRI, REA	FGN (ECN)	*	*	
	(b) Improving the propagation of energy – efficient lighting fittings.	ECN	NASENI, FMI, FMP, FMLH&UD, NOA, REA	FGN (ECN)	*	*	
	(c) Developing energy efficiency related curriculum for applications in primary and secondary education.	FMEd.	UBEC, ECN, FMP, FMST, NERDC	FGN (FMEd.)	*	*	
(vi) Encouraging extensive use of renewable energy through incentives to households.	(a) Promoting the use of renewable energy resources in households.	ECN	FMP, NERC, FMLH&UD, REA	FGN (ECN)	*	*	*

9.4 COMMERCIAL/SERVICES

9.4.1 Policies

i. The nation shall vigorously pursue the development of an optimal energy mix for the services sector.

ii. The nation shall ensure regular and adequate availability of all fuel types for the services sector.

9.4.2 Objectives

i. To establish a rational utilization of available energy types for various services applications.

ii. To promote adaptive technology in energy utilization in the services sector.

9.4.3 Action Plan

Table 9.5: Action Plan for Energy Utilization in the Commercial/Services Sector

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Establishing a databank on the energy consumption pattern of the services.	(a) Designing and regularly updating an information systems indicating consumption patterns/rates of the services sector in comparion with the recommended pattern/rate for a given period.	ECN	TIs, RIs, NOTAP, FMP	FGN (ECN)	*	*	*
	(b) Supporting and subsidizing energy efficient modernization of services and commercial buildings built by industrialized technologies.	ECN	FMF, FMST, FMLH&UD	FGN (ECN)	*	*	
(ii) Developing building codes and building certification schemes for public and commercial buildings.	(a) Developing and enacting laws that governs energy related certifications for public and commercial buildings	NASS	ECN, FMLH&UD, FMEnv.	FGN (NASS)	*		
(iii) Promoting passive energy houses and zero – energy buildings.	(a) Encouraging the public to build zero – energy buildings through sensitizations, documentaries and campaigns.	NBRRI	ECN, FMLH&UD	FGN (NBRRI)	*	*	*
(iv) Developing energy performance test standards and labelling.	(a) Adopting international best practices in the areas of energy performance test standards and labelling.	SON	ECN, NBRRI	FGN (SON)	*	*	*
	(b) Upgrading available testing laboratories e.g Standards Organization of Nigeria (SON) and setting up more energy performance test laboratories across the Nation.	SON	ECN, MAN, DPs, OPS	FGN (SON)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(v) Phasing out incandescent bulbs and adopting efficient lightiong technology in public and commercial buildings.	(a) Embarking on a nation wide retrofitting campaigns in commercial and services buildings.	ECN	NOA, SON, FMP, EDAN	FGN (ECN)	*	*	
	(b) Developing and implementing of energy efficiency directives related to public procurements.	ECN	BPP, FMJ	FGN (ECN)	*	*	*
(vi) Ensuring least – cost lighting in non residential buildings.	(a) Developing laws that guides non residential buildings on the use of least – cost lighting and sanctioning defaulters.	ECN	FMJ, NASS, SON, NERC	FGN (ECN)	*	*	*
	(b) Providing more efficient gas boilers and solar water heating systems for household use at subsidized rates.	ECN	FMP, NNPC, MPR, NOTAP, FMST, FMLH&UD, NASENI, FMF	FGN (ECN)	*	*	*

9.5 AGRICULTURE

9.5.1 Policies

i. The nation shall ensure adequate and reliable supply of energy to the agricultural sector.

ii. The nation shall ensure that appropriate sources of energy are utilized judiciously and efficiently for the overall agricultural activities, with minimum harm to the environment.

iii. The nation shall emphasize the use of affordable, adaptable, reliable and sustainable agricultural technologies, possessing flexible energy utilization capabilities.

iv. The nation shall ensure sustainable storage facilities for agricultural products using energy efficient technologies.

9.5.2 Objectives

i. To increase agricultural productivity and efficiency through the use of appropriate energy sources.

ii. To exploit alternative sources of energy especially bio-energy resources (agro-forestry waste), thereby minimizing the heavy dependence on electricity and petroleum in the total energy mix of the agricultural sector.

iii. To enhance the productive capacity of rural farmers who mainly rely on the cumbersome manual methods of farming.

iv. To develop and promote efficient technologies that would be flexible in their energy requirement.

v. To promote the establishment of storage facilities that would be flexible in energy requirement for all agricultural products especially the seasonal products.

9.5.3 Action Plan

Table 9.6: Action Plan for Energy Utilization in the Agricultural Sector

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Supporting research and development activities for the evolvement of appropriate technologies that can use available/multiple energy sources, including renewable energy sources.	(a) Encouraging mass cultivation of energy crops such as cassava, jatropha and sugar cane for production of biofuels.	FMA&RD	ECN, RCs, RIs, TIs, SGs, LGCs, DPs, OPS, FMWR, FML&P, FAN	FGN (FMA&RD)	*	*	*
	(b) Intensifying R & D effort in developing appropriate technologies that can use available/multiple energy sources.	FMA&RD	ECN, RCs, RIs, TIs, SGs, LGCs, DPs, OPS	FGN (FMA&RD)	*	*	*
	(c) Intensifying renewable energy sources in agricultural processes.	FMA&RD	ECN, RCs, RIs, TIs, SGs, LGCs, DPs, OPS	FGN (FMA&RD)	*	*	*
	(d) Encouraging genetic engineering application in the production of drought resistant animals and energy crops.	FMA&RD	ECN, RCs, RIs, TIs, SGs, LGCs, DPs, OPS, FMWR	FGN (FMA&RD)	*	*	*
(ii) Developing improved crops, quick growing trees for aforestation, and energy crops.	a) Strenghtening the national programme on improved crops and selective breeding (including biotechnology) such as the agriculuture transformation agenda (ATA).	FMA&RD	ECN, OPS, DPs, FMST, SGs (ADP), LGCs, RCs, RIs, TIs	FGN (FMA&RD)	*	*	
	(b) Providing adequate funds and grants to Research Institutes for R & D.	FMA&RD	ECN, OPS, DPs, FMST, SGs (ADP), LGCs, RCs, RIs, TIs	FGN (FMA&RD)	*	*	*
	(c) Providing improved seeds/seedlings for Farmers at subsidized rates.	FMA&RD	BOA, ECN, OPS, DPs, FMST, SGs (ADP), LGCs, RCs, RIs, TIs	FGN (FMA&RD)	*		
(iii) Disseminating the developed technologies through extension programmes in the farming communities.	(a) Designing and sponsoring publicities on developed technologies through the print, electronic media and extension workers.	FMA&RD	FMI, NOA, OPS, DPs, NGOs, ECN, CBOs, Community Leaders	FGN (FMA&RD)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(b) Training the Farmers on the use of the new technologies.	FMA&RD	FMI, FMF, BOA, NOA, OPS, DPs, NGOs, ECN, CBOs, FAN, Community Leaders	FGN (FMA&RD)	*	*	*
(iv) Training the existing extension personnel in effective dissemination of the newly developed technologies.	(a) Developing and executing training programmes for extension personnel in effective operation and maintenance of the newly developed, appropriate and efficient energy technologies for the rural agricultural sector.	FMA&RD	FMI, OPS, DPs, NGOs, ECN, CBOs, Community Leaders	FGN (FMA&RD)	*	*	*
(v)Promoting the use of renewable energy resources for agriculture.	(a) Facilitating accessibility and affordability of renewable energy resources to farmers.	ECN	FMA&RD, FMWR, SGs, ADPs, LGCs, OPS, FAN	FGN (ECN)	*		
	(b) Intensifying the utilization of renewable energy sources in agricultural activities.	FMA&RD	ECN, SGs, ADPs, LGCs	FGN (FMA&RD)	*	*	*
	(c) Developing appropriate promotion programmes and strategies for the use of renewable energy resources in agriculture.	ECN	FMA&RD, FMWR, SGs, ADPs, LGCs	FGN (ECN)	*	*	*
(*vi) Establishing a databank on energy demand, supply and consumption in the agricultural sector.*	(a) Mandating all agricultural facilities (especially large enterprises) including agricultural products processing plants to provide energy demand, supply and consumption data annually to the ECN.	ECN	FMA&RD, FMWR, NBS, CBN, FMJ, OPS, ADPs	FGN (ECN)	*	*	*
	(b) Measuring energy consumption yearly in comparison to the previous year and against comparative weather periods (normalizing energy data).	ECN	NIMET, FMWR, FMA&RD	FGN (ECN)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(vii) Developing, training and disseminating adaptable storage technologies.	(a) Creating awareness among farmers on the use of Storage facilities using energy efficient technologies at regular intervals.	ECN	NOA, FMA&RD, FMST, FAN	FGN (ECN)	*	*	
	(b) Providing incentives and subsidies to fast track design, fabrication and utilization of energy efficient storage technologies.	ECN	FMA&RD, FMF, BOA, FMST, MAN	FGN (ECN)	*	*	
(viii) Developing simple agricultural machines that can use multiple energy sources.	(a) Enlightening commercial and large scale farmers on the merits of agricultural machines that make use of multiple energy sources.	ECN	NOA, FMA&RD, FMST, NOTAP, FAN, DPs, OPS	FGN (ECN)	*	*	
	(b) Providing subsidized agricultural machines that can use multiple energy source to commercial and large scale farmers within the country.	ECN	NOA, FMA&RD,, FMF, BOA, FMST, NOTAP, FAN, DPs	FGN (ECN)	*	*	
(ix) Providing incentives for cost effective and adequate energy supply for agricultural activities.	(a) Sensitizing farmers on the various cost effective energy supply sources that can be utilized while carrying out their agricultural activities.	ECN	NOA, FMF, BOA, FMA&RD, FMST, NOTAP	FGN (ECN)	*		
(x) Implementing energy audits in the agricultural sector to identify and quantify the structure of energy supply, demand, utilization patterns, efficiencies and substitution potentials etc., for both the small scale and large-scale farming.	(a) Continuous development of efficient energy consumption and supply patterns through comprehensive energy analysis and planning of the nation's energy resources.	ECN	FMA&RD, FMP	FGN (ECN)	*	*	*

CHAPTER TEN

ENERGY EFFICIENCY AND CONSERVATION

10.0 Introduction

In Nigeria, energy demand-supply imbalance is high, with low energy access. In order to enhance energy access to all, energy efficiency and conservation best practices must be imbibed. Energy efficiency refers to "using less energy to provide a level of energy service". Energy efficiency lowers energy use and therefore relevant in seducing energy demand-supply imbalance. It is achieved by means of more efficient technologies or processes rather than by behavioural changes.

Energy conservation on the other hand refers to “using less energy to achieve a lesser energy service through behavioural change. Energy conservation can be implemented with little or no cost, and result in immediate cost savings; while energy efficiency measures often require cash outlay. Both energy efficiency and energy conservation contribute to achieving environmental and economic enhancement goals.

There is significant potential for energy savings in the supply and demand sides of the nation’s energy sector. Therefore, sector-wide adoption of supply and demand side’s energy efficiency and conservation measures in the entire energy production and utilization is imperative. Since expenditure on energy constitutes a large proportion of the country’s GDP and a particularly large proportion of poor household expenditure, it is necessary to emphasize the effective and efficient use of energy. Fuel substitution is equally important to reduce the negative impact of the use of some fuels on the environment and to reduce the cost of energy services. For instance, substitution in the use of wood-fuel with LPG will reduce deforestation. The major sectors to be considered for energy efficiency and conservation are residential, industrial, transportation, services/commercial, agriculture and energy efficient building designs.

Energy efficiency and conservation best practices have many benefits, which include: reduction in amount of energy used to produce goods or services, thereby improving business’s competitiveness; while making more energy available for supply to other parts of the country. It minimizes the urgent need for new power station so that capital is freed up for other projects like health and education. Energy conservation has attractive business opportunities. Energy conservation is a cheap, quick and relatively painless way for most developing countries to stretch energy supplies, slash energy costs, and save foreign exchange. Most energy resources deplete,

increased energy efficiency therefore help to extend their availability. With economic growth there is likely to be a return to tight energy markets, but increased energy efficiency will delay and lessen the impact of such tightening. Investments in energy efficiency and conservation often provide a better return than in investments in energy supply: increased energy efficiency and conservation will therefore improve the general efficiency of the economies. There is widespread public concern about the environmental consequences of energy production and use: increased energy efficiency and conservation in general reduces greenhouse gas emissions from the avoided energy generation and use.

Unfortunately, energy efficiency is facing a lot of obstacles such as: Low level of awareness; lack of baseline energy consumption data; weak enforcement of laws and regulations leading to proliferation of low quality energy-efficient (EE) products; low local manufacturing capacity of energy-efficient equipment/appliances; High initial capital cost; poor billing systems by utilities (e.g, estimated bills); unreliable power supply and poor instrumentation and lack of energy audit toolkits and expertise. The following policies, strategies and corresponding actions are aimed at removing these barriers.

10.0.1 Policies

i. The nation shall adopt and promote energy efficiency and conservation best practices in the exploration and utilization of the nation's energy resources.

ii. The nation shall mainstream energy efficiency and conservation best practices into all sectors of the economy.

iii. The nation shall build capacity of the relevant agencies/organizations to develop and enforce policies and regulations (Minimum Energy Performance Standards – MEPS) to promote energy efficiency best practices.

iv. The nation shall adopt appropriate energy pricing, metering, and billing mechanisms.

v. The nation shall integrate energy efficiency and conservation studies into the curricula of educational institutions.

10.0.2 Objectives

i. To guarantee reliable energy access for all at appropriate costs and in a sustainable and environmentally friendly manner.

ii. To monitor the energy use patterns of the various sectors of the economy.

iii. To encourage end-users to adopt energy efficiency best practices, minimize energy wastages and enhance energy security.

iv. To ensure the efficient exploitation of the nation's energy resources.

v. To enhance self-reliance in the efficient exploitation of the nation's energy resources.

vi. To reduce adverse effects of energy related activities on the environment.

vii. To increase the proportion of hydrocarbon resources available for special applications such as industrial feedstock and for export.

viii. To eliminate avoidable investments in energy supply infrastructure.

10.0.3 Action Plan

Table 10.1: Energy Efficiency and Conservation Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Strengthening existing institutional and legal framework for the promotion of energy efficiency and conservation.	(a) Expanding ongoing activities and structures of existing institutions.	ECN	FMP, MPR NERC, NNPC, NASS	FGN (ECN)	*	*	*
	(b) Passing into law the existing regulatory measures to ban the importation and sale of inefficient appliances.	SON	ECN, FMP, NERC, FMIT&I, MAN	FGN (SON)	*	*	
	(c) Reviewing periodically the energy efficiency and conservation regulatory and pricing mechanism.	ECN	FMIT&I, NIPC, FMP, NERC, MAN	FGN (SON)	*	*	*
	(d) Building high-level political consensus on energy efficiency and conservation goals and strategies.	ECN	FMP, MPR, FMST, NASS, OSGF	FGN (ECN)	*	*	*
	(e) Streamlining and harmonizing all policies and plans on energy efficiency and conservation for a unified target setting.	ECN	FMP, MPR, NNPC, NERC, NASS	FGN (ECN)	*	*	*
	(f) Developing Minimum Energy Performance Standard for end-use appliances.	SON	NERC, NNPC, ECN	FGN (SON)	*	*	*
	(g) Conducting studies to monitor the energy use patterns in the different sectors of the economy.	ECN, NUC, NBTE, NCCE	NNPC, NERC, DISCOs	FGN (ECN)	*	*	*
	(h) Assigning responsibility and creating accountability for energy efficiency and conservation policy implementation.	ECN	NERC, NNPC, MAN, FMIT&I, FMLH&UD, FMA&RD, SON	FGN (ECN)	*	*	*
(ii) Strengthening national, regional and international collaboration on energy efficiency and conservation.	(a) Expanding cooperation with all stakeholders in both developing and developed countries.	ECN	FMP, MPR, DPs, MFA, NPC	FGN (ECN, MFA), DPs	*	*	*
	(b) Organizing study tours and training to countries already advanced in promoting energy efficiency and conservation best practices.	ECN	FMP, MPR, FMT, FMI&TI, FMLH&UD, FMA&RD, DPs	FGN (ECN), DPs	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(c) Facilitating coordination amongst stakeholders within the country in the promotion of energy efficiency and conservation.	ECN	FMP, MPR, NNPC, NERC, FMT, FMLH&UD, FMA&RD, FMIT&I	FGN (ECN)	*	*	
	(d) Aligning with regional organizations such as ECREEE to build capacity of relevant national stakeholders.	ECN	FMP, MPR, FMT, FMLH&UD, FMIT&I, FMA&RD	FGN (ECN)	*	*	*
	(e) Accessing international funds and expertise to compliment government efforts in the development of energy efficiency and conservation.	ECN	DPs, FMP, MPR, MFA	FGN (ECN)	*	*	*
	(f) Encouraging Federal and State Institutions to mainstream energy efficiency and conservation programmes into their development efforts.	NOA, ECN	FMI, SGs, NPC, CSOs, MDAs	FGN (NOA, ECN)	*	*	*
(iii) Adopting appropriate policy instruments – building standards/codes, mandatory labeling, mandatory energy audit, energy use disclosure, soft loans, tax credits, investment subsidies, etc.	(a) Developing Minimum Energy Performance Standards (MEPS) for end-use appliances.	ECN, SON	FMP, NERC, MAN, OPS, DPs, PBs	FGN (ECN, SON)	*	*	
	(b) Providing information for consumers about energy efficient labels of all end-use appliances.	NOA, ECN	SON, FMP, NERC, MAN, CSOs	FGN (NOA, ECN)	*	*	
	(c) Introducing mandatory energy audits in the commercial, industrial and public sectors of the economy.	ECN	FMP, NERC, NGOs, OPS, DPs, MAN, FMLH&UD, FMIT&I	FGN (ECN)	*	*	
	(d) Setting up an energy efficiency fund to accelerate the implementation of energy efficiency policies and plans.	ECN	NERC, MAN, NNPC, FMF, BOI	FGN (ECN)	*	*	
(iv) Conducting comprehensive energy end-use analysis in various sectors of the economy.	(a) Carrying out studies to monitor the energy use patterns in the different sectors of the economy.	ECN	NERC, OPS, MAN, NNPC, NURTW, CSOs, NBBRI, NBS	FGN (ECN)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(v) Introducing energy audits in key sectors of the nation's economy.	(a) Conducting energy audit regularly and implementing the recommendations of the audit process.	ECN	NERC, NGOs, OPS, DPs, MAN, NBRRI, NURTW	FGN (ECN), OPS, DPs	*	*	
(*vi) Promoting education, information and public awareness campaign on energy efficiency and conservation best practices.*	(a) Organizing public awareness programmes on the need for energy efficiency and conservation practices.	ECN	FMP, NERC, NOA, NGOs, OPS, DPs, MAN, NBRRI,CPC, NURTW, NNPC, FMT, FMA&RD, FMLH&UD, FMIT&I	FGN (ECN), OPS, DPs	*	*	
	(b) Introducing energy efficiency into the nation's education curricular.	ECN, NERDC, NUC, NBTE, NCCE	FMP, NERC, NOA, NGOs, OPS, DPs, MAN, NBRRI,CPC, NURTW, NNPC, FMT, FMA&RD, FMLH&UD, FMIT&I	FGN (ECN), OPS, DPs	*	*	
	(c) Launching public information campaigns and educational programmes to raise awareness of energy efficient systems.	ECN	FMEd., FMP, NERC, NOA, NGOs, OPS, DPs, MAN, NBRRI,CPC, NURTW, NNPC	FGN (ECN), OPS, DPs	*	*	
(vii) Promoting the establishment of Energy Management Services Companies (EMSCOs)	(a) Identifying existing EMSCOs in the country.	NERC, NNPC, ECN	FMP, MPR,OPS, CPC	FGN (ECN, NERC, NNPC), OPS	*	*	*
	(b) Developing appropriate monitoring and regulatory mechanisms for new and existing EMSCOs.	NERC, NNPC, ECN	FMP, MPR,OPS, CPC	FGN (ECN), OPS	*	*	*
(viii) Launching a national Demand-Side Management (DSM) initiative.	(a) Intensifying Demand Side Management programmes in the electicity companies.	GENCOs	NERC, DISCOs, FMP	FGN (SON)	*	*	
	(b) Developing standards and rating electrical appliances under the labeling programme.	SON, ECN	NERC, DISCOs, GENCOs	FGN (SON)	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(c) Improving the level of implementation of the metering and informative billing system.	DISCOs	NERC, GENCOs, NNPC	DISCOs	*	*	*
(ix) Providing economic, fiscal and financial incentives to promote energy efficiency in all sectors of the economy.	(a) Developing appropriate incentives for the promotion of energy efficiency in the country.	NIPC	ECN, FMIT&I, NERC, NNPC	FGN (NIPC)	*	*	*
	(b) Increasing involvement of local and foreign financial institutions in financing energy efficiency and conservation programmes.	FMF	CBN, BOI, MFA, ECN, NERC, NNPC	FGN (FMF)	*	*	
	(c) Introducing rebate programmes to promote the use of efficient appliances.	NIPC	NCS, FMF, ECN, FMIT&I, NERC, NNPC	FGN (NIPC)	*	*	*
(x) Promoting research, development and adoption of internationally available energy efficient technologies and measures.	(a) Establishing more testing laboratories and strengthening the existing ones to enhance R&D and compliance in energy efficiency.	ECN, SON	FMP, NERC, NGOs, RCs, RIs, TIs, MPR, NNPC, FMT, NBBRI	FGN (ECN, SON)	*	*	*
	(b) Supporting exchange programmes in the tertiary institutions to enhance energy efficiency and conservation R&D activities.	ECN, FMEd.	NUC, NAPTIN, TIs, RIs, RCs, MPR, NBTE, NCCE	FGN (ECN, FMEd.)	*	*	*
(xi) Introducing energy efficiency awards in all sectors of the economy.	(a) Conducting Annual National Energy Efficiency Awards for all sectors of the economy.	ECN	FMF, FMIT&I, FMT, FMA&RD, OPs, FMP, FMLH&UD, MPR, NGOs	FGN (ECN)	*	*	*
(xii) Increasing the share of green electricity by 1 % every year on year-to-date basis (YTB) compared to 2012 level.	(a) Diversifying energy supply by adopting advanced, cleaner, more efficient and cost-effective energy technologies.	ECN, NERC	FMP, NERC, OPS, FMLH&UD, FMIT&I, MAN	FGN (ECN, NERC)	*	*	
(xiii) Setting and enforcing targets about energy efficiency and conservation.	(a) Setting energy efficiency targets for each sector of the economy.	NPC, ECN	NBS, FMP, MPR, MAN, NAEC, NGSA	FGN (NPC)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(b) Measuring performance towards set targets.	NPC, ECN	NBS, FMP, MPR, MAN, NAEC, NGSA	FGN (NPC)	*	*	*
(xiv) Establishing necessary guidelines and regulations on energy efficiency, conservation, consumption, technology, fuel mix, information gathering, etc, as appropriate.	(a) Developing energy efficiency guidelines for end-use appliances.	ECN	FMP, SON, NERC, OPS, MPR, NGOs, FMLH&UD	FGN (ECN)	*	*	
	(b) Developing framework for communicating energy efficiency best practices.	ECN, NOA	FMP, SON, NERC, OPS, MPR, FMLH&UD, NGOs, DPs, FMI, MAN, NNPC, FMIT&I	FGN (ECN, NOA), DPs	*	*	
(xv) Ensuring reduction of electricity generation, transmission and distribution losses from the current level of 15 – 40 % to less than 10 % by 2020.	(a) Refurbishing the existing generation, transmission and distribution network infrastructure.	DISCOs, TCN, GENCOs	FMP, NERC, OPS, ECN, FMLH&UD, MAN, FMIT&I	FGN (TCN, DISCOs, GENCOs)	*	*	
	(b) Replacing the existing inefficient generation, transmission and distribution network infrastructure with the efficient infrastructure.	DISCOs, TCN, GENCOs	FMP, NERC, OPS, ECN, FMLH&UD, MAN, FMIT&I	FGN (TCN, DISCOs, GENCOs)	*	*	*
(xvi) Establishing appropriate energy efficiency regulatory and legislative framework.	(a) Developing MEPS and energy labeling system framework.	ECN, SON	NGOs, DPs, FMP, NERC	FGN (ECN, SON), DPs	*	*	
	(b) Introducing regulatory measures on import and sale of inefficient appliances and equipment.	ECN, SON, NCS	FMP, NERC	FGN (ECN)	*	*	
(xvii) Establishing guidelines for energy efficiency best practices in all sectors of the nation's economy.	(a) Developing energy efficiency guidelines for end-use appliances.	ECN	FMP, SON, NERC, OPS, MPR, NGOs, DPs, FMT, FMLH&UD, FMIT&I	FGN (ECN), DPs	*	*	
	(b) Creating enabling environment for the promotion of energy efficiency and conservation in the country.	ECN	NIPC, SON, OPS, NGOs, DPs, FMP, MPR, FMLH&UD, FMT, FMIT&I	FGN (ECN), DPs	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(xviii) Designing and implementing Minimum Energy Performance Standards (MEPS) for equipment and appliances.	(a) Developing MEPS and energy labelling system framework.	ECN, SON	FMP, NERC, OPS, MPR, FMT, NGOs, DPs, FMLH&UD, FMIT&I	FGN (ECN, SON)	*	*	
(xix) Designing and implementing appropriate mandatory labelling for all energy consuming appliances.	(a) Developing an appropriate and acceptable energy label for the Country.	ECN, SON	FMP, NERC, OPS, MPR, FMT, NGOs, DPs, FMLH&UD, FMIT&I	FGN (ECN, SON)	*	*	
	(b) Sensitizing consumers on energy efficient labels of all end-use appliances.	NOA, ECN	SON, FMP, NERC, MAN, CSOs	FGN (NOA, ECN)	*	*	
(xx) Ensuring the certification and accreditation of energy auditors and energy efficiency practitioners.	(a) Developing standards in line with international best practices for energy managers and auditors.	ECN, SON, NAPTIN	FMP, NERC, OPS, MAN, FMIT&I, FMT, FMLH&UD, NNPC	FGN (ECN)	*	*	*
	(b) Implementing qualification accreditation and certification schemes.	ECN, SON, NAPTIN	FMP, NERC, OPS, MAN, FMIT&I	FGN (ECN)	*		
(xxi) Integrating energy efficiency and conservation studies into the curricula of educational institutions in Nigeria.	(a) Developing energy efficiency and conservation curricula.	NERDC, ECN, NUC, NBTE, NCCE	FMP, FMEd. NGOs, DPs	FGN (ECN, FMEd.), DPs	*	*	*
	(b) Organizing sensitization workshops on energy efficiency and conservation curricula.	ECN, NUC, NBTE, NCCE	FMEd., NUC, NBTE, NCCE, NERDC	FGN (ECN)	*	*	*
(xxii) Replacing all incandescent light bulbs in every home, industry, institution and establishment in Nigeria with LEDs and other high energy saving lamps by year 2025.	(a) Encouraging the replacement of inefficient lamps with efficient lamps.	ECN	FMP, NGOs, DPs, NERC, OPS FMLH&UD, FMIT&I	FGN (ECN), DPs	*	*	
	(b) Phasing out the importation and sale of inefficient appliances.	NCS, MAN	SON, ECN	FGN (ECN)	*	*	*
	(c) Encouraging local manufacturing of energy saving lamps.	ECN, MAN	FMIT&I, SON	FGN (ECN)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(xxiii) Achieving by 2025, the establishment of a broad range of equipment energy efficiency standards and labeling by 2025.	(a) Encouraging importers and manufacturers to increase the efficiency of their products.	ECN, SON, MAN, SMEDAN	MAN, FMIT&I, OPS, NGOs	FGN (ECN, SON)	*	*	
	(b) Taking action, where appropriate, to phase-out subsidies on inefficient appliances.	ECN, SON	NCS, FMF, NIPC, MAN, OPS	FGN (ECN, SON)	*	*	
(xxiv) Reducing by 2025 energy-related greenhouse gas emissions 15 % of 2013 level.	(a) Developing framework to ensure energy savings that is equivalent to 1.5 % emission reduction annually.	ECN, SON, MAN	FMEnv., NESREA, NGOs, DPs	FGN (ECN, SON), DPs	*	*	
	(b) Developing framework for environmental management of the used lamps.	NESREA, MAN	ECN, FMEnv., DPs	FGN (NESREA), DPs	*	*	

10.1 INDUSTRY

10.1.1 Policies

i. The nation shall promote the adoption, development and application of industrial energy efficiency and conservation best practices.

ii. The nation shall require large, energy-intensive industries, and encourage other industrial energy users, to implement cost-effective energy savings best practices, and mandatorily report annually to designated-authorities.

iii. The nation shall adopt appropriate Minimum Energy Performance Standards (MEPS) for electric motors and other categories of industrial equipment, and implement portfolios of measures to address barriers to the optimization of energy efficiency in the design and operation of industrial systems and processes.

iv. The nation shall develop and implement a package of specially designed incentives and other measures to promote energy efficiency in small and medium scale enterprises (SMEs).

v. The nation shall over time, remove energy subsidies and internalize environmental costs to encourage industrial energy efficiency practices.

10.1.2 Objectives

i. To promote the efficient utilization of all energy types in industrial activities.

ii. To decouple the rate of growth of industrial energy consumption from the rate of growth in industrial output.

iii. To bring the energy intensities of industrial sectors in line with international standards and best practices.

10.1.3 Action Plan

Table 10.2: Energy Efficiency and Conservation Plan for the Industrial Sector

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Mandating industries to provide information on equipment energy performance, training initiatives, audits, technical advice documentation, and system-assessment protocols.	(a) Enacting appropriate law mandating industries to provide information on their energy efficiency and conservation related activities.	ECN, MAN	FMP, FMIT&I, SON, OPS, MPR	FGN (ECN)	*	*	*
	(b) Developing an inventory of industrial energy consuming appliances.	ECN, MAN	FMP, FMIT&I, SON, OPS	FGN (ECN, FMIT&I)	*	*	
	(c) Sensitizing the industrial sector on industrial energy efficiency best practices.	ECN, MAN	FMP, FMIT&I, SON, OPS	FGN (ECN, FMIT&I)	*	*	
(ii) Encouraging effective operational use of information flow in power factor, reduction peak load management and the use of energy efficient equipment and machinery.	(a) Encouraging timely maintenance of equipment.	ECN, FMIT&I, MAN	OPS	FGN (FMIT&I, ECN), OPS	*	*	*
	(b) Encouraging the use of capacitor bank in the industries.	ECN, FMIT&I, MAN	FMP, OPS	FGN (ECN, FMIT&I), OPS	*	*	*
	(c) Providing energy audit equipment for designated agencies.	ECN	OPS, FMIT&I, DPs, MAN	FGN (ECN), OPS	*	*	*
	(d) Building the capacity of personnel of relevant agencies to monitor implementation of energy efficiency best practices in industries.	ECN, MAN	FMP, OPS, FMIT&I, DPs	FGN (ECN), OPS	*	*	
(iii) Setting up and promoting Minimum Energy Performance Standards (MEPS) and Labels for electric motors and other categories of industrial equipment such as distribution transformers, compressors, pumps and boilers, etc.	(a) Developing MEPS for industrial equipments.	SON, ECN	ECN, FMIT&I, FMP, NERC, MAN	FGN (SON)	*	*	
	(b) Providing enforcement mechanism to ensure compliance to industrial MEPS.	SON, ECN, NCS	ECN, FMIT&I, FMP, NERC, MAN	FGN (SON)	*	*	
	(c) Providing training for SON personnel to monitor and enforce industrial MEPS.	SON, ECN	ECN, FMIT&I, FMP, NERC, MAN, NAPTIN	FGN (SON)	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(iv) Strengthening the existing testing laboratories to support national and regional Labeling and Standards (S&L) programmes.	(a) Developing and implementing an energy labelling programme for the industrial sector.	ECN, SON	MAN, OPS, FMIT&I, FMP, DPs	FGN (ECN, SON)	*	*	
	(b) Ugrading the existing specialized equipment laboratory to certify locally manufactured and imported electrical appliances and industrial equipment.	SON, ECN	ECN, FMP, FMIT&I, OPS, MAN	FGN (ECN)	*	*	*
(v) Setting up guidelines for implementing energy efficiency projects in the industry, as well as, guidelines for consumers and manufacturers.	(a) Developing industrial energy efficiency implementation guidelines.	ECN	SON, FMIT&I, MAN, FMP	FGN (ECN)	*	*	
(*vi) Strengthening institutional framework to promote energy conservation and efficient use of energy in industries.*	(a) Stregnthening institutions and agencies promoting energy efficiency best practices in the industrial sector.	ECN, NASS, MAN	NERC, FMP, SON, NNPC, MPR, SMEDAN, FMIT&I	FGN (ECN)	*	*	
	(b) Building human capacity in the implementation of industrial energy efficiency programmes.	ECN, MAN	FMIT&I, OPS, FMP, MPR, SON, SMEDAN	FGN (ECN)	*	*	*
(vii) Providing high-quality and relevant information on proven practices for energy efficiency in industries.	(a) Disseminating information on industrial energy efficiency best practices.	ECN, MAN	FMP, NOA, MPR, FMIT&I	FGN (ECN)	*	*	
	(b) Intensifying energy efficiency campaign to accelerate the shift to energy efficient appliances in the sector.	ECN, MAN	SON, FMP, NOA, MPR, FMIT&I, OPS	FGN (ECN)	*	*	
(viii) Making available energy performance benchmarking information that can be easily used by industries and structured to allow international and national economy comparisons.	(a) Establishing industrial energy consumption benchmark.	ECN, MAN	NERC, FMP, FMIT&I	FGN (ECN, FMIT&I)	*	*	*
	(b) Creating awareness on the set benchmark.	ECN, MAN	OPS, NERC, FMP, FMIT&I, MPR	FGN (ECN, FMIT&I)	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(ix) Encouraging investment in energy-efficient industrial equipment and processes by putting in place targeted financial incentives such as tax incentives for energy-efficient investments in industry (particularly the SMEs).	(a) Creating incentives to promote investments in industrial energy efficiency.	NIPC	ECN, FMF, MAN, FMP, NOA, MPR, FMIT&I, SMEDAN	FGN (NIPC)	*	*	*
	(b) Government to create fund to suport the audit of energy usage in the industry.	NIPC	ECN, FMF, MAN, FMP, NOA, MPR, FMIT&I, SMEDAN	FGN (NIPC)	*	*	*
	(c) Special incentives for local manufacturers of electric motors, transformers, pumps, compressors, boilers.	NIPC	ECN, FMF, MAN, FMP, NOA, MPR, FMIT&I, SMEDAN	FGN (NIPC)	*	*	*
(x) Fostering public private financing of energy efficiency upgrades in industry through risk-sharing or loan guarantees with private financial institutions and enabling the market for energy performance contracting.	(a) Providing rebates and other incentives to industries for enhancing energy performance contracting.	NIPC, MAN	FMIT&I, BOI, OPS, SMEDAN	FGN (NIPC), OPS	*	*	
	(b) Encouraging the financial institutions to provide financing opportunities for industrial energy efficiency projects, and federal, state, and local governments to patronize the products of the companies.	ECN, MAN	FMIT&I, BOI, OPS, FMF, FIs, SGs, MDAs, LGAs	FGN (ECN, FMIT&I)	*	*	
(xi) Reducing specific energy consumption of key industrial outfits within the range of international best practices.	(a) Encouraging the establishment of energy units in industries.	ECN, MAN	FMIT&I, OPS, SMEDAN	FGN (ECN, FMIT&I)	*	*	
	(b) Promoting the adoption of state-of-the-art industrial energy efficient appliances and equipment.	ECN, MAN	FMIT&I, SMEDAN, OPS	FGN (ECN, FMIT&I)	*	*	
(xii) Identifying and assessing energy saving opportunities by benchmarking, measuring and documenting energy consumption in industries.	(a) Ensuring all registered corporations submit annually, energy consumption report.	ECN, FMIT&I	FMP, MAN, OPS, CAC, NERC, SMEDAN	FGN (ECN, FMIT&I), OPS	*	*	*
	(b) Establishing industrial energy consumption benchmark.	ECN, FMIT&I	MAN, FMP, OPS, NERC	FGN (ECN, FMP), OPS	*	*	
	(c) Creating awareness on the set benchmark.	ECN, FMIT&I	MAN, FMP, OPS, NERC, NOA, DPs	FGN (ECN, FMIT&I), OPS	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(xiii) Implementing actions to capture identified energy-saving opportunities.	(a) Promoting the adoption of energy efficiency and conservation best practices.	ECN	NERC, FMP, FMIT&I, MAN, SMEDAN, OPS	FGN (ECN)	*	*	
(xiv) Reporting publicly the energy-saving opportunities identified and the actions taken to capture them.	(a) Conducting public enlightenment through workshops, seminar, lectures etc.	ECN	FMP, FMIT&I, MPR, OPS, NERC, NOA, SMEDAN	FGN (ECN), OPS	*	*	*
	(b) Creating energy efficiency and conservation awareness.	ECN	FMP, FMIT&I, SMEDAN, MPR, OPS, NERC	FGN (ECN), OPS	*	*	
	(c) Promoting mandatory energy auditing for medium and large scale industries.	ECN, SMEDAN, MAN	FMP, FMIT&I, OPS, NERC	FGN (ECN, SMEDAN), OPS	*	*	*
(xv) Ensuring that energy audits are carried out by qualified personnel in industry, and the audit reports are widely promoted and easily accessible.	(a) Developing appropriate Industrial Energy Auditor Certification Scheme.	ECN, SON	ECN, NERC, FMP, SMEDAN, FMIT&I	FGN (ECN)	*	*	
	(b) Developing standards in line with international best practices for industrial energy managers and auditors.	ECN, SON	FMP, NERC, OPS, MAN, FMIT&I, SMEDAN	FGN (ECN, SON)	*	*	
	(c) Implementing qualification accreditation and certification schemes for Industrial Energy Auditors.	ECN, SON, SMEDAN	FMP, NERC, OPS, MAN, FMIT&I, NAPTIN	FGN (ECN)	*	*	*
(xvi) Removing energy subsidies and internalize the external costs of energy through policies such as carbon pricing.	(a) Developing appropriate pricing regime for all energy products.	NERC, PPPRA	NNPC, ECN, OPS, MPR, FMP	FGN (NERC, PPPRA)	*	*	
(xvii) Promoting the adoption of the more-efficient industrial equipment and machinery e.g. electric motors and drives in industry with the view to achieving 50 % retrofit by 2030.	(a) Developing MEPS for industrial equipments.	ECN, SON	MAN, FMF, FMP	FGN (SON, ECN)	*	*	
	(b) Establishing mandatory retrofit of inefficient equipment for the industries.	ECN, MAN	FMF, FMP, FMIT&I, BOI, SON	FGN (ECN, SON, FMIT&I)	*	*	

10.2 TRANSPORTATION

10.2.1 Policies

i. The nation shall ensure the use of energy efficient and environmentally friendly technologies in the transport sector.

ii. The nation shall vigorously promote the development of mass transit systems.

iii. The nation shall establish regulations to provide incentives for the purchase and use of higher-efficient vehicles and disincentives for less-efficient vehicles.

iv. The nation shall encourage and establish an organized and reliable public transportation system.

v. The nation shall establish energy efficiency, fuel quality and emissions standards for vehicles.

vi. The nation shall establish and enforce regulations, standards & codes of practice which will stimulate the supply of energy efficient vehicle technologies.

vii. The nation shall encourage modal shift to public transport or non-motorized modes, walking and cycling, from road to rail and waterways and urban mobility planning.

viii. The nation shall cap highway speed limit to 110km/h or lower to save fuel and reduce vehicle emission.

10.2.2 Objectives

i. To shift transport to more environmentally friendly and energy efficient modes.

ii. To reduce energy consumption and greenhouse gas (GHG) emissions from transportation systems.

iii. To encourage and/or enforce transport fuel efficiency in the design of public and private transport facilities.

iv. To orient the demand towards more efficient vehicles, and encourage people to drive less.

v. To lessen the huge reliance on private vehicles for mobility, and encourage car-pooling system.

vi. To highlight the importance of transport energy and put in place actions to develop a more energy efficient transport system.

vii. To reduce transport-related environmental pollutions and associated health problems.

viii. To promote optimum and efficient utilization of petroleum fuels and substitution in order to reduce the nation's dependence on fuel imports, thereby releasing resources to deal with other imperatives and funding for more productive investment.

ix. To increase public knowledge and awareness of efficiency issues in the transport industry, including specific efficiency indicators.

x. To increase the overall energy efficiency of local, national and regional transport systems, and promote shifts of passengers and freight to more efficient modes.

xi. To ensure that transport infrastructure is built to support the most energy efficient transport modes.

10.2.3 Action Plan

Table 10.3: Energy Efficiency and Conservation Plan for the Transport Sector

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Embarking on public education and information programmes on energy efficiency in transport system.	(a) Organizing public awareness programmes on energy efficiency in transport sector.	ECN, FMT	FMT, NBS, DPs, OPS, DPR, FMI, NNPC, IPM	FGN (ECN)	*	*	*
	(b) Introducing transport energy efficiency into the nation's education curricular.	ECN, FMT	FMEd., NERDC, NUC NOA, NGOs	FGN (ECN), OPS, DPs	*	*	
	(c) Organizing public information campaigns and educational programmes to raise awareness on energy efficient vehicles.	ECN, FMT	FMP, NERC, NOA, NGOs, OPS, DPs, MAN, NBRRI,CPC, NURTW, NNPC	FGN (ECN), OPS, DPs	*	*	
	(d) Organizing campaigns in motor parks and other traffic spots on energy efficiency in the transportation system.	ECN, FMT	FMT, NBS, FMI	FGN (ECN)	*	*	*
(ii) Encouraging eco – driving techniques (training courses, awareness raising campaigns) that enable drivers to optimize their car fuel economy.	(a) Organizing training courses, sensitizations and campaigns on the use of eco friendly driving techniques.	ECN, FRSC	FMEnv, FMT, FMI, NOA	FGN (ECN)	*	*	*
	(b) Encouraging local production of fuel economy vehicles.	FMPR	ECN, MAN, FMF, FMT	FGN (FMPR)	*		
(iii) Introducing information on fuel economy and CO_2 emissions shown on a fuel economy label to be displayed at the point of sale of cars.	(a) Introducing mandatory energy labeling of vehicles on fuel economy and CO_2 emission. .	SON, MAN	FMT, ECN	FGN (SON)	*	*	*
	(b) Educating the public on fuel economy and the implication of CO_2 emissions.	ECN	FMI, NOA, FMT, FMEnv	FGN (ECN)	*	*	*
(iv) Encouraging sustainable modal shift in transportation like: motorized modes to cycling and walking; private vehicles usage to public mass transport.	(a) Promoting the use of mass transit transport system.	FMT, SGs	FMT, NBS, FMC&I	FGN (FMT)	*	*	*
	(b) Providing infrastructure for cycling and walking in the transport systems.	, FMT, LGAs	FMEnv, FMT, FMI, NOA	FGN (FMT)	*		
	(c) Providing proper town planning to reduce distances between offices and residential areas.	FML,H&UD	FMEnv, FMT, FMI, NOA NITPL, ECN	FGN (FML,H&UD)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(v) Energy use efficiency improvements through the use of less carbon emitting fuels, such as natural gas as well as unleaded fuel.	(a) Promting the use of clean transport fuels.	NNPC, FMT	FMST, FMF, DPR, OPS, ECN	FGN (NNPC, FMT)	*	*	*
	(b) Introducing mandatory energy labeling of vehicles on fuel economy and CO_2 emission.	NNPC, FMT	FMST, FMF, DPR, OPS, ECN	FGN (NNPC, FMT)	*	*	*
	(c) Sensitizing the public on the use of clean transport fuels.	NNPC, FMT	FMST, FMF, DPR, OPS, ECN, NOA	FGN (NNPC, FMT)	*	*	*
(vi) Reviewing the legislative and other arrangements for public transportation management, regulation and monitoring.	(a) Reviewing existing legislation on public transport management in the country..	FMT	NASS, FMF, OPS, NAC	FGN (FMT)	*	*	
	(b) Encouraging the private sector to invest and provide services in the public transportation sector.	FMT	OPS, DPs	FGN (FMT)	*	*	
(vii) Introducing measures to encourage the use of cleaner vehicles like labelling, taxation and infrastructure charges, grants and subsidies and srcappage schemes .	(a) Introducing mandatory energy labeling of vehicles on fuel economy and CO_2 emission.	SON	FMT, ECN, FMPR, FMEnv.	FGN (SON)	*	*	*
	(b) Phasing out vehicles with high CO_2 emission from the auto mobile market.	SON	FMT, ECN, FMPR, FMEnv.	FGN (SON)	*	*	*
(viii) Implementing and periodically strengthening mandatory fuel efficiency standards for light- and heavy – dutyvehicles; for heavy – duty vehicles, this includes establishing testing procedures.	(a) Developing internationally–accepted fuel efficiency standards.	FMT	SON, ECN, FMPR, FMEnv., NASS	FGN (FMT)	*	*	*
	(b) Strengtheningmotor vehicles testing centres. within the country.	FMT	SON, ECN, FMPR, FMEnv., NPA	FGN (FMT)	*		
	(c) Strengthening the relevant government agencies for effective enforcement and monitoring of motor vehicles in relation to vehicle emission.	FMT	VIO, FRSC, FMEnv., ECN	FGN (FMT)	*	*	*
	(d) Discouraging the use of old vehicles.	FMT, VIO	FRSC, FMEnv., NOA	FGN (FMT)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(ix) Adopting measures such as labelling, incentives and taxes to boost vehicle efficiency and accelerate the market penetration of new efficient vehicle technologies. This should include infrastructure support and incentive schemes for very low CO_2 – emitting and fuel – efficient vehicles.	(a) Providing incentives and tax waivers for the manufacturing of low CO_2 emitting and fuel efficient vehicles.	FMT, FMF	FMIT&I, SON, FMEnv., MAN, NAC	FGN (FMT)	*	*	*
	(b) Strenghtening policies with respect to the sales of very low CO_2 emitting and fuel efficient vehicles.	SON, ECN	FMT, ECN, FMPR, FMEnv.	FGN (SON)	*	*	*
(x) Improving the performance of tyres, air conditioning, lighting and other non engine components that affect vehicle's fuel efficiency, including mandatory fitting of tyre – pressure monitoring systems on new road vehicles and the introduction of energy efficiency requirements for air conditioning systems.	(a) Providing tyre pressure monitoring systems for road users at subsidized prices to encourage its use.	FMT, DPR	DPs, FMF, CBN	FGN (FMT)	*	*	*
	(b) Sensitizing road users on energy efficient airconditioning systems for vehicles.	FMT, ECN	ECN, VIO, NOA	FGN (FMT)	*	*	*
(xi) Increasing progressively km/fuel ratio of automobiles on Nigeria roads by a factor each year to meet international best practices.	(a) Developing international-accepted annual km/fuel mobile ratio.	MPR, FMT	FMT, ECN, NBS, FRSC, VIO	FGN (FMPR)	*	*	*
	(b) Periodic review of the annual automobile ratio.	MPR, FMT	FMT, ECN, NBS, FRSC, VIO	FGN (FMPR)	*	*	*
(xii) Ensuring better integration between different public transport systems, walking and cycling.	(a) Developing framework for the proper design of the different modes of transportation.	FMT	VIO, FMPR, NASS, FMEnv	FGN (FMT)	*	*	*
	(b) Integrating energy efficiency into the design and building of transport systems.	FMT, ECN	VIO, FMPR, NASS, FMEnv	FGN (FMT)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(c) Building human capacity in the implementation of transport energy efficiency programmes.	FMT, ECN	VIO, FMPR, NASS, FMEnv.	FGN (FMT)	*	*	*
(xiii) Introducing and enforcing appropriate fuel economy standards, including compulsory fitting of speed limiting equipment.	(a) Integrating energy efficiency best practices into the existing National Transport Policy.	FMT, FRSC, VIO	VIO, FMPR, NASS, FMEnv.	FGN (FMT)	*	*	*
	(b) Introducing mandatory fitting of speed limiters in vehicles.	FMT, FRSC, VIO	VIO, FMPR, NASS, FMEnv.	FGN (FMT)	*	*	*
(xiv) Mandatory installation of pollution control devices such as catalytic converters in vehicular exhaust emission systems and the implementation of tougher legislation relating to exhaust emissions.	(a) Enforcing the use of catalytic converters in vehicle's exhaust systems.	FMT, VIO	VIO, FMPR, NASS, FMEnv.	FGN (FMT)	*	*	*
	(b) Ensuring that vehicle inspection criteria include exhaust systems.	FMT, VIO	VIO, FRSC, FMEnv.	FGN (FMT)	*	*	*
(xv)Implementing,mo-nitoring and disseminating mandatory standards/regulations for vehicle efficiency.	(a) Developing MEPS for automobiles.	FMT, SON	VIO, SON, FMPR, ECN, NASS, FMEnv.	FGN (FMT)	*	*	*
	(b) Establishing testing laboratories for the efficiency of automobiles.	FMT, SON, ECN	VIO, FRSC, FMEnv.	FGN (FMT)	*	*	*
	(c) Building human capacity on enforcement of automobilies MEPS.	FMT, ECN	VIO, SON, FMPR, ECN, NASS, FMEnv.	FGN (FMT)	*	*	*

10.3 RESIDENTIAL

10.3.1 Policies

i. The nation shall promote the use of energy efficient and environmentally friendly technologies in the residential sector.

ii. The nation shall promote energy efficiency standards for heating and air conditioning systems, appliances, and other plug-in-loads such as lighting and consumer electronics in residential homes.

10.3.2 Objectives

i. To combat health-sensitive indoor pollutants.

ii. To reduce the effects of peak demand on power capacity.

iii. To introduce labeling/efficiency standards for household appliances.

iv. To introduce state-of-the-art energy-efficient technologies in residential sector.

10.3.3 Action Plan

Table 10.4: Energy Efficiency and Conservation Plan for the Residential Sector

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Promoting the use of energy efficient domestic cookstoves in the residential sector.	(a) Carrying out demonstration projects on energy efficient cookstoves in residential sector.	ECN	ECN, FMEnv., SON, NBRRI, TI, RIs, RCs	FGN (FMEnv.), OPS, DPs	*	*	*
	(b) Providing subsidized cookstoves to end-users.	ECN	ECN, FMEnv., SON, NBRRI, TI, RIs, RCs	FGN (FMEnv.), OPS, DPs	*	*	*
	(c) Creating effective markets for energy efficient cookstove in Nigeria.	ECN	ECN, FMEnv., SON, NBRRI, TI, RIs, RCs	FGN (FMEnv.), OPS, DPs	*	*	*
	(d) Encouraging R and D on energy-efficient cookstoves.	ECN	ECN, FMEnv., SON, NBRRI, TI, RIs, RCs	FGN (FMEnv.), OPS, DPs	*	*	*
(ii) Designing, promoting and implementing Minimum Energy Performance Standards (MEPS) and mandatory labeling for household energy consuming appliances.	(a) Developing MEPS for household appliances.	SON, ECN	ECN, FMIT&I, FMP, NERC, MAN	FGN (SON)	*	*	
	(b)Providing enforcement mechanism to ensure compliance to residential MEPS	SON	ECN, FMIT&I, FMP, NERC, MAN	FGN (SON)	*	*	
	(c) Building human capacity on enforcement of MEPS in the residential sectors.	SON	ECN, FMIT&I, FMP, NERC, MAN	FGN (SON)	*	*	
(iii) Raising awareness on the cost-benefits of energy efficiency in the homes.	(a) Organizing public awareness programmes on energy efficiency in the residential sector.	ECN, FMLH&UD, NOA	NBBRI, NBS, DPs, OPS, DPR, FMC&I,	FGN (ECN)	*	*	*
	(b) Introducing household energy efficiency into subjects/courses of the nation's education curricular.	ECN, FMLH&UD	FMEd, NERDC, NUC NOA, NGOs,	FGN (ECN), OPS, DPs	*	*	
	(c) Organizing public information campaigns and educational programmes to raise awareness on energy efficient household appliances.	ECN, FMLH&UD, NUC, NBTE, NCCE	FMP, NERC, NOA, NGOs, OPS, DPs, MAN, NBRRI,CPC, NURTW, NNPC	FGN (ECN), OPS, DPs	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(iv) Establishing demonstration projects to encourage investment in energy efficiency measures in the residential sector.	(a) Carrying out demonstration retrofitting projects in residential sector.	ECN, NBBRI	ECN, NCS, DPs, SON, FMLH&UD, NBBRI	FGN (ECN), DPs	*	*	
	(b) Providing subsidized energy efficient appliances to end-users in the residential sector.	ECN	ECN, NCS, DPs, SON, FMLH&UD, NBBRI	FGN (ECN), DPs	*	*	
	c) Creating effective markets for energy efficient appliances in Nigeria.	ECN, MAN, SMEDAN	ECN, NCS, DPs, SON, FMLH&UD, NBBRI	FGN (ECN), DPs	*	*	
(v) Encouraging widespread adoption of energy saving lamps e.g. light-emitting diodes (LEDs) and compact fluorescent lamps (CFLs) and the phasing-out of inefficient lamps e.g. incandescent bulbs.	(a) Providing energy efficient lamps at subsidized rates.	ECN, NIPC	FMF, OPS, SON, FMP, DPs	FGN (ECN), DPs	*	*	
	(b) Encouraging the replacement of inefficient lamps with efficient ones.	ECN	FMP, FMEd. NUC, NBTE, NCCE, NGOs, DPs, NERC, OPS, MPR, FMLH&UD	FGN (ECN), DPs	*	*	*
	(c) Phasing out the importation and sale of inefficient lamps.	ECN, NCS	FMP, FMEd. NUC, NBTE, NCCE, NGOs, DPs, NERC, OPS, MPR, FMLH&UD	FGN (ECN), DPs	*	*	*
	(d) Encouraging local manufacturing of energy saving lamps.	ECN, MAN, SMEDAN	FMP, FMEd. NUC, NBTE, NCCE, NGOs, DPs, NERC, OPS, MPR, FMLH&UD	FGN (ECN), DPs	*		
	(e) Highway streetlights to be replaced with energy efficient lamps	ECN	FMP, FMEd. NUC, NBTE, NCCE, NGOs, DPs, NERC, OPS, MPR, FMLH&UD	FGN (ECN), DPs	*	*	
(vi) Encouraging a shift towards modern energy services and more energy-efficient household appliances through utility end-use energy efficiency schemes such as the Demand Side Management (DSM) techniques.	(a) Intensifying Demand Side Management programmes in the electricity generating companies.	GENCOs	SON, DPs, FMH, NERC, DISCOs	FGN (SON)	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(vii) Keenly following trend in technology changes in household energy appliances to take advantage of emerging energy efficient and renewable energy technologies (e.g. solar water heaters, solar PV etc.).	(a) Encouraging collaborative R & D activities in energy efficiency and conservation with international organizations.	ECN, FMLH&UD	FMP, NERC, NOA, NGOs, OPS, DPs, MAN, NBRRI,CPC, NURTW, NNPC	FGN (ECN), OPS, DPs	*	*	*
	(b) Encouraging participation in international conferences on energy efficiency technolgies.	ECN, FMLH&UD	FMP, NERC, NOA, NGOs, OPS, DPs, MAN, NBRRI,CPC, NURTW, NNPC	FGN (ECN), OPS, DPs	*	*	*
	(c) Fast-tracking the establishment of specialized energy efficiency testing laboratories.	ECN, FMLH&UD, SON	FMP, NERC, NOA, NGOs, OPS, DPs, MAN, NBRRI,CPC, NURTW, NNPC	FGN (ECN), OPS, DPs	*	*	
(viii) Incorporating energy efficient standards into the National Building Code.	(a) Ensuring the inclusion of energy efficiency standards into the National Building Codes.	NBRRI, FMLH&UD	ECN, OPS, FMIT&I	FGN (NBRRI)	*	*	
	(b) Sensitizing relevant stakeholders on building energy efficiency standards.	NBRRI, ECN, FMLH&UD	ECN, OPS, FMLH&UD	FGN (NBRRI)	*	*	
	(c) Enforcing building energy efficiency standards especially in building construction sector.	NBRRI	ECN, OPS, FMLH&UD	FGN (NBRRI)	*	*	
(ix) Establishing a framework for adoption and promotion of installation of smart meters or Pay As You Consume (PAYC) meters in all households by 2025.	(a) Introducing smart meters in all households by 2025.	ECN, NERC	FMIT&I, NGOs, CBOs, OPS, DPs	FGN (ECN)	*	*	*
	(b) Sensitizing end-users on the benefits of smart Meters.	ECN	FMIT&I, NGOs, CBOs, OPS, DPs	FGN (ECN)	*	*	*
	(c) Ensuring the availability of smart meters in all households.	FMP	NERC, ECN, FMF	FGN (FMP)	*	*	
(x) Achieving by 2030 universal access to safe, clean, affordable, efficient and sustainable cook stoves/fuel switching to LPG in all households.	(a) Sensitizing households on efficient and sustainable cookstoves/clean cooking fuels.	ECN	FMST, NUC, NBTE, NCCE, TIs, RIs	FGN (ECN)	*	*	*
	(b) Intensifying research on energy efficient cookstoves.	ECN	FMST, NUC, NBTE, NCCE, TIs, RIs	FGN (ECN)	*		

	(c) Creating incentives for fuel switching to LPG and mass production of efficient cookstoves.	ECN	FMF, FMST, MAN, OPS, DPs	FGN (ECN)	*	*	

10.4 COMMERCIAL/SERVICES

10.4.1 Policies

i. The nation shall ensure the use of energy efficient and environmentally friendly technologies in the commercial sector.

ii. The nation shall promote the adoption and development of energy efficiency and conservation best practices in the commercial and services sector.

iii. The nation shall require large, energy-intensive commercial/services companies, to implement cost-effective energy savings best practices, and periodically report on their efforts to designated authorities.

iv. The nation shall develop and adopt appropriate energy efficiency codes and standards for horizontal technologies and machineries used in the commercial sector.

v. The nation shall adopt appropriate Minimum Energy Performance Standards (MEPS) for major energy-consuming appliances and equipment.

vi. The nation shall promote energy efficiency standards for heating and air conditioning systems, appliances, and other plug-in loads such as lighting and consumer electronics in commercial/services sector.

10.4.2 Objectives

i. To promote a reliable and efficient use of energy with minimal negative environmental impact through the use of energy efficient technologies and gradual transition to modern energy services.

ii. To promote the efficient utilization of all energy types in commercial/services activities.

iii. To decouple the rate of growth of commercial energy consumption from the rate of growth in commercial activities and productivity.

iv. To demonstrate the Federal Government’s commitment to sustainable energy development within its own building stock.

v. To progressively upgrade the energy performance of existing public and commercial building stock.

vi. To achieve best practice energy performance in new public and commercial building stock.

10.4.3 Action Plan

Table 10.5: Energy Efficiency and Conservation Plan for the Commercial/Services Sector

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Establishing minimum energy performance standards (MEPS) for energy-related equipment and appliances for the sector.	(a) Developing MEPS for appliances used in the commercial/service sector.	SON, ECN	ECN, FMIT&I, FMLH&UD, FMP, NERC, MAN, SMEDAN	FGN (SON)	*	*	*
	(b)Providing enforcement mechanism to ensure compliance to MEPS.	SON, ECN, NCS	ECN, FMIT&I, FMP, NERC, MAN, SMEDAN, FMLH&UD	FGN (SON)	*	*	*
	(c) Building human capacity on the development of MEPS and its enforcement in the Commercial/Services Sector.	SON	ECN, FMIT&I, FMP, NERC, MAN, SMEDAN, FMLH&UD	FGN (SON)	*	*	*
(ii) Encouraging the widespread adoption of light-emitting diodes (LEDs), compact fluorescent lamps (CFLs) and other high energy saving lamps, and the phase-out of incandescent bulbs for services sector lighting in order to reduce electricity demand.	(a) Providing energy efficient lamps at subsidized rates.	ECN, NIPC	FMF, OPS, SON, FMP, DPs	FGN (ECN), DPs	*	*	*
	(b) Encouraging the replacement of inefficient lamps with efficient ones.	ECN	FMP, NGOs, DPs, NERC, OPS, FMLH&UD	FGN (ECN), DPs	*	*	*
	(c) Phasing out the importation and sale of inefficient lamps.	ECN, SON, NCS	FMP, NGOs, DPs, NERC, OPS, FMIT&I, FMLH&UD	FGN (ECN), DPs	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(iii) Encouraging a shift towards modern energy services and more energy-efficient services sector appliances through (utility end-use energy efficiency schemes such as the Demand Side Management (DSM) techniques.	(a) Organizing periodic technology fair on the results of energy efficiency R&D.	ECN	FMST, RCs, RIs, TIs, DPs, FMEd.	FGN(ECN)	*	*	*
	(b) Intensifying Demand Side Management programmes in the electricity companies.	GENCOs	SON, DPs, FMH, NERC, DISCOs, TCN	FGN (SON)	*	*	
(iv) Creating framework for the adoption and installation of smart meters or Pay As You Consume (PAYC) meters.	(a) Installing smart meters in commercial buildings nationwide by 2025.	NERC, DISCOs	FMLH&UD, NGOs, CBOs, OPS, DPs, ECN, FMP	FGN (NERC)	*	*	*
	(b) Sensitizing end-users on the benefits of smart Meters.	NERC, DISCOs NOA	FMLH&UD, NGOs, CBOs, OPS, DPs, ECN, FMP	FGN (NERC)	*	*	*
	(c) Ensuring the availability of smart meters in all households at subsidized rates.	NERC, DISCOs	FMLH&UD, NGOs, CBOs, OPS, DPs, ECN, FMP	FGN (NERC)	*	*	*
(v) Equipping 50 % of educational institutions and all health centers, and 15 % of all hotels and agro-food industries with solar thermal heating systems to meet their hot water needs by 2025.	(a) Promoting the installations of solar thermals in schools, hotels and SMEs.	NERC, ECN, NOA	FMST, FMEd., SGs, LGCs, RIs, TIs, ECN	FGN (ECN), OPS	*	*	*
	(b) Providing solar thermal heating systems at subsidized rate to meet energy demand target.	ECN, FMP	FMP, FMST, FMF, DPs, OPS	FGN (ECN)	*	*	
	(c) Encouraging health centres, hotels and agro food industries make use of solar thermal heating systems.	ECN, FMH, NUC, NBTE, NCCE, MAN, SMEDAN	FMP, NOA, FMI	FGN (ECN)	*	*	

10.5 BUILDING DESIGNS

10.5.1 Policies

i. The nation shall integrate and implement energy efficiency building designs and conservation techniques and principles into the construction of a new building and retrofitting existing ones to be more-energy-efficient.

ii. The nation shall promote passive design techniques in building designs.

10.5.2 Objectives

i. To ensure that the energy needs of buildings are met safely, efficiently and at reasonable prices.

ii. To minimize the environmental impact of energy production and use in buildings.

iii. To promote the efficient use and conservation of energy in buildings.

10.5.3 Action Plan

Table 10.6 Energy Efficiency and Conservation Plan for Building Designs

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Establishing Building Energy Consumption Indicators and Benchmarks for buildings.	(a) Developing EE building indicators and benchmarks.	ECN	NBRRI, FMP, OPS	FGN (ECN)	*	*	*
(ii) Initiating National Energy Efficiency Awards to draw public and professional attention and to encourage wider acceptance of the building energy efficiency and conservation codes.	(a) Initiating annual award for most energy efficient buildings in the public and private sector.	ECN	NBRRI, FMP, OPS, FMLH&UD, DPs	FGN (ECN)	*	*	*
(iii) Introducing energy audit programs in buildings.	(a) Developing accreditation scheme for energy auditors in the building sector.	ECN	NBRRI, FMP, OPS, FMLH&UD, DPs	FGN (ECN)	*	*	*
	(b) Providing capacity building for the existing energy auditors.	ECN	NBRRI, FMP, OPS, FMLH&UD, DPs	FGN (ECN)	*	*	*
	(c) Building capacity of Architects, Builders and other experts in the building sectors on energy efficiency best practices.	ECN	NBRRI, FMP, OPS, FMLH&UD, DPs, Relevant Proffessional Bodies	FGN (ECN)	*	*	*
(iv) Establishing guidelines for energy efficient practices in all government buildings.	(a) Integrating energy efficiency into the existing building codes.	ECN	FMW, FMP, FMLH&UD, DPs	FGN (ECN)	*	*	*
(v) Integrating the use of passive designs and climatic conditions in (e.g. day lighting and natural ventilation).	(a) Building capacity of relevant agencies/organizations to encourage energy efficiency best practices in the building sector.	ECN	FMW, FMP, FMEnv., FMLH&UD, DPs	FGN (ECN)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(vi) Developing and implementing building energy-efficiency and conservation standards and codes.	(a) Integrating energy efficiency in to the existing building codes.	ECN	FMW, FMP, SON, FMLH&UD, DPs, CPC	FGN (ECN)	*	*	*
(vii) Promoting the adoption of an Energy Efficiency Registration Scheme for buildings.	(a) Developing and adopting energy efficiency registration scheme for buildings in Nigeria.	ECN	FMW, FMP, SON, FMLH&UD, DPs, CPC, NBRRI	FGN (ECN)	*	*	*
(viii) Introducing Green Building Standard and Certification System (GBDCS).	(a) Developing certification programme for green buildings.	ECN	FMW, FMP, SON, FMLH&UD, DPs, CPC, NBRRI, FMEnv.	FGN (ECN)	*	*	*

10.6 AGRICULTURE

10.6.1 Policies

i. The nation shall promote the development and adoption of energy efficiency and conservation best practices in entire agricultural value chain.

ii. The nation shall develop and adopt appropriate energy efficiency codes and standards for farm machineries and equipment.

10.6.2 Objectives

i. To promote the efficient utilization of all energy types in agricultural activities.

ii. To decouple the rate of growth of agricultural energy consuption from the rate of growth in agricultural output.

iii. To reduce energy use in agricultural practices while increasing outputs.

10.6.3 Action Plan

Table 10.7: Energy Efficiency and Conservation Plan for the Agricultural Sector

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Improving the efficiency of irrigation pump set.	(a) Intensifying R & D effort in developing energy efficient irrigation pump set.	FMA&RD	ECN, RCs, RIs, TIs, DPs, OPS	FGN (FMA&RD)	*	*	*
	(b) Creating awareness on efficient irrigation pump sets in Nigeria.	FMA&RD	ECN, RCs, RIs, TIs, DPs, OPS	FGN (FMA&RD)	*	*	*
(ii) Increasing the efficiency of non – pumping farm machinery.	(a) Developing MEPS for farm machinery and equipments	FMA&RD	ECN, RCs, RIs, TIs, DPs, OPS	FGN (FMA&RD)	*	*	*
	(b) Providing enforcement mechanism for MEPS of farm machinery and equipments.	FMA&RD	ECN, RCs, RIs, TIs, DPs, OPS	FGN (FMA&RD)	*	*	*
(iii) Minimizing the need for traction through low – tillage agriculture.	(a) Promoting the use of efficient traction equipment.	FMA&RD	ECN, RCs, RIs, TIs, DPs, OPS	FGN (FMA&RD)	*	*	*
(iv) Using energy efficient equipment and machinery for post – harvest drying and storage.	(a) Commercializing the existing R&D on energy efficiency post harvest drying and storage equipment.	FMA&RD	FMIT&I, ECN, RIs, RCs, FMST, NOTAP, OPS	FGN (FMA&RD)	*	*	*
	(b) Improving on the existing R & D outputs for post-harvest drying and storage.	FMA&RD	FMIT&I, ECN, RIs, RCs, FMST, NOTAP, OPS	FGN (FMA&RD)	*	*	*
(v) Promote the use of evronmentally friendly green fuels	(a) Promote the cultivation and processing of agricultural feedstocks that could be processed for the production of biofuels such as bioethanol and biodiesel.	FMA & RD	ECN	FGN (FMA&RD)	*	*	*
	(b) Establish codes and standards for biofuels.	SON	ECN,FMST	FGN (SON)	*	*	*
	(c) Establish procedures and facilities for testing of biofuels.	SON	ECN,FMST	FGN (SON)	*	*	*
	(d) Create awareness on the use of biofuels in the agricultural sector.	FMA & RD	ECN,FMST	FGN (FMA&RD),	*	*	*

CHAPTER ELEVEN

ENVIRONMENT AND CLIMATE CHANGE

11.0 Introduction

The major environmental problems related to energy production, distribution and consumption in the country are mainly deforestation and pollution.

From available statistics, the nation's 15 million hectares of forest and woodland reserves could be depleted within the next fifty years. These would result in negative impacts on the environment, such as soil erosion, desertification, loss of biodiversity, micro-climatic change and flooding. Most of these impacts are already evident in different ecological zones in the country, amounting to huge economic losses and health challenges.

Oil exploration, production and export of oil and gas resourses by the petroleum sector have substantially improved the nation's economy over the past five decades. However, activities associated with oil exploration, development and production have significant detrimental impacts on the atmosphere and environment as a whole.

Pollution is the other major environmental concern. Combustion of fossil fuels, especially in the transport and industrial sectors, contributes greatly to air pollution in our major cities. The combustion products (CO_2, N_2O, etc) are greenhouse gases (GHGs) that lead to global warming, with attendant negative consequences on agriculture, water supply, forest resources, sea level rise, health, etc. Another source of air pollution is the continued flaring of large volumes of natural gas in the oil fields in the Niger Delta. Presently efforts are being made by the government to reduce gas flaring through gas gathering projects implemented under CDM flexible mechanism in all energy sectors.

In addition to air pollution, there is substantial water and soil pollution occurring due to oil spillage during oil production and distribution. Over the years, oil spillage has had significant adverse impact on aquatic resources and soil degradation.

As a result of these possible negative impacts, there is a need to incorporate environmental considerations into the nation's energy development and utilization.

11.0.1 Policy

i. The nations energy resources shall be exploited, distributed and utilized in an environmentally friendly and sustainable manner.

11.0.2 Objective

i. To ensure that in the course of producing, processing, distribution and utilizing energy, the environment is adequately protected.

11.0.3 Action Plan

Table 11.1: Action Plan for Environment and Climate Change

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Ensuring the existence of adequate environmental standards for all major energy production, transportation, transmission and utilization operations.	(a) Reviewing, updating and harmonizing the existing "Guidelines and standards for environmental pollution control in Nigeria" especially as they relate to energy production, supply and utilization.	FMEnv.	ECN, NERC, NAC, NNRA, DPR, NOSDRA, DPs, NESREA, SON	FGN (FMEnv.)	*	*	*
(ii) Strengthening the relevant regulatory agencies in order to ensure the enforcement and compliance of appropriate set standards.	(a) Reviewing the terms of reference and laws of environmentally relevant regulatory institutions with a view to strengthening them.	FMEnv.	ECN, NAC, DPR, NERC, SON, FMJ, MMSD, NNRA, NOSDRA, NESREA	FGN (FMEnv.)	*	*	*
	(b) Reactivating and upgrading the Environment Reference Laboratories, and revising their institutional supervision, financial and operational arrangement for greater effectiveness in the execution of their mandates.	FMEnv.	ECN, NAC, DPR, NERC, SON, MMSD, NNRA, FMJ, NOSDRA, NESREA	FGN (FMEnv.)	*	*	*
(iii) Setting appropriate targets for the attainment of definite progress in the mitigation and control of energy related environmental problems.	(a) Establishing definite targets and timelines for the attainment of specific environmental quality parameters.	FMEnv.	NNPC, ECN, DPR, OPS, DPs	FGN (FMEnv.)	*	*	*
	(b) Developing and implementing projects on natural gas power plants, Petrochemical plants, LNG plants, and gas re-injection to ensure complete phase out of gas flaring as soon as possible.	NNPC, FMEnv.	NERC, DPR REA, OPS, FMP, IPPs, FMEnv.	FGN (FMEnv., NNPC), OPS, DPs	*	*	*
	(c) Ensuring 10% reduction in energy-related emissions by 2020.	FMEnv.	ECN, FMT, FMIT&I, OPS, SON, NAC, NDDC, NESREA	FGN (FMEnv.), OPS, DPs	*	*	*
	(d) Ensuring 5% replacement of fuelwood with alternative energy sources by 2020.	FMEnv.	ECN, FMST, FMIT&I, OPS, SON, NGOs, CBOs	FGN (FMEnv.), OPS, DPs, NGOs	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(iv) Putting in place appropriate programmes to ensure the attainment of the set target for the mitigation and control of energy related environmental problems.	(a) Establishing a country-wide environment information network and database on energy-related pollutants.	FMEnv.	NNRA, FMWA&SD, NAC, NNPC, NGOs, CBOs, ECN, FMIT&I, NERC, OPS, DPs, NESREA	FGN (FMEnv.), OPS, DPs	*	*	
	(b) Designing and sponsoring publicity through the print and electronic media on energy-related environmental problems, their mitigation and adaptation.	FMEnv.	NNRA, FMA&RD, NAC, NNPC, NGOs, CBOs, ECN, FMIT&I, NERC, OPS, DPs, NESREA, MEDIA	FGN (FMEnv., NNPC, FMIT&I), OPS, DPs	*	*	*
	(c) Carrying out massive sensitization and awareness campaign on energy related environmental problems, their mitigation and adaptation.	FMEnv.	NNRA, NAC, DPs, FMWA&SD, ECN, NNPC, NGOs, CBOs, FMIT&I, NERC, OPS, MEDIA	FGN(FMEnv., NNPC), OPS, DPs	*	*	*
	(d) Monitoring of development trends in energy supply and utilization and their impact on the environment.	ECN	FMEnv., MMSD, OPS, FMP, FMST, NERC	FGN (ECN), OPS, DPs	*	*	*
	(e) Establishing coal and biomass briquetting plants.	MMSD	ECN, SGs, LGCs, OPS	FGN (MMSD)	*	*	*
	(f) Extending the 8-yr age ban on importation of used cars to include all categories of vehicles and machineries.	FMF	MPA, FMT, SON, OPS, FRSC, NCS, NAC	FGN (FMF)	*	*	
	(g) Strengthening the relevant government agencies for effective enforcement and monitoring of motor vehicles in relation to pollution abatement.	FMT	NAC, FMW, DPR, FMIT&I, FRSC, SON, FMEnv.	FGN (FMT)	*	*	*
	(h) Enforcing laws that governs monitoring of used machineries and electrical appliances as it relates to pollution.	FMST	SON, FMEnv., FMIT&I, COREN	FGN (FMST)	*	*	
	(i) Discouraging the use of 2-stroke engine motorcycles for public transportation.	NAC	FMT, MPA, FMF, FRSC, FMEnv., OPS	FGN (NAC)	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(j) Enacting laws requiring vehicles imported into the country to have catalytic converters.	NAC	NASS, FMJ	FGN (NASS)	*	*	*
(v) Ensuring monitoring of vital environmental parameters in the production, processing and utilization of energy.	(a) Monitoring of solid, liquid, gaseous, thermal and radioactive wastes and emissions from energy activities and installations.	FMEnv.	ECN, NNPC, , FMP, DPR, MMSD, FMST, FMIT&I , NASRDA	FGN (FMEnv.)	*	*	*
	(b) Strengthening the relevant agencies to ensure compliance with environmental laws and regulations.	FMEnv.	ECN, NNPC,FMP , DPR, MMSD, FMST, FMJ	FGN (FMEnv.)	*	*	*
(vi) Carrying out environmental impact assessment of major energy projects.	(a) Building capacity in environmental sciences, engineering and management.	FMEnv.	ECN, FMST, PTDF NUC, FMH, TIs NBTE, NCCE, RIs, RCs	FGN (FMEnv.)	*	*	*
	(b) Ensuring strict adherence to the recommendations of EIA on all energy projects.	FMEnv.	FMH, FMST, OPS, DPs, SGs, LGCs, Communities	FGN (FMEnv.)	*	*	*
(vii) Providing viable and affordable alternatives to firewood in order to minimize deforestation and decelerate the rate of desert encroachment and erosion.	(a) Implementing renewable energy masterplan projects.	ECN	FMP, NERC, REA, FMEnv., FMST, FMF, FMWR, RCs, RIs, DPs, OPS	FGN (ECN) DPs, OPS	*	*	*
	(b) Empowering and sensitizing women at the community level on the effective use of clean energy stoves.	ECN	FMWA&SD, NCWD, NGOs, ECN, FMEnv., FMA&RD, FMP	FGN (ECN)	*	*	*
(viii) Utilizing appropriate technologies in the exploitation, distribution and utilization of the various energy resources to minimize the harmful effects on the environment.	(a) Developing and implementing regulatory instruments for promoting the use of efficient and environmentally friendly technologies by operators in the regulated energy sector industries.	FMST	NERC, MMSD, FMEnv., NOSDRA, NNRA, DPR	FGN (FMST)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(ix) Encouraging R&D in the optimal utilization of various energy sources to minimize the associated adverse environmental impacts.	(a) Studying, classifying and cataloguing the efficiency of the various energy end-use products with a view to minimizing their associated adverse environmental impacts.	ECN	FMST, RCs, RIs, TIs, Ecological Fund	FGN (ECN)	*	*	*
	(b) Funding R & D on energy-related environmental problems.	FMST	FMEnv., ECN, Ecological Fund	FMST	*	*	*
	(c) Establishing more environmental professorial chairs.	FMEnv.	ECN, FMST, DPs, NNPC, PTDF, ETF, Ecological Fund	FGN (FMEnv.)	*	*	*
(x) Encouraging the utilization of environmentally friendly energy sources.	(a) Establishing promotional and demonstration projects on environmentally friendly energy technologies	ECN	FMWA&SD, FMEnv., FMST	FGN(ECN)	*	*	*
	(b) Encouraging the establishment of industries for the production of energy efficient end-use devices.	SMEDAN	NGOs, ECN, OPS, FMIT&I, DPs	FGN (SMEDAN)	*	*	*
	(c) Developing and implementing incentives for local manufacture of renewable energy equipment and for the utilization of renewable energy devices.	ECN	SMEDAN, OPS, DPs,FMEnv.	FGN (ECN), OPS	*	*	*
	(d) Incubating mature renewable energy technologies from R&D efforts.	NBTI	OPS, DPs, FMST, ECN	FGN (NBTI), OPS, DPs	*	*	*
	(e) Organizing and implementing extension services for women on the use of environmentally-friendly energy sources and devices.	ECN	FMWA&SD, FMA&RD, FMWR SGs, LGCs, FMEnv., OPS, DPs, RMRDC	FGN (ECN)	*	*	*
	(f) Sensitizing the public on the use of environmentally friendly energy resources.	ECN	FMEnv., Media, NGOs, CBOs,	FGN (ECN)			

CHAPTER TWELVE

OTHER ENERGY ISSUES

12.1 Research and Development

The crucial dependence of the sustainable socio-economic advancement of any nation on research and development activities is now universally acknowledged. This dependence is applicable also to the development of vital sectors of the national economy, including the energy sector. For this sector therefore, it is important that research and development are given adequate attention with regards to key issues such as energy resources development and utilization.

12.1.1 Policy

i. The nation's energy resources shall be developed and utilized on a sustainable basis through research and development.

12.1.2 Objectives

i. To initiate and promote energy related research and development programmes; and ensure that such programmes are applications- oriented and market driven.

ii. To promote participation in research and development by Nigerians in all areas of energy exploration, development and utilization.

iii. To develop intermediate and high level manpower through research and development, training and retraining.

12.1.3 Action Plan

Table 12.1: Research and Development Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Developing and promoting local capability in the nation's energy centers, tertiary institutions and research institutes for the design and fabrication of efficient energy devices and technologies for the utilization of renewable energy resources.	(a)Establishing priorities and setting targets for capacity building of research personnel and scientific officers in the nation's energy centres and research institutes for the acquisition of state –of- the- art techniques in design, fabrication and testing of energy-efficient devices.	ECN	FMST, RCs, RIs, TIs, DPs, FMEd., NUC, TETFUND	FGN (ECN)	*	*	*
	(b) Upgrading and equipping with full funding existing research centres and institutes to centres of excellence for the design and fabrication of efficient energy devices and technologies for the utilization of renewable energy resources.	ECN	FMST, RCs, RIs, TIs, DPs, FMEd.	FGN (ECN)	*	*	*
(ii)Promoting the demonstration and dissemination of renewable energy devices and technologies for their adoption and market penetration.	(a) Organizing periodic technology fair on the results of energy R & D.	ECN, NOTAP	FMST, RCs, RIs, TIs, DPs, FMEd., RMRDC	FGN(ECN, NOTAP)	*	*	*
	(b) Setting up linkages and consultancy units within the research centres for patenting of R & D outputs and their eventual incubation.	ECN	FMST, RCs, RIs, TIs, DPs, FMEd., FMIT&I, NOTAP	FGN(ECN)	*	*	*
	(c) Designing and sponsoring publicity programmes through the print and electronic media on the effectiveness and cost benefits of renewable energy devices.	ECN	FMST, FMIT&I, RCs, RIs, TIs, SGs, LGCs, OPS	FGN (ECN), OPS, SGs, LGCs	*	*	*
	(d) Acquiring and equipping mobile demonstration vans for promotion and demonstration of renewable energy technology devices.	ECN	NOA, FMST, FMIT&I, RCs, RIs, TIs, SGs, LGCs, OPS, NGOs	FGN (ECN), OPS, SGs, LGCs	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(iii) Monitoring and assessing international technological development in all energy areas; and initiating and sustaining local capability for their applications in all sectors of the economy.	(a)Expanding the mandate of the linkage and consultancy units in the research centres to include monitoring and assessment of international technological developments and products in all energy areas for their local adaptation and application.	ECN	FMST, MFA, NOTAP	FGN(ECN)	*	*	*
	(b) Ensuring participation in, and organizing international conferences, workshops and fairs to keep abreast oftechnological developments.	ECN	FMST, OPS, DPs, TIs, RIs, RCs, TETFUND, PTDF, NPC	FGN(ECN)	*	*	*
(iv) Initiating and promoting energy educational programmes and research activities in tertiary institutions and research institutes.	(a) Developing and implementing curricula on energy education and energy programmes for primary, secondary and tertiary institutions.	ECN	FMST, FMEd., NERDC, UBEC, NUC, NBTE, TIs, RIs, SGs, LGCs	FGN (ECN), DPs	*	*	*
(v) Encouraging result oriented research and development in the energy sector by making expenditure on such efforts tax deductible.	(a)Making upward review of existing fiscal incentives on funding result-oriented R & D by the private sector.	ECN	FMST, FMF, OPS, RCs, RIs, TIs	FGN (ECN), OPS	*	*	*
	(b) Sensitizing the OPS on the importance of letting out their energy related problems for research to R & D institutions and Centres.	ECN	FMST, OPS, TIs, RIs, RCs	FGN (ECN), OPS	*	*	*
	(c) Improving the percentage of energy R&D handled by local institutions.	ECN	FMIT&I, RIs, RCs, TIs, FMST, OPS, DPs	FGN (ECN), OPS	*	*	*
(vi) Establishing research and development training programmes for the development of specialized energy manpower.	(a) Ensuring implementation of the national energy manpower development plan.	ECN	FMEd., FMST, FMIT&I, OPS, DPs, NERC, NNPC, FME, FML, FMWA&SD	FGN (ECN), OPS	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(vii) Selecting and deploying appropriate energy technologies through research and development.	(a) Creating more research centers to adopt/adapt and reverse engineer appropriate technology systems for proliferations and deployment.	ECN	FMST, RCs, RIs, NASENI	FGN (ECN)	*	*	*
	(b) Funding of research and development infrastructures adequately.	FMST	ECN, RCs, RIs,TIs,	FGN (ECN)	*	*	*
(viii) Encouraging the energy producing and processing companies to set up research and development outfits in the country and to make use of research and development institutions in Nigeria	(a) Creating awareness on the need to have research and development unit in every company	ECN	FMST, RMRDC	FGN (ECN)	*	*	*
	(b) Providing financial incentives by way of tax holiday or tax rebate.	FMF	NIPC, FIRS, FMIT&I	FGN (FMF)	*	*	*

12.2 Manpower Development and Training

Sufficient and well trained manpower is critical in the energy sector as it constitutes the main pivot in the overall functioning of the entire energy organs, both in the public and private sectors of the economy. Currently, there seems to be a significant lack of indigenous energy manpower training experts in the country. There is inadequacy in capacity building – manpower training and development. Compared to the population of the country, there are insufficient energy related courses in most tertiary institutions in the country. It is necessary to provide linkages with related professional bodies both within and outside the country. Efforts must therefore be made by all to ensure manpower development and training in the nation's energy sector.

12.2.1 Policy

i. The nation shall promote manpower development and training in the nation's energy sector.

12.2.2 Objective

i. To develop the human capacity needed to meet the manpower requirement of the nation's energy sector.

12.2.3 Action Plan

Table 12.2: Action Plan for Manpower Development and Training

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Establishing a national human resource data base in the energy sector.	(a) Conducting periodically a national manpower survey to determine the human resource needs and supply in the energy sector.	ECN	NBS, NPC, NBTE, NUC, CBN, NISER, OPS, DPs, Professional Bodies	FGN (ECN), OPS, DPs	*	*	*
	(b) Disseminating the report of the surveys to stakeholders.	ECN	NBTE, OPS, NBS, MI, NPC, NUC, CBN, DPs, NISER, Professional Bodies	FGN (ECN, NISER), OPS, DPs	*	*	*
	(c)Updating the National Human Resource Database.	ECN	NBTE, OPS, NBS, MI, NPC, NUC, CBN, DPs, NISER, Professional Bodies	FGN (ECN, NISER), OPS, DPs	*	*	*
(ii) Determining periodically the manpower stock and needs.	(a) Conducting survey to access the manpower requirement.	ECN	ECN, FMEd., NUC, DPs, NBTE, NCCE, FML&P	FGN (ECN)	*	*	*
(iii) Developing a national programme to meet energy manpower needs.	(a) Introducing energy awareness into the nation's educational curriculum.	FMEd.	ECN, NERDC, NUC, DPs, NBTE, NCCE	FGN (FMEd.)	*	*	*
	(b) Establishing technical collaboration with specialized institutions and industries on energy programmes outside the country.	ECN	FMEd., NNPC, OPS, DPs, MFA, PTDF, NPC	FGN (ECN)	*	*	*
	(c) Call for memoranda from stakeholders on the requirements necessary for an effective training and manpower development in the energy sector.	ECN	NNPC, NAEC, OPS, FMP DPs, PTDF, FMWR, FMA&RD, NUC, NBTE	FGN (ECN)	*	*	*
	(d) Promoting local capability in the nation's Energy Centres and Research Institutes for the design and fabrication of efficient energy devices and technologies.	ECN	FMP, FMST, NNPC, NAEC, OPS, PHCN, DPs, PTDF, FMA&RD, FMWR, NUC, NBTE, RMRDC, RIs	FGN (ECN)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(e) Providing increased funding to R & D activities.	ECN	FMF, FMP, NNPC, NAEC, OPS, DPs, PTDF, FMA&RD, FMWR, NUC, NBTE, FMST, RMRDC	FGN (ECN)	*	*	*
	(f) Developing and implementing R & D programmes in energy efficiency and conservation.	ECN	FME, NNPC, NAEC, OPS, FMP, DPs, PTDF, FMA&RD, FMWR, NUC, NBTE	FGN (ECN)	*	*	*
(iv) Ensuring the integration of Research, Development and Manpower training in the energy sector.	(a) Reviewing energy-related manpower development programmes of the nation's Institutions, Research Institutes and Centres.	FMST	ECN, TIs, RCs, RIs, NPC, FMEd., NNPC, FMPE	FGN (FMST)	*	*	*
	(b) Evaluating the existing infrastructural facilities in the nation's energy Research Institutes and Centres with a view to providing conducive atmosphere for R & D activities.	ECN	FMST, RCs, RIs, TIs, NPC, FMLH&UD, NNPC, FMP, FMEnv.	FGN (ECN)	*	*	*
	(c) Organizing regular interactive fora for stakeholders in R&D, Production and training.	ECN	NOTAP, NNPC, FMPE, OPS, DPs, NBTI, NBTE, NCCE, RIs, RCs, TI, NUC	FGN (ECN)	*	*	*
	(d) Developing framework for effective hands on training programmes.	ECN	NBTE, ITF, NCCE, FMST, RCs, RIs, OPS, DPs	FGN (ECN)			
	(e) Encouraging industries to incorporate R&D projects from pilot stageto production.	FMIT&I	FMP, FMST, FMI, OPS, RCs, MAN, FMIT&I, ECN	FGN (FMIT&I)	*	*	*
(v) Formulating legal frame work for ensuring inter – agency collaboration in the energy sector manpower development.	(a)Developing institutional framework for collaboration in the energy sector.	ECN	NBTE, OPS, NBS, MI, NPC, NUC, CBN, DPs, NISER, Professional Bodies	FGN (ECN, NISER), OPS, DPs	*	*	
	(b) Establishingan inter – ministerial committee for manpower development.	ECN	MPR, FMP, FMST, FMEnv., FMEd.,	FGN (ECN)	*		
	(c) Strengthening laws already put in place for energy producers to support training and manpower development.	NASS	NASS, FMJ, FMP, NERC, MPR, ECN,OPS, ITF	FGN (NASS)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(d) Developing an energy education curricula for all levels.	FMEd.	FMP, FMST, FMI, OPS, DPs, NAEC, ECN, NERDC, NUC, NBTE	FGN (FMEd.)	*	*	*
(vi) Ensuring through legislation, that energy producers make available certain percentage of their annual profit to support/fund manpower development and training.	(a) Developing an energy education curricula for all levels.	FMEd.	FMP, FMST, FMI, OPS, DPs, NAEC, ECN	FGN (FMEd.)	*	*	*
(vii) Introducing energy education at all levels of the nation's educational curricula.	(a) Introducing energy education for all, through organization of conferences, seminars, workshops, short term courses, etc.	ECN	FMEd., FMP, FMST, FMI, OPS, DPs, NAEC	FGN (ECN)	*	*	*
	(b) Introducing hands-on training in research laboratories, energy producing units, energy research centres, precision machine workshops, etc.	ECN	FMEd., FMP, FMST, FMI, OPS, DPs, NAEC, RCs, RIs, TIs	FGN (ECN)	*	*	*
	(c) Establishing engineering workshops for the training of energy practitioners.	ECN	FMEd., FMP, FMST, FMI, OPS, DPs, NAEC, RCs, RIs, Tis	FGN (ECN)	*	*	
	(d) Directing the host university of each energy research centre to run certificate and degree programmes in energy studies.	ECN	FMP, FMST, FMI, OPS, DPs, NAEC, RCs, RIs, TIs, NUC, FMEd.	FGN (ECN)	*	*	
(viii) Integrating energy studies into the curricula of secondary and tertiary institutions while emphasizing thier multi-disciplinary nature.	(a) Carrying out survey exercise to determine the manpower stock and needs in the nation.	ECN	NBTE, OPS, NBS, MI, NPC, NUC, CBN, DPs, NISER, Professional Bodies	FGN (ECN, NISER), OPS, DPs	*	*	*

12.3 Local Content

To attain the vision 20:2020 intent and beyond, it is necessary that human capacity development be a major focus in the energy sector. Equally important is the necessity to transform the vast endowment of energy related resources in the country for the benefit of the nation. We need to develop in the country training institutions to enhance the support, design and fabrication not only in the oil and gas industry but in all spheres of the energy mix. We should also develop local coal technology and the vast renewable energy available to the country. Research in these areas should be pursued by encouraging collaboration between the industry and the tertiary institutions to foster world class technological development locally.

12.3.1 Policy

i. The nation shall encourage the use of locally available Resources in all aspect of the energy sector in Nigeria.

12.3.2 Objective

i. To encourage local production of inputs required for development of energy sector.

12.3.3 Action Plan

Table 121.3: Action Plan for Local Content

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Identifying, quantifying and qualifying resources for use in the energy sector in Nigeria.	(a) Conducting studies on the quantity and quality of available energy resources in the country.	ECN	NERC, FMF, CBN, OPS, NNPC, MPR, BPE, FMP, MMSD, RMRDC, FMST, NBS	FGN (ECN)	*	*	*
(ii) Conducting studies on national demand and export possibilities of locally produced materials in the energy sector.	(a) Funding research studies on the national possibillities of locally produced raw materials in the energy sector.	ECN	CBN, FMF, RIs, Tis, FMIT&I, FMST, RMRDC	FGN (ECN, CBN)	*	*	*
	(b) Encouraging the local production of materials in the energy sector through tax waivers and provision of subsidies.	ECN	FMF, FMIT&I, FMI, RMRDC, FMST, FMA&RD, FMWR, NIPC, NOTAP	FGN (ECN)	*	*	*
(iii) Providing incentives to encourage local manufacturing and production of equipments and consumables used in the energy sector.	(a) Creating Energy Development Fund.	ECN	FMST, FMIT&I, RMRDC, CBN, BOI, BOA, FMF	FGN (ECN)	*	*	*
	(b) Reducing tax on locally manufactured goods.	FIRS	CBN, NCS	FGN (FIRS)	*	*	*
(iv) Enacting law(s) to ensure local sourcing of materials related to energy production and utilization.	(a) Strengthening the institution that are saddled with the mandate of the local content development and raw material sourcing.	NCDMB, RMRDC	FMST, RCs, RIs, OPS, FMIT&I, SON	FG (RMRDC, NCDMB)	*	*	*
(v) Establishing a common and comprehensive local content measurement for the entire energy sector.	(a) Creating an enabling law on local content for the energy sector.	ECN	FMST, ECN, FMP, RC's, RI's, ECN	FGN (ECN)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(vi) Increasing patronage of indigenous engineering and applied research groups in the execution of projects right from feasibility studies.	(a) Creating laws that compel companies to use certain percentage of indegenous engineers and researchers.	COREN	ECN, NSE, FMST, FMF, FMW	FGN (COREN)			
	(b) Engaging with employers to discourage the discrimination for doing the same job.	COREN,	FMF	FGN (COREN, NSE)			
(vii) Establishing a financing mechanism which will support indigenous investments in the energy sector industries.	(a) Implementing all the activities prescribed for strategies i, ii, iv, v, vi under financing.	CBN	ECN, FMF, NIPC, OPS	FGN (CBN), OPS	*	*	*
(viii) Putting in place other incentives, appropriate to each energy sub-sector, which will promote indigenous private sector participation and competitiveness in the sub-sector.	(a) Implementing the incentives prescribed in the plans for each energy sub-sector	ECN	NERC, FMF, CBN, OPS, NNPC, MPR, BPE, FMP	FGN (ECN)	*	*	*
(ix) Putting in place schemes to ensure broad-based access by Nigerians to shares in privatized energy sector industries.	(a) Establishing and implementing appropriate monetary policies	BPE	FMF, SEC, OPS DECD, ADB	FGN (BPE)	*	*	
(x) Encouraging the establishment of energy sector production and service industries by indigenous investors.	(a) Providing tax holidays and level playing field	ECN	FMST, RCs, RIs, OPS, NIPC, FMIT&I	FG (ECN)	*	*	*
(xi) Creating appropriate motivation through the Memorandum of Understanding and / or Operating Licenses in the energy sector, for increasing the local content of value added in the activities of energy sector industries.	(a) Including and implementing local content of value added in all energy sector projects.	ECN	NERC, FMF, CBN, OPS, NNPC, MPR, BPE, FMP	FGN (ECN)	*	*	*

12.4 Bilateral, Regional and International Cooperation

Nigeria is involved in bilateral, regional and international arrangements in the area of energy within the framework of its economic relations with other countries and multilateral institutions. This collaboration is designed to complement domestic efforts towards energy security for the nation. Energy supply, jointmanagement and equity participation in the development of energy sources are important aspects of our bilateral and multilateral cooperation arrangements with other African Countries.

The nation's membership of sub-regional, regional and international organizations such as ECOWAS, APPA, AU, UN, IAEA, WEC, OPEC, AFREC, etc, provides opportunity for it to play an active role in their energy agenda. It is necessary to foster this multilateral co-operation for rapid national economic development. From past experiences in the effort of the Africa region towards economic integration, it is clear that a step-by-step approach based on common interests and the pooling of resources offers the best prospects for a successful and lasting integration. In this respect, the energy sector offers some mutually beneficial opportunities for projects which can be implemented in the short to medium term.

12.4.1 Policies

i. The nation's energy resources shall be deployed in promoting and enhancing regional and international co-operation for the overall economic and technological advancement of the nation.

ii. The nation shall lay emphasis on fostering and strengthening energy cooperation and integration within the ECOWAS sub – region.

iii. The nation shall pursue international collaboration on energy.

12.4.2 Objectives

i. To enhance Nigeria's effective participation in energy related international organizations.

ii. To facilitate the adoption of technology for the development of the energy sector.

iii. To encourage a cooperative approach in the exploitation of energy resources and development of energy supply infrastructure.

iv. To optimize the utilization of the region's energy resources.

v. To grow the national economy, promote security and influence regional and international decision on energy.

vi. To expand access to energy services through international collaboration.

12.4.3 Action Plan

Table 12.4: Bilateral, Regional and International Co-operation Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Strenghtening co - ordinated approach to regional and sub-regional energy planning based on co-operation and consultation among member countries of ECOWAS and other members of the African Union (AU).	(a) Ensuring regular payment of Nigeria's membership dues in ECOWAS and other AU energy related bodies.	ECN	FMST, RCs, RIs, TIs, NNPC, FMP, MFA, AFRC, ECOWAS, AU	FGN (ECN, FMST, RCs, RIs, TIs)	*	*	*
	(b) Ensuring full representation and participation in the activities of these sub-regional and regional bodies in energy related matters.	ECN	FMST, RCs, RIs, TIs, NNPC, MFA, AFRC, ECOWAS, AU	FGN (ECN)	*	*	*
(ii) Promoting the standardization and cerification of energy related plants, machineries and spares and the establishment of infrastructural facilities within the community for their production.	(a) Negotiating and developing common standards for energy related plants, machineries, spares and equipment for use within the sub- region.	SON, ECN	FMIT&I, ECOWAS, MFA, DPs, OPS, Professional bodies	FGN (SON), OPS, DPs	*	*	*
	(b) Establishing facilities for standardization of energy-related plants, machineries, spares and equipment.	SON, ECN	FMIT&I, ECN, DPs, ECOWAS, MFA, OPS	FGN (SON), OPS, DPs	*	*	*
(iii) Mobilizing domestic capital and creating a favourable investment climate to attract international financing for energy development projects.	(a) Negotiating a financing instrument to mobilize domestic funds within the region for long-term investments in the energy sectors.	FMF	SEC, DPs, OPS, MFA, FMIT&I, CBN, BOI	FGN (FMF), DPs, OPS	*	*	*
	(b) Continuing the on-going reform and restructuring programmes in the country's energy sub- sectors and encouraging similar programmes in other countries of the sub-region.	BPE	NERC, DPR, NNPC, DPs, ECOWAS, NCP	FGN (BPE), DPs, OPS	*	*	*
(iv) Pooling available human resources through networking of National Energy Training and Research Centers.	(a) Establishing a database of experts and institutions in the energy sector of the region.	ECN	FMST, ECOWAS, DPs, FMP, NBS, OPS, Professional Bodies	FGN (ECN)	*	*	*
	(b) Encouraging the formation of sub-regional and regional energy-related associations and professional bodies.	ECN	Professional Bodies, DPs, NPC, NGOs, MFA, AU, ECOWAS	FGN (ECN)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(v) Ensuring Nigeria's active membership in energy related regional and international organizations	(a) Ensuring periodic review of Nigeria's membership status in sub-regional, regional and international energy related organizations.	ECN	MFA, FMST,	FGN (ECN)	*	*	*
	(b) Ensuring prompt payment of dues to all sub-regional, regional and international energy related organizations Nigeria belongs to.	ECN	FMST, MFA	FGN(ECN)	*	*	*
(vi) Promoting favourable trading relationships with member countries of ECOWAS and the AU, which will ease the financing of energy supply and other energy related projects.	(a) Negotiating the relaxation of trade restrictions on energy supply and technologies in Africa.	FMIT&I	MFA, ECN, AU, ECOWAS, OPS	FGN (FMIT&I)	*	*	*
	(b) Exploring new areas of energy trade with member countries of the AU.	FMIT&I	MFA, ECN, AU, ECOWAS, OPS	FGN (FMIT&I)	*	*	*
(vii) Strenghtening the West African Power Pool.	(a) Pursuing vigorously the realization of the on-going sub-regional and regional energy projects as well as initiating new ones.	ECN	FMA&RD, FMWR, OPS, DPs, NERC	FGN (ECN), OPS, DPs	*	*	*
	(b) Establishing mutually beneficial energy trading terms with regional and sub-regional partners.	ECN, NNPC	FMWR, OPS, DPs, SON, NERC	FGN (ECN), OPS, DPs	*	*	*
	(c) Establishing regional and sub-regional networks of energy research establishments and energy equipment testing laboratories.	ECN	FMWR, OPS, ECN, SON, DPs	FGN (ECN), OPS, DPs	*	*	*
	(d) Initiating the formation of a joint committee of member states within the ECOWAS sub-region engaged in energy programmes to work out joint proposals for presentation to development partners for funding.	ECN	FMWR, OPS, DPs, ECOWAS, FMP	FGN (ECN), OPS, DPs	*	*	*
	(e) Establishing energy sector networks, information and experience exchange strategies.	ECN	NERC, DPs, OPS, FMP	FGN (ECN), DPs, OPS	*	*	*

12.5 Gender Issues

It is difficult for many traditional energy planners to understand how gender mainstreaming and empowerment relate to their work as these appear to be political or social welfare concerns far removed from decisions about fuel supplies and technology choices. Gender sensitivity may be viewed as an 'add-on' to energy programmes, one that is easy to drop off. Energy policy specialists rarely pay attention to gender issues and therefore do not consider gender issues in policy making. Energy planning in reality is gender-blind; it fails to recognize that the women's practical productive and strategic energy needs are different from those of men, so inadvertently discriminates usually against them.

Integrating energy projects into other types of development programmes can help to shift the focus from technology-driven interventions to more integrated initiatives that take into account a community's social and economic development needs. In that context, it is likely that concerns about women's need might seem more understandable. Promoting increased participation of women in energy decision making at all levels in another way to ensure that women concerns are taken into account.

12.5.1 Policies

i. The nation shall encourage and ensure gender mainstreaming in energy issues; infrastructure programs and projects.

ii. The nation shall disaggregate energy use, supply and impacts by gender in energy project design and implementation.

12.5.2 Objectives

i. To create awareness on gender issues in the energy sector.

ii. To provide better basis for incorporating gender in energy project design and implementation at the micro- and macro- policy levels.

12.5.3 Action Plan

Table 12.5: Action Plan for Gender Issues

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Promoting integrated approaches and various solutions that recognize the importance of wood energy and cooking for poor women and its health implication.	(a) Embarking on sensitizations and outreaches to create awareness on the environmental and health implications of the use of open wood fires.	ECN	FMWA&SD, FMF, OPS, NGOs, DPs, NESREA, LGCs, SG	FGN (ECN), DPs	*	*	
	(b) Providing energy efficient wood stoves and other kinds of clean energy cooking devices at subsidized prices.	ECN, DTCA	FMWA&SD, FMF, OPS, NGOs, DPs	FGN (ECN, DTCA), DPs	*	*	
	(c) Organizing trainings for women living in the rural communities to guide them on how to construct energy efficient wood stoves.	ECN	FMWA&SD, FMF, OPS, NGOs, DPs, DTCA	FGN (ECN), DPs	*	*	
(ii) Providing equal access to credit facilities, extension support services and training in energy and electricity supplies for women's domestic task as well as their micro – enterprise activities.	(a)Providing basic services and solution for rural upliftment by educating women in skill development,electrification and empowerment.	ECN	FMWA&SD, FMF, OPS, NGOs, DPs, LGCs, SGs, NCWD	FGN (ECN), DPs	*	*	
(iii) Developing a reliable gender responsive statistical data on women that needs empowering.	(a) Conducting a survey for the purpose of generating data.	FMWA&SD	ECN, FMF, OPS, NGOs, DPs, NBS, NPC, LGCs, SGs	FGN (ECN), DPs	*	*	
(iv) Incorporating gender concerns into energy and rural development policies and programmes.	(a) Organising meetings with women, development partners, and stakeholders at the grassroot level and making recommendations to governments.	ECN	FMWA&SD, FMF, OPS, NGOs, DPs	FGN (ECN), DPs	*	*	*
(v) Monitoring and evaluating the impacts of rural energy projects on poverty alleviation and gender equity.	(a) Providing continous monitoring and evaluation and carry out post project impact accessment.	ECN	FMWA&SD, FMF, OPS, NGOs, DPs	FGN (ECN), DPs	*	*	

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(vi) Establishing gender units in all MDAs in the energy sector.	(a) Creating gender units in all MDA's.	FMWA&SD	FMWA&SD, FMF, OPS, NGOs, DPs, MDAs	FGN (ECN), DPs	*	*	
(vii) Ensuring gender sensitive capacity building programmes in the energy sector.	(a)Organizing training and capacity building to accommodate gender mainstreaming responsibility.	FMWA&SD	ECN, FMF, OPS, NGOs, DPs, NCWD	FGN (ECN), DPs	*	*	*
(viii) Ensuring equal access to electricity for water pumping, agricultural processing, security, work productivity, and health in the framework of sectoral development initiatives.	(a) Reserving a particular percentage of electricity for domestic use. 6	FMWA&SD	FMF, OPS, NGOs, DPs, MDAs, DISCO, REA, SGs, LGs, ECN	FGN(FMWA &SD), DPs	*	*	*
(ix) Conducting gender sensitive capacity building programmes in the energy sector.	(a) Empowering the train the trainee programme.	FMWA&SD	FMF, OPS, NGOs, DPs, MDAs, ECN	FGN (ECN), DPs	*	*	

CHAPTER THIRTEEN

ENERGY FINANCING

13.0 Introduction

Energy Infrastructure projects are capital-intensive. Therefore ensuring easy accessibility to adequate, reliable and affordable energy services, in Nigeria, requires huge investment.

The key question that needs to be addressed is: what are the options and strategies for mobilizing domestic and international capital to finance the investment requirements of sustaining long term energy and socio-economic development in Nigeria

In the light of the above question, some measures need to be put in place in addressing the key issues. For instance, energy projects should be properly chosen, designed and packaged to be attractive to domestic and foreign investors. Moreover maximum advantage should be taken of the international funds available for environmentally sound energy projects

In Nigeria access to energy finance is affected by:

- Inadequate national support system that guarantees the attraction and security of investment;
- Inadequate financial capacity for energy investment;
- Slow judicial process in settling dispute;
- Inadequate strategies for attracting offshore financing;
- Political and regulatory risks for investment in energy infrastructure;
- Inadequate incentives to business to invest in new technologies;

Some of the remedial measures to counter these, especially for the energy sector, have been enumerated in this master plan such as; establishing a tax holiday scheme, Introducing tariffs that guarantee good rate of return on investment etc. Moreover some of the identified niche products that could be employed in financing energy projects are Equity financing mechanism, bond market, financial collaboration between government/private with bilateral and multilateral institutions etc.

13.1 FINANCING

13.1.1 Policies

i. Investments in the nation's energy sector shall be accorded high priority within the economic sector.

ii. The nation shall provide financing policy frame work for achieving a sustainable development of the sector.

iii. The nation shall explore and adopt all viable financing options from local and international sources for cost effective exploitation of its energy resources.

iv. The nation shall encourage increase in private investments, both domestic and foreign, in the energy sector.

v. The nation shall implement an Integrated Infrastructure Master Plan (NIIMP) to enable cross sectoral harmony and finacing frame work.

vi. The nation shall create an investment friendly environment through improving real and percieved risk by private investors measured through Transparency International corruption Index, World Bank doing business index, millenium challenge corporation rating, e.t.c.

13.1.2 Objectives

i. To ensure the availability of adequate funding for the energy sector.

ii. To ensure continuity in the funding of projects in the energy sector.

iii. To attract both local and foreign investments from a highly competitive international finance market

iv. To ensure that the energy supply options adopted are the most cost – effective for the country.

v. To increase foreign exchange earnings through export of energy products.

vi. To encourage Public Private Partnership in the energy financing.

13.1.3 Action Plan

Table 13.1: Action Plan for Energy Financing

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) *Providing fiscal incentives for prospective investors in the energy sector.*	(a) Providing fiscal incentives (such as suspension of import duty , tax holiday, investment grants, operational grants, etc.) to encourage local production of energy systems and components.	ECN, FMF	CBN, NASS, FMP, FMST, DPR, NNPC, OPS, DPs, NIPC	FGN (ECN, FMF)	*	*	
	(b) Providing value chain financial products and services to scale up bankable RE and EE projects.	FMF, ECN	CBN, NERC, DPR, BOI, OPS, DPS	FGN (ECN)	*	*	*
(ii) Reviewing the existing laws and regulations for the operation of the energy sector industries so as to increase private sector participation in the industries.	(a) Implementing the existing Electricity Sector Power Reform Act, consistently.	FMP, BPE, NERC	REA, FMF, OPS, DPs, FMST, ECN, MMSD, FMJ, NASS, DPR, NNPC	FGN (FMP) BPE, NERC	*	*	*
	(b) Introducing environmental regulations that encourage investment in environmental friendly technologies.	FMEnv.	NERC, REA, FMF, OPS, DPs, FMST, ECN, MMSD, FMJ, NASS, FMP, DPR, NNPC	FGN (FMEnv.)	*	*	
(iii) Ensuring periodic review of energy pricing to guarantee a reasonable return on investment.	(a) Introducing tariffs that guarantee good rate of return on investment.	NERC, PPPRA	NNPC, FMJ, FMP, DPR, REA, FMIT&I, OPS, FMF, ECN	FGN (NERC, PPPRA), OPS	*	*	*
(iv) Employing the use of Public Private Patnership (PPP) models to finance viable energy projects.	(a) Instituting a scheme for accelerated depreciation of equipment in respect of (foreign) loans invested in energy projects.	FMF	ECN, OPS, MAN, FMIT&I, NPC, CBN, DPs, NIPC	FGN (FMF), OPS, DPs	*	*	*
(v) Encouraging the inflow of offshore investment funds from international investment banks and brokerage firms.	(a) Introducing concessionary feed -in tariff for RE based energy supply.	NERC, REA	ECN, FMF, OPS, FMP	FGN (NERC, REA), OPS	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
	(b) Establishing special risk fund scheme for commercialization of new and emerging energy technologies such as RET.	FMF	FMST, ECN, OPS, DPs, CBN, NASS, NIPC, SEC, NSE	FGN (NERC, REA), OPS	*	*	
	(c) Attracting and leveraging long-term financing from international institutions and climate finace (e.g Green Climate Fund).	FMF	SEC, CBN, OPS	FGN (NERC, REA), OPS	*	*	*
	(d) Providing adequate security for energy infrastructural facilities.	OSGF	Security Agencies, SGs, LGCs	FGN (OSGF)	*	*	*
(vi) Encouraging energy firms to source development funds from the Nigerian capital market.	(a) Establishing and implementing appropriate monetary policies.	SEC	CBN, OPS, FMF	FGN (FMF)	*	*	*
(vii) Establishing a clear legal and regulatory frame work for energy financing in Nigeria.	(a) Developing laws related to energy financing.	ECN	FMF, CBN, NASS, NERC, FMJ, PPPRA	FGN (ECN)	*	*	*
(viii) Empowering the fiscal and monetary authorities to execute energy fiancing in Nigeria.	(a) Establishing and implementing appropriate monetary policies. Establishing plan that will monitor and execute energy financing in Nigeria.	FMF	SEC, OPS	FGN (FMF)	*	*	*
(ix) *Furthering the internalization of Nigeria's Capital Market by encouraging stocks of Nigeria's energy corporate units to be quoted in the International Stock Exchange to attract foreign portfolio investment capital.*	(a) Establishing and implementing appropriate Capital market policies.	FMF, SEC	CBN, SEC , NSE	FMF, SEC	*	*	*
(x) *Expanding the scope of venture capital financing to embrace investments in the energy sector.*	(a) Establishing and Implementing appropriate policies.	FMF, SEC	CBN, OPS	FMF	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(xi) Establishing a financial mechanism for the energy sector.	(a) Providing Infrastructure Project Development Facilty (IPDF) to finance the development of a pipeline of bankable energy projects.	FMF	CBN, SEC, OPS	FMF	*	*	*
	(b) Establishing Government Resource Fund as independent source to support energy projects.	FMF	CBN, SEC, OPS, BOI	FMF	*	*	*
	(c) Setting up long term refinancing mechanisms for energy assets.	FMF	CBN, SEC, OPS	FMF	*	*	*
	(d) Instituting mechanisms for developing corporate bonds to unlock pension funds for Energy Financing.	FMF, DMO	CBN, SEC, OPS, PENCOM	FMF, DMO	*	*	*

CHAPTER FOURTEEN

PLANNING AND POLICY IMPLEMENTATION

14.0 Introduction

The interdependencies of the energy sector and the other sectors of the economy, the strong interrelationship between energy demand, supply and consumption and the associated environmental pollution due to energy, point to the complexity of, and the need for energy planning. A nation must have effective energy planning and management strategies arising from its energy policy, in order to be able to meet short-, medium-, and long-term energy requirements of the various sectors of its economy.

Energy planning can be seen as a process of establishing a conceptual framework of organizing the future development of energy systems of a nation based on the past and present consumption trends and factors/parameters driving energy consumption in that society. It is basically the process of understanding the operation of the energy supply and demand systems and the procedure by which decisions are made to invest in new energy equipment, to change the pattern of energy use, to formulate energy policies, to allocate energy resources for growth and development and to provide reliable energy and make it available, accessible and affordable.

Energy planning and policy implementation in the country take place at four different levels. At the *National Level*, they involve macro planning and policy implementation as part of the multi-sectoral national development policies and plans, which are the responsibilities of the National Planning Commission. At the *Sectoral Level*, they involve overall sectoral planning, monitoring and co-ordination of policy implementation for the energy sector, in all its ramifications. The function ensures consistency of sub-sectoral energy policies and plans with the overall national energy policies and plans and that the implementation of the latter is in accordance with provisions. At the *Sub-sectoral Level*, more specific sub-sectoral planning and policy implementation for the development, exploitation and utilization of particular energy resources, are carried out in the various energy sub-sectors, namely oil and gas, electricity, solid minerals, etc. These involve the Ministries of Petroleum Resources, Power and Steel, Solid Minerals, and others respectively. Other energy utilization sub-sectors such as transport, industry, agriculture, as well as research and development, are also relevant. Finally, at the *Operational Level*, activities involve the execution of the policies and plans developed at the sub-sectoral level by operational establishments such as oil exploration, production and marketing companies, power generating, transmission and distribution companies.

There is no policy that can succeed without proper implementation. In order to achieve the stated policy objectives and successfully implement the strategies, various instruments including policy, legal and regulatory framework, economic measures, information and education, capacity development and institutional framework have to be employed.

In addition, for effective and efficient implementation of the master plan, monitoring and evaluation mechanisms must be put in place in order to make sure that the implementation of the plan is on course and if necessary to revise it to fulfill its objectives and goals. Monitoring and Evaluation provide the tools to:

- measure progress of how the stated goals are being achieved
- track inputs, activities and outputs
- determine whether the implementation of the master plan is on course
- highlight problems or potential problems before the situation becomes critical
- review strategies and take corrective actions to ensure that performance conforms to expected outputs in the light of new experience

In order to adequately monitor and evaluate the achievement of targets set in the master plan, a number of performance variables or parameters have been defined for each energy type. Each performance variable can easily be compared with the target values set under the short, medium or long-term scenarios. In this way, the progress of implementation of the National Energy Master Plan can easily be monitored and evaluated.

14.1 ENERGY PLANNING

14.1.1 Policies

i. The nation shall develop an integrated energy planning system involving the energy related programmes and activities of the various sectors of the economy.

ii. The nation's energy planning system shall be comprehensive, covering the resource exploitation, processing, consumption and conservation activities.

iii. The nation's energy plans and programmes shall be consistent with the overall national development goals.

iv. The nation's energy planning process shall be carried out in collaboration with relevant ministries, departments and agencies at the federal, states and local levels as well as other stakeholders.

v. The nation's energy planning process shall be evidence based.

14.1.2 Objectives

i. To ensure coherency in the energy plans and activities of the various sectors of the economy.

ii. To ensure that the various energy plans and programmes are consistent with the overall national energy policy and development plans.

iii. To provide a framework for national decision making in energy related matters.

iv. To provide the enabling frame work for the adequate supply of energy to different sectors of the economy.

v. To optimize the supply and utilization of the various energy resource types.

vi. To promote local content in the energy sector.

vii. To provide input into national development planning and policy formulation.

viii. To ensure an environmentally sustainable development of the energy sector.

ix. To ensure that planning is based on reliable, timely and relevant energy statistics.

14.1.3 Action Plan

Table 14.1 Action Plan for Energy Planning

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Strengthening co-operation between Energy Commission of Nigeria and other relevant stakeholders in the energy sector.	(a) Intensifying formal collaborative partnership.	ECN	All national, regional, and international bodies active in the energy sector	FGN (ECN)	*	*****	
(ii) Encouraging formal discussion and collaboration among institutions in the energy sector whose activities are inter-related.	(a) Intensifying formal collaborative partnership.	ECN	Collaborating Institutions	FGN (ECN)	*		
(iii) Encouraging the establishment of energy planning and implementation units at state levels and encouraging the assignment of responsibilities for energy related matters at local government levels.	(a) Establishing State Energy Planning and Implementation Units.	ECN	SGs, LGCs, NPC	FGN (ECN), SGs, LGCs	*	*****	
(iv) Ensuring that the strategic plans and programmes of the energy sub-sectors are appropriately appraised for ensuring consistency with the overall national energy policy and plans and resolving conflicts arising from sub-sectoral plans and programmes.	(a) Carrying out integrated energy planning studies.	ECN	All Collaborating Energy bodies and institutions, NPC	FGN (ECN)	*	*	*
	(b) Presenting the results of energy planning studies to stakeholders.	ECN	All Collaborating Energy bodies and institutions	FGN (ECN)	*	*	*****
(v) Establishing a national energy information management system which will involve consistent data gathering and processing of energy resource inventory, consumption pattern, energy technologies, and other relevant socio-economic parameters.	(a) Strengthening the National Energy Information System.	ECN	All Collaborating Energy bodies and institutions, NBS	FGN (ECN), OPS, DPs	*	*	*
	(b) Fast-tracking the development of National Energy Data Bank.	ECN	All Collaborating Energy bodies and institutions, NBS	FGN (ECN), OPS, DPs	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(vi) Submitting energy data and information as may be required by the energy Commission of Nigeria to carry out its monitoring, co-ordination and data banking functions at specified intervals, by the sub sectoral agencies that generate or collect the primary data.	(a) Fast-tracking the development of National Energy Data Bank.	NBS	All Collaborating Energy bodies and institutions	FGN (ECN), OPS, DPs, NBS	*	*	*
	(b) Generating energy data bank for energy planning.	NBS	All Collaborating Energy bodies and institutions	FGN (ECN, NBS), OPS, DPs	*	*	*
(vii) Developing an energy master plan, which is based on the study of energy demand by energy type and category of end-use, energy supply, as well as energy-economy -environment interactions.	(a) Fast-tracking the development of the national energy master plan.	ECN	All Collaborating Energy bodies and institutions	FGN (ECN), DPs	*		
	(b) Presenting the energy master plan to the stakeholders.	ECN	All Collaborating Energy bodies and institutions	FGN (ECN), DPs	*		
	(c) Submitting the energy master plan to the Federal Executive Council.	ECN	FMST, NPC	FGN (ECN)	*		
	(d) Monitoring, evaluating and periodic reviewing of the Energy Master Plan.	ECN	All Collaborating Energy bodies and institutions	FGN (ECN)	*	*	*
(viii) Putting in place an effective programme for accelerated manpower development.	(a) Assessing energy manpower stock and needs.	ECN	All Collaborating Energy bodies and institutions	FGN (ECN), OPS, DPs	*	*	*
	(b) Making recommendations to the Federal Executive Council on energy manpower needs.	ECN	All Collaborating Energy bodies and institutions	FGN (ECN), OPS, DPs	*	*	*
	(c) Organizing training and workshops on energy manpower needs.	ECN	All Collaborating Energy bodies and institutions	FGN (ECN), OPS, DPs	*	*	*

14.2 Policy Implementation

14.2.1 Policies

i. The nation's energy related policies will derive from, and be consistent with, the overall National Energy Policy.

ii. The Energy Commission shall be the focal point for the coordination, monitoring and evaluation of the policy implementation at the National, State and Local Government levels.

14.2.2 Objectives

i. To ensure the effective implementation of the national energy policy.

ii. To ensure that the energy sector plays its expected role in the realization of the goals of the national development plan.

iii. To ensure consistency between the national energy policy and the various sub-sectoral policies on energy matters.

iv. To ensure that there is no conflict between the various sub-sectoral energy policies.

v. To strengthen the coordination, monitoring and evaluating functions of the Energy Commission.

vi. To ensure that the impact of NEP is fully effective to all end users.

14.2.3 Action Plan

Table 14.2: Policy Implementation Plan

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Ensuring the existence of a forum to provide opportunities for regular discussions among agencies and departments involved in the production or utilization of energy.	(a) Instituting an Annual Energy Summit to review the state of energy production and utilization.	ECN, **NDPHC**	All Collaborating Energy bodies and institutions	FGN (ECN), OPS, DPs	*	*	*
(ii) Encouraging private sector participation in the provision of energy services in the country, while recognizing the role of government in the provision of some basic energy infrastructure.	(a) Continuing the privatization of existing energy-related public enterprises under suitable regulations.	BPE, **NDPHC**	ECN, NERC, DPR, NNPC, FMEnv., FMP	FGN (BPE), NDPHC	*	*	*
	(b) Encouraging the emergence of private energy services companies.	NIPC	ECN, OPS	FGN (NIPC), OPS	*	*	*
(iii) Prioritizing of the policy strategies for implementation, with the setting of realistic targets and effective monitoring and evaluation of the implementation process.	(a) Initiating the procedure for prioritization, monitoring and evaluating the NEMP.	ECN	NERC, DPR	FGN (ECN)	*	*	*
	(b) Prioritizing policy strategies for implementation.	ECN	NNPC, DPR, OPS, DPs	FGN (ECN)	*	*	*
	(c) Setting realistic targets after effective monitoring and evaluation of implementation status.	ECN	DPR, NNRA, NERC, NPC	FGN (ECN)	*	*	*
(iv) Instituting a system of carrying out regular checks and receiving reports on the implementation of the approved policy by all actors in the energy sector.	(a) Assessing periodically the NEP implementation status.	ECN	NERC, DPR	FGN (ECN)	*	*	*
	(b) Monitoring the performance of the energy sector.	ECN	SGs, LGCs, NERC, DPR, NPC	FGN (ECN), SGs, LGCs	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(v) Ensuring that approved fiscal measures, which are necessary for the achievement of set objectives of the policy, are promptly carried out.	(a) Implementing and itemizing approved fiscal measures periodically.	ECN	NERC, DPR, NASS, NIPC	FGN (ECN, NERC, DPR)	*	*	*
(vi) Setting and enforcing targets about energy efficiency and conservation.	(a) Setting and enforcing (implementing) energy mix targets for the national economy.	ECN	NERC, DPR, NNPC	FGN (ECN)	*	*	*
	(b) Setting and enforcing Energy Efficiency Standards.	ECN	NERC, DPR, SON	FGN (ECN)	*	*	*
(vii) Integrating energy studies into the curricula of secondary and tertiary institutions, while emphasizing their multi-disciplinary nature.	(a) Preparing energy studies curricula for secondary and tertiary institutions and NYSC programmes.	FMEd., ECN	ECN, NERDC, NYSC, NUC, NCCE, NBTE, OPS, DPs, SGs, LGCs,	FGN (FMEd., ECN, NYSC)	*	*	
(viii) Creating regular fora for public awareness, education and participation in the realization of the goals and objectives of the energy policy.	(a) Conducting public awareness workshops, seminars, lectures, etc.	ECN	All Collaborating Energy bodies and institutions	FGN (ECN), OPS, DPs	*	*	*
	(b) Designing and sponsoring publicity in electronic and print media.	ECN	All Collaborating Energy bodies and institutions	FGN (ECN), OPS, DPs	*	*	*
	(c) Encouraging energy DSM and SSM in the national economy.	ECN	All Collaborating Energy bodies and institutions	FGN (ECN), OPS, DPs	*	*	*
	(d) Instituting an Annual Energy Summit to review the state of energy production and utilization.	ECN	All Collaborating Energy bodies and institutions	FGN (ECN), OPS, DPs	*	*	*
(ix) Production of regular publication on the state of the energy sector and creation of relevant/accessible website for effective dissemination of information.	(a) Prioritizing strategies for implementation.	ECN	NNPC, DPR, OPS, DPs, NERC	FGN (ECN)	*	*	*

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(x) Effective selection and deployment of appropriate energy technologies through research and development.	(a) Prioritizing strategies for implementation.	ECN	NNPC, DPR, OPS, DPs, NERC	FGN (ECN)	*	*	*

Table 14.3: NEMP Implementation Monitoring

STRATEGIES	ACTIVITIES	IMPLEMENTING AGENCIES	COLLABORATING AGENCIES/ ORGANISATIONS	FUNDING SOURCES	TIMELINE		
					S	M	L
(i) Developing periodic monitoring and evaluation framework for the National Energy Masterplan.	(a) Establishing a national Steering Committee comprising of key stakeholders to undertake the monitoring and evaluation of the implementation of the NEMP.	ECN	All Collaborating Energy bodies and institutions	FGN (ECN), OPS, DPs	*	*	*
(ii) Ensuring periodic reporting on the monitoring and evaluation of activities.	(a) Dissemination of findings through the print and electronic media.	ECN	All Collaborating Energy bodies and institutions	FGN (ECN), OPS, DPs	*	*	*
(iii) Organizing periodic stakeholders forum on implementation.	(a) Organizing national workshops on the implementation of the NEMP.	ECN	All Collaborating Energy bodies and institutions	FGN (ECN), OPS, DPs	*****	*****	*****
	(b) Organizing sectoral workshops, conferences and seminars on the implementation of the NEMP.	ECN	All Collaborating Energy bodies and institutions	FGN (ECN), OPS, DPs	*	*	*

APPENDIX A

MONITORING AND EVALUATION PARAMETERS

The implementation of the National Energy Master Plan will be effectively monitored and evaluated. Effective monitoring is essential in order to

(a) Ensure that stated goals are being achieved

(b) Track inputs, activities and outputs;

(c) Determine whether or not implementation of the NEMP is on course

(d) Highlight problems or potential problems before the situation becomes critical

(e) Take corrective actions to ensure that performance conforms to strategy or that the strategy is revised in the light of new experience.

Many factors may influence progress towards meeting set objectives, and these include unexpected turns in the economy, ineffective strategies and ineffective policies. Further, problems can result from ineffectiveness (not doing the right things) or inefficiency (doing right things poorly). Effective monitoring keeps track of these factors and any other changes in the system.

In order to adequately monitor and evaluate the achievement of targets set in the NEMP, a number of performance variables or parameters have been defined for each energy type as shown in tables 1 to 15 below. Only variables that can be quantified in standard units have been selected for each evaluation period. Each performance variable can easily be compared with the target values set under the short, medium or long-time scenarios. In this way, the Energy Masterplan implementation progress can easily be monitored and evaluated. Tables 1 to 15 are shown below:

Table A1: Crude Oil Plan Evaluation Parameters

Performance Variable	**Units**	**Present Value**	**Target Values**		
			Short	**Medium**	**Long**
Indicated reserves	Billion barrels				
Crude Oil production	Million barrels per day				
Refining Capacity	Million barrels per day				
Refining capacity utilization	%				
Transport fuel storage capacity	Day				
Pipeline utilization effectiveness (volume of products transmitted by pipeline as percentage of total volume of products transported)	%				

Table A2: Natural Gas Plan Evaluation Parameters

Performance Variable	Units	Present Value	Target Values		
			Short	Medium	Long
Indicated reserves	Trillion standard cubic feet				
Total production	Billion standard cubic feet per annum				
Percentage flared	%				
Total length of distribution network	1CM				

Table A3: Tar Sands/Bitumen Plan Evaluation Parameters

Performance Variable	Units	Present Value	Target Values		
			Short	Medium	Long
Proven reserves	Million tonnes				
Inferred reserves	Million tonnes				
Production rate	Tonnes per annum				

Table A4: Coal Plan Evaluation Parameters

Performance Variable	Units	Present Value	Target Values		
			Short	Medium	Long
Proven reserves	Million tonnes	639			
Inferred reserves	Million tonnes	2750			
Total Production	Thousand tonnes per annum				
Smokeless coal production	Tonnes per annum				

Table A5: Nuclear Plan Evaluation Parameters

Performance Variable	Units	Present Value	Target Values		
			Short	Medium	Long
Rate of graduate-level manpower development	Number of new graduates per annum				
Rate of post-graduate manpower development	Number of new postgraduates trained per annum				
Rate of technical manpower development	Number of new technicians trained per annum				

Table A6: Hydropower Plan Evaluation Parameters

Performance Variable	Units	Present Value	Target Values		
			Short	Medium	Long
Total installed capacity (large scale)	MW				
Total installed capacity (mini-hydro)	MW				
Total installed capacity (micro hydro)	MW				
Percent capacity utilization (large scale)	%				
Percent capacity utilization (mini hydro)	%				
Percent capacity utilization (micro hydro)	%				

Table A7: Fuelwood Plan Evaluation Parameters

Performance Variable	Units	Present Value	Target Values		
			Short	Medium	Long
Total forestry reserve area as percent of total land area	%				

Table A8: Environment Plan Evaluation Parameters

Performance Variable	Units	Present Value	Target Values		
			Short	Medium	Long
Participation in energy/environment public campaigns	Man – hours				
Total volume of crude oil spilled	Barrels				

Table A9: Solar, Biomass and Wind Plans Evaluation Parameters

Performance Variable	Units	Present Value	Target Values		
			Short	Medium	Long
Number of pilot projects commissioned	-				
Percentage of commissioned projects operational	%				
Number of local renewable energy equipment manufactures	-				
Total value of renewable energy equipment manufactured locally	~~₦~~				
Total value of renewable energy equipment imported	~~₦~~				

Table A10: Electricity Plan Evaluation Parameters

Performance Variable	Units	Present Value	Target Values		
			Short	Medium	Long
Installed capacity (grid-connected)	MW				
Installed capacity (off-grid)	MW				
Capacity utilization (grid-connected)	%				
Capacity utilization (off grid)	%				
Percent access to electricity	%				
Average availability of power supply	%				
Per capita electricity consumption	kWh/annum				

Table A11: Agriculture Plan Evaluation Parameters

Performance Variable	Units	Present Value	Target Values		
			Short	Medium	Long
Training of personnel on dissemination of new energy technologies for agricultural applications	Man – hours				
Participation in activities held to promote utilization of renewable energy technologies in agriculture	Man – hours				

Table A12: Energy Efficiency and Conservation Plan Evaluation Parameters

Performance Variable	Units	Present Value	Target Values		
			Short	Medium	Long
Number of new codes, standards and regulations on energy efficiency /conservation approved	-				
Number of new energy efficient equipment and machinery developed locally	-				
Energy saving due to the utilization of more energy efficient equipment and energy conservation techniques	MJ				

Table A13: Research, Development and Training Plan Evaluation Parameters

Performance Variable	Units	Present Value	Target Values		
			Short	Medium	Long
Total value of funds provided for energy research and development	₦				
Number of new energy topics included in curriculum for secondary and tertiary institutions	-				
New specialist training in energy technologies	Man-years				
Total value of scholarships awarded for degree or postgraduate training in energy technologies	₦				

Table A14: Finance Plan Evaluation Parameters

Performance Variable	Units	Present Value	Target Values		
			Short	Medium	Long
Total value of new investments in the energy sector	₦				
Total value of new loans granted for energy related projects	₦				
Total contribution to GDP by energy related business activities	%				

Table A15: Indigenous Finance Plan Evaluation Parameters

Performance Variable	Units	Present Value	Target Values		
			Short	Medium	Long
Percentage of shares in privatized energy sector industries acquired by Nigerians	% !				

Periodic Reports

In order to ensure that the monitoring and evaluation of the Masterplan is carried out effectively, it is essential that periodic reports be prepared. Each report is to include the data of tables 1 to 15, as well as critical comments regarding each strategy approved in the Energy Policy Document. If necessary, recommendations for improvement of any strategy may be indicated. The periodic reports should be submitted to the Board of the Energy Commission of Nigeria for consideration.

In order to embody significant details and allow sufficient time between consecutive reports, the period of reporting should be one year. Preliminary quarterly reports may also be useful.