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## **SECTION SEVEN**

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# **NATIONAL ELECTRIC POWER POLICY**

## PREFACE

The reform of the electricity sector is of extreme priority to the Government of Nigeria and the citizenry. The efforts made in the past have not yielded much result as the sector could not attract the desired investment for maintenance and expansion of generation, transmission and distribution systems. As a result of the lack of investments in new systems and maintenance of existing facilities, electricity demand from existing consumers cannot be met. The current administration has chosen privatisation as a cardinal economic programme to address the problems of the power sector and other sectors of the national economy.

Consequently, the National Council on Privatisation (NCP) under Vice-President Atiku Abubakar has empowered a 23-member Electric Power Sector Reform Implementation Committee (EPIC) to develop recommendations to promote the policy goals of total liberalization, competition and private sector led growth of the electricity sector. The first task of EPIC included the determination of the policy direction that will form the basis of a new beginning in the development of the electricity sector.

In keeping with democratic norms and for purposes of transparency, openness and stakeholder consultation, the policy recommendations of a world-renowned electricity sector expert was discussed at a workshop. The forum provided an opportunity for the general public to express their views and articulate their interests. Thereafter, EPIC reviewed the recommendations and prepared a policy draft for the adoption of NCP and the approval of the Federal Executive Council.

The objectives of the reform contained in this policy go beyond attending to the immediate needs of the electricity sector, though this is also important. The Government of Nigeria also wishes to put in place a system that will ensure in the long term, that the problems currently facing the sector do not arise again. A reform programme is therefore proposed that will permit the flow of private sector resources to fund power sector expansion and ensure that the performance of the sector is enhanced in such a way as to contribute effectively to the socio-economic development of Nigeria.

We are, through this policy document extending invitations to investors and other stakeholders in the power sector, the world over to avail themselves of the abundant opportunities that the reform restructuring and privatisation of Nigeria's electricity industry offer.

Dr. Olusegun Agagu  
Honourable Minister Of Power & Steel  
March 2001.

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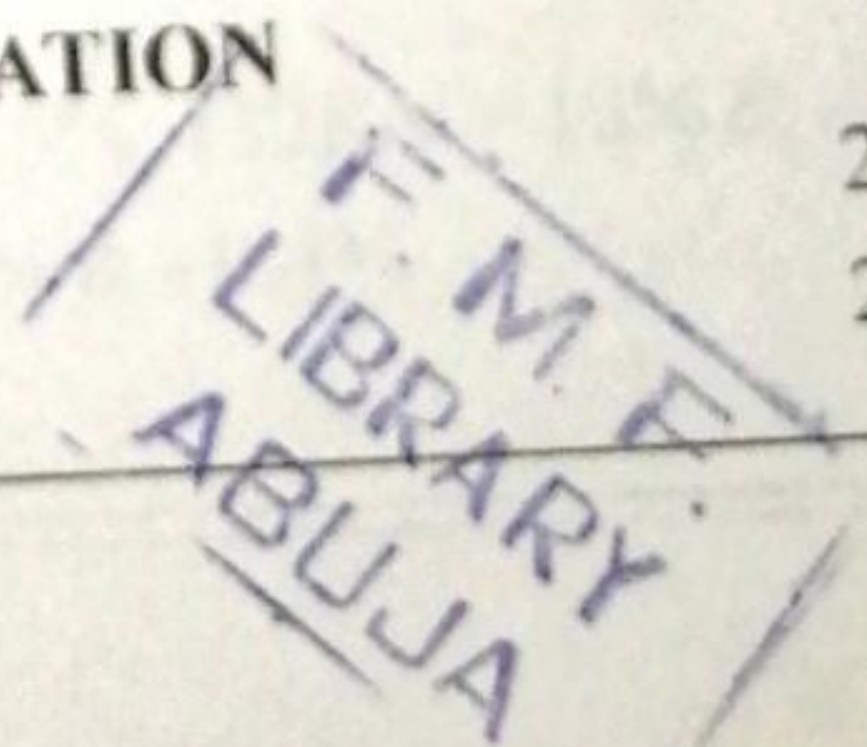
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**Details of Power Generation Stations**

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## Chapter One

# INTRODUCTION

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### 1.1 Historical Overview

The Power Sector is very critical to the economic, industrial, technological, and social development of the country. Electricity consumption has become one of the indices for measuring the standard of living of a country.

Electricity generation in Nigeria began in 1926. the Nigerian Electricity Supply Company (NESCO) commenced operations as an electric utility Company in Nigeria in 1929 with the construction of a hydro electric power station at Kurrafar near Jos. The Electricity Corporation of Nigeria (ECN) was established in 1951, while the first 132KV line was constructed in 1962, linking Ijora Power Station to Ibadan Power Station.

The Niger Dams Authority (NDA) was established in 1962 with a mandate to develop the hydropower potentials of the country. However, ECN and NDA were merged in 1972 to form the National Electric Power Authority (NEPA). In 1998, NEPA ceased to have an exclusive monopoly over electricity generation, transmission, distribution and sales.

### 1.2 Present Status Of The Electricity Supply Infrastructure

The National Electricity grid presently consists of nine generating stations (3 hydro and 6 thermal) with a total installed generating capacity of 5906 MW, (the details of the generation stations are given in Appendix 1). The transmission and distribution network includes the following:

**Transmission:**            5000km of 330KV lines  
                                      6000km of 132KV lines  
                                      23 of 330/132KV sub-stations  
                                      91 of 132/33KV sub-stations

**Voltage Control Policy:** 300KV + 5% & - 15%; 132KV + 10% & - 15%

**Frequency Control Policy:** 50Hz + 0.4% & - 0.4%

**Distribution**

23,753km of 33KV lines  
19,226km of 11KV lines  
679 of 33/11KV sub-station  
20,543 of 33/0.415KV or 11/0.415KV sub-stations.

**Frequency Control:** 50Hz; 33KV +/- 10%

There are also 1790 distribution transformers and 680 injection sub-stations. Although the installed capacity of the existing power stations is 5906MW, the maximum load ever recorded was 2,470MW. Presently most of the generating units have broken down as they have not been maintained as and when due. As at August 2000, the peak generation was 1,500MW. This is grossly below the demand, which is estimated to be about 4,500MW. The transmission lines are radial and are overloaded. The switchgears are obsolete while power transformers have not been maintained for a long time.

The distribution sub-sector is in dire need of upgrading as many of its distribution transformers are overloaded while the lines look more like "Cobwebs". Overall transmission and distribution losses are in the range of 30 - 40%. When these are added to the poor payment record of consumers, collections are less than 50% of power generated.

### 1.3 Supply And Demand Imbalances

As noted above, the present generation level of about 1,500MW is much below the estimated demand of 4,500MW. There is about 2,400MW of self-generation in the form of small diesel and petrol generating sets. The Federal and State Governments have vigorous policies of connecting local government headquarters and other towns and villages to the National Grid. This, coupled with the creation of new States and Local Governments, have transformed additional parts of the so-called rural areas into load centers, thus adding pressure to the already overloaded electricity supply system. The estimated percentage of Nigerians having access to electricity from NEPA is only 36%.

The forecast load for the year 2001 is 4,833.7MW. In order to meet this demand, a generating capacity of about 6000MW is required. Furthermore, the estimated demand for power in 2005 and 2010 are respectively 9780MW and 20,000MW. These will require generating capacities of 12,700MW and 25,000MW by the respective



years. Thus it is necessary to fully rehabilitate the existing power stations (which will provide a maximum of 5400MW generating capacity), rehabilitate some critical transmission and distribution lines and their associated substations and add new generating, transmission and distribution capacity to the grid, in the immediate and foreseeable future.

### **1.5 Need For Reform**

The power sector is very capital intensive. It is obvious that Government, with its many responsibilities in other sectors of the economy, cannot fund its development as outlined above. There is therefore the need to reform the sector so as to:

- (i) attract and encourage private sector participation
- (ii) attract capital to fund the sector and
- (iii) ensure a level playing ground for all investors.

The Electric Power Policy Statement therefore is to ensure that Nigeria has an Electricity Supply Industry (ESI) that can meet the needs of its citizens in the 21<sup>st</sup> Century. This will require a fundamental reform at all levels of the power industry. The Federal Government will therefore:

- (i) provide overall direction for the development of the electricity supply industry.
- (ii) ensure the general consistency of electric power policy with all other national policies, and specifically with other aspects of energy policy.
- (iii) Enact promptly the necessary laws, regulations and other measures required to support the electricity policy.

It is expected that there will be an independent regulatory agency, which will also be responsible for the issuance of licenses to companies operating in the Electricity Supply Industry.

# POLICY OBJECTIVES

### 2.0 General

The overwhelming objective of the Electric Power Policy Statement is to ensure that Nigeria has an ESI (electricity supply industry) that can meet the needs of its citizens in the 21<sup>st</sup> Century. This will require a fundamental reform at all levels of the industry. A technically and commercially efficient ESI is critical for achieving Nigeria's growth and development goals.

The time has come for a new start that will enable the ESI.

- a) to meet all current and prospective economically justifiable demands for electricity throughout Nigeria;
- b) to modernize and expand its coverage; and
- c) to support national economic and social development including relations with neighbouring countries.

The priority is to create efficient market structures, within clear regulatory frameworks, that encourage more competitive markets for electricity generation and sales (marketing), which, at the same time, are able to attract private investors and ensure economically sound development of the system. This will ensure that the demand is met in an efficient and economically viable manner. The policy objectives are divided into the short-to-medium term (3-5 years) and the long-term (to commence beyond 5 years).

### 2.1 Short - to - Medium Term Objectives

The Short to Medium Term Objectives are:

- a) to ensure a system of generation, transmission distribution and marketing that is efficient, safe, affordable and cost-effective throughout the country;
- b) to ensure that the power sector attracts private investment both from Nigeria and from Overseas.
- c) to develop a transparent and effective regulatory framework for the

- power sector;
- d) to develop and enhance indigenous capacity in electric power sector technology;
- e) to participate effectively in international power sector activities in order to promote electric power development in Nigeria, meet the country's international obligations and derive maximum benefit from international cooperation in these areas;
- f) to ensure that the government divests its interest in the state-owned entities and entrenches the key principles of restructuring and privatization in the electric power sector.
- g) to promote competition to meet growing demand through the full liberalization of the electricity market;
- h) to review and update electricity laws in conformity with the need to introduce private sector operation and completion into the sector.

## **2.2 Long - Term Objectives**

The Long - Term Objectives are:

- a. to provide a new regulatory environment that is sufficiently flexible to take into account new technological developments and the international trends in the power sector;
- b. to ensure that electricity supply is made more reliable, economically efficient and equitable so as to effectively support the socio-economic development of the country;
- c. to provide universal access to electricity, although not necessarily through the grid;
- d. to encourage domestic production of electrical equipment in Nigeria, and the development of related software and services;
- e. to establish and meet aggressive targets for the rural electrification programme.
- f. to protect the integrity, and ensure the security, of the state and its citizens;
- g. to encourage Nigerian electric power sector operating companies to become global leaders in the industry;
- h. to ensure minimum adverse environmental impact;
- i. to create the enabling environment, including the provision of

- incentives, that will attract investors and resources to achieve the objectives earlier stated;
- j. to ensure a leadership role for Nigeria in the development of the proposed West African Power Pool.
  - k. to minimize government guarantees for privately funded investment; and
  - l. to ensure that subsidies are efficiently targeted.

## Chapter Three

# POLICY AND REGULATORY INSTITUTIONS

### 3.0 General

Across the world, countries are unbundling their electricity supply industries. Only the network elements of electricity transmission and distribution are natural monopolies. Both electricity generation and the sales/marketing of electricity are potentially competitive activities.

Technological developments, such as the development of combined cycle gas powered generators, have greatly reduced economies of scale and increased the gains from introducing competition into generation. Similarly, the development of modern computing technologies has brought improvements in transmission and system dispatch systems which allows for the introduction of short-term and contract markets in bulk power. Such markets encourage the introduction of private management methods and private investment as well as fostering the privatization of existing assets.

The intention is that the proposed reforms should introduce these now widely applied developments to Nigeria, as laid out in this policy document.

To support these reforms, it will be necessary:

- a) to update the role of Government and the Ministry of Power and Steel; and
- b) to establish an effective regulatory framework, based on an independent regulatory agency.

### 3.1 Components

Nigeria's Power Sector shall consist of the following components:

- a) Federal Government
- b) Ministry of Power and Steel;
- c) State Governments;
- d) Competing Generation Companies;
- e) Nigerian Electricity Regulatory Commission;
- f) A single Transmission Company;

- g) A Special Purpose Entity;
- h) On-grid Distribution Companies.
- i) Off-grid generation and distribution companies;
- j) Grid-connected auto-generators

### **3.1.1 The Federal Government**

The Federal Government will:

- a) provide overall direction for the development of the electricity industry in Nigeria;
- b) ensure the general consistency of electric power policy with all other national policies and, specifically, with other aspects of energy policy and Federal Government policy on foreign investment and borrowing; and
- c) enact promptly the necessary laws, regulations and other measures required to support the Federal policy on electricity.

### **3.1.2 The Federal Ministry of Power and Steel**

The Federal Ministry of Power and Steel will have the overall responsibility for formulating electric power policy. The policy issues that need to be addressed include issues such as: fuel use and the fuel mix in generation, the relative role of private and public finance; the role of competition relative to central direction, rural electrification objectives and criteria and electricity import and export targets/limits. Many of these issues are discussed in this paper.

The specific functions of the Ministry will include:

- (i) Proposing policy options and recommendations to government concerning legislation, policy on investment, etc;
- (ii) Monitoring and evaluating the implementation and performance of government policy in the industry.
- (iii) Establishing, monitoring and evaluating the performance of policies for increasing the access to electricity, particularly in rural and semi-urban areas, as set out in this policy paper.
- (iv) Representing Government on electricity matters pertaining to regional and international bodies and organizations; and
- (v) Liaising with the National Assembly on matters concerning the electricity industry.

### **3.1.3 State Governments**

The State Governments will carry out their responsibilities for the development of off-grid electrification and their joint responsibilities with Federal Government on the establishment of Electricity Power Stations as set out in the 1999 Constitution.

The state role will also include regulation of off-grid non-centrally dispatched electricity operations, which are wholly limited within the state boundaries.

### **3.1.4 Nigerian Electricity Regulatory Commission**

**3.1.4.1** A privatized electricity industry, with competition over monopoly transmission and distribution grids, requires an effective regulatory agency that is independent both of Government and of all the companies operating in the industry. The Ministry of Power and Steel will therefore provide in a new Electricity Law for an independent regulatory body that:

- (i) has clear appointment and dismissal rules;
- (ii) has a source of independent funding; and
- (iii) faces appropriate checks and balances to ensure that regulation not only operates in a fair transparent way but is also seen to operate in a fair and transparent way.

**3.1.4.2** There will therefore be an independent regulatory agency for electricity in the form of a Regulatory Commission, which shall be called the Nigerian Electricity Regulatory Commission (NERC), based on the following regulatory arrangements.

- (i) NERC will be an independent Federal agency and electricity regulator for grid connected services;
- (ii) NERC will have decision making powers on the key aspects technical and economic regulation (viz: tariff regulation, approval of capacity expansion plans and regulated company business plans, oversight of capacity, tendering, competition, standards, quality of service, service obligation etc);
- (iii) NERC will be properly established with its powers, duties constitution etc, laid down in a new Electricity Act;
- (iv) NERC will have the main responsibility for issuing licences to the companies operating in the Nigeria ESI. These regulatory licences will specify the rights and obligations of each business and company and will

provide the basis under which NERC will monitor and enforce the economic and technical regulation of the sector. There will be separate licences for:

- a) Transmission (including dispatch);
  - b) Generation;
  - c) Distribution and
  - d) Retail sales.
- (v) NERC will have all the necessary regulatory functions for electricity. In particular, it will, through the licences, have the responsibility for decisions on regulatory approval for:
- a) electricity tariffs and prices, wholesale and retail;
  - b) business and capacity expansion plans for transmission, generation and distribution;
  - c) the enforcement of competition over the transmission network, including the regulation of (a) transmission connections, (b) transmission access rights and (c) fair cost reflective use-of system prices;
  - d) enforcement of competition over electricity generation, distribution and sales;
  - e) setting and enforcing national quality standards; and
  - f) enforcing the legal rights of consumers.
- (vi) NERC will also be responsible for:
- a) ensuring that all major investments in generation capacity expansion are carried out by competitive tender; and
  - b) agreeing on the rules for supervising such competitive tenders, including acting as an appeals body in the case of accusations or complaints over the conduction of tenders.
- (vii) NERC will act as an appeals agency over regulatory decisions taken at state level.

**3.1.4.3** Appeals procedure against any faults in the regulatory process committed by NERC shall be as defined in the new electricity law.



## Chapter Four

# STRUCTURE OF THE ELECTRIC POWER INDUSTRY

### 4.0 General

The main objective of the reform is to ensure that in the future, Nigeria will enjoy an efficient and competitive electricity industry, which provides a continuous supply of electricity at defined quality standards to consumers in all areas of Nigeria at the lowest necessary price.

This objective will be met by the introduction of competition and the appropriate regulatory framework. In order to introduce competition, functional segmentation of NEPA is crucial.

This will require:

- (i) the separation of transmission and dispatch from generation;
- (ii) the establishment of transmission company;
- (iii) the establishment of a number of competing, privately owned generation companies from existing NEPA generating facilities;
- (iv) the opening up of generation to new market entrants; and
- (v) the establishment of a number of distribution and sales (marketing) companies which will also be privatized.

Later, competition in wholesale and retail sales (marketing) will be developed, including the opening of trade in the sales (marketing) of electricity to generators and to other new market entrants.

### 4.1 Licensing of Power Sector Operators

The companies created out of NEPA, plus the new companies will all operate under licences issued by NERC which will monitor and enforce the licence conditions.

The picture above applies to grid-connection services. In addition, the Government anticipates considerable expansion of off-grid electricity supply. This will be encouraged to develop under a wide range of industry and ownership structures.

### 4.2 Key Transition Arrangements

The success of the reform programme depends, critically on the specification and

successful implementation, during the transition period, of clear and realistic measures, which are compatible with the short and medium term objectives of the reform. Some of these have been stated elsewhere in this policy document. This section presents, further, some key element of the transition arrangements.

#### **4.2.1 Duration of the Transition period**

(i) Start of the Transition period:

Government is committed to ensuring adequate power supply and the viability of the short-to-medium term plans. To achieve these, some form of private power generation ownership will have to be built during the transition period. The plan for IPPs and EPPs, which will bridge the energy gap by 2002 and 2003, will have to be made now. Consequently, the transition period is to start forthwith.

(ii) End of Transition Period:

The end of the transition period will correspond to the following benchmarks:

- a) That is when management and ownership control of distribution companies (discos) whose combined sales revenues exceed 85% of the total sales of all discos are transferred to the private sector.
- b) All thermal plants are either sold or are on concession to private operators.

#### **4.2.2 Energy Trading Arrangements**

The energy trading arrangements during the transition period will be in accordance with the following provision:

- (i) An Autonomous Special Purpose Entry (SPE) created by the unbundling of NEPA will take over NEPA's energy purchasing obligations. The SPE will sign subsequent PPAs (subject to the specified annual limits) and will sell power to the distribution companies.
- (ii) During the transition period, it is expected that NEPA will have been unbundled into four functional areas; namely, generator, transmission/System Operator, power trading (by the SPE) and distribution. When generation and distribution sectors are further unbundled into daughter companies, contracts between the generation transmission entity/company which is also the system operator will

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wheel power from the generation to the distribution companies.

- (iii) The FMPS and NEPA will ensure that appropriate contractual arrangements are put in place in time prior to unbundling.

#### **4.2.3 PP/ROT and EPP Contracts**

- (i) In view of the fact that the rehabilitation of NEPA's power plants prior to their privatization is necessary and may:
  - a) require private sector participation
  - b) be inadequate to meet the expected demand by the year 2002/2003; it is necessary to sign some IPPs, ROTs and EPP now to ensure power sufficiency in the short/medium term.
- (ii) The Special Purpose Entity shall enter into IPP, ROT and EPP contracts and resell power to NEPA, its distribution subsidiaries or privatized distribution companies.
- (iii) The amount of power to be contracted under IPPs shall be limited to no more than 800MW in 2001 and 700MW in 2002 subject to the findings of the demand and supply forecast.

#### **4.2.4 Subsidies**

- (i) Tariff shall be adjusted in a gradual manner subject to increase in power supply. Subsidy shall be available as long as tariff remains lower than the cost of purchase of energy from EPP and IPPs.
- (ii) The Federal Government of Nigeria shall explicitly make provisions for necessary subsidies in its annual budget.

#### **4.2.5 Tariff Changes**

- (i) Government recognizes the urgent need to revise tariffs upwards.
- (ii) Government will take steps to ensure an early completion of the tariff strategy study, as provided for this policy document so as to provide a basis for the tariff adjustments that need to be made during the transition period.

#### **4.2.6 Federal Government of Nigeria Guarantees and Limits on Guaranteed IPP Capacity**

It was noted that as long as tariffs are not adequate to cover the full cost of supplying power and the billing and collection remained inefficient, there will be need for

government guarantees of the PPA (IPPs, EPPs, ROTs). In specifying the guarantees, the following points are to be considered:

- (i) The guarantees must be tangible, dependable and enforceable;
- (ii) The maximum IPP capacity to be guaranteed shall be limited to 800MW in 2001 and 700MW in 2002, subject to the findings of supply and demand forecast, in order to prevent excessive burden from the cost of the guarantees.

#### **4.2.7 Contractor Financing of ROTs, EPP and IPPs**

- a) NEPA should not put its revenue into Escrow Accounts for contract financing.
- b) In place of Escrow Accounts for NEPA revenue, FGN shall set up a credit support arrangement for ROTs, EPP and IPPs that avoids creating impediments for the unbundling and privatization of NEPA.

#### **4.2.8 Improvements of Billing and Collection**

Improvements of Billing and Collection will, among other benefits reduce the amount of increase to the tariff. Appropriate measures, including the following, shall be put in place, by NEPA, to ensure the expeditious attainment of this objective. NEPA shall:

- a) Install as soon as possible grid meters at substations
- b) Proceed with and complete its programme for installation of prepayment meters, expeditiously. However, NEPA shall ensure that the financing arrangement for the programme result in a net gain in cash flow for NEPA.
- c) Complete its customer Census.
- d) Expand the use of banks as vehicles for bills collections in preference to the use of NEPA Kiosks.
- e) Encourage illegally connected customers to become legally connected by reducing connection charges.
- f) Progressively concession billing and collection to the private sector.

#### **4.3 Completion in the Medium Term**

The outline of the proposed structure of the Nigerian ESI after it has been unbundled and after both the generation and the distribution companies have been privatized (as specified in 4.2.1 [I]) are outlined below;

- (i) There will be a number of competing generating companies - to be spun off from NEPA, plus new IPPs.
- (ii) All thermal generating companies will be 100% privately owned. Large hydro stations may remain partially or wholly state-owned, in which case they shall be concession to private sector operators;
- (iii) Power will be traded primarily on the basis of bilateral contracts between generation companies and distribution companies so that each distribution company will have a portfolio of power purchase contracts with various generators and generators will have a portfolio of sales contracts.
- (iv) Generators and distributors will be able to trade power and capacity in the contract market by contract exchanges and sales;
- (v) Generators pay the full price of natural gas and other fuels.
- (vi) For within-day power imbalances, there will initially be a set of imbalance tariffs ('top-up' tariffs for when generators are required to provide power in excess of contracted demand and 'spill' tariffs for when generators are required to provide power at levels below contracted demand). Over time, these imbalance tariffs may well be developed by voluntary agreement into a simple spot market for daily or hourly power imbalances with an associated settlement system and a market operator, probably managed by the transmission company;
- (vii) For generation capacity expansion, the following will apply;
  - a. The distribution and/or generation companies in discussion with the transmission company will initiate generation capacity expansion. The transmission company will retain the responsibility for making projections of future capacity requirements.
  - b. Capacity expansion plans will be approved by the regulatory agency;
  - c. Following regulatory approval of the capacity expansion plans, the distribution and/or generation companies will prepare business plans (including the proposed planned increase in contract for generation) and submit these business plans for regulatory approval.
  - d. Following regulatory approval of the distribution and/or

generation companies' business plans, they will commission expansions in generation capacity on the basis of tenders for new capacity. These tenders will be supervised by the regulatory agency which will act as an appeals route in cases where due process is not followed or where there are complaints or malpractices.

- (viii) Companies that generate power for their own use will have the right to sell power to distribution companies.

#### 4.3.2 Transmission, Dispatch and System Planning

- (i) There will be a single transmission company which will coordinate the electricity system. It will: (a) handle the transmission of power on an open-access basis, on the basis of regulated transmission tariffs, (b) manage system operation and dispatch and (c) manage the settlement system. The transmission company will be responsible for all power lines of 132 KV and above;
- (ii) The transmission company's role will be that of electricity transport. It will neither buy nor sell electricity nor will it be able to own (or have any ownership stake in electricity generation, distribution or sales (marketing) businesses.
- (iii) The transmission company will not be purely privately owned and may remain 100% state-owned. To the extent that there are private shareholdings in the transmission company, these will be under limits to ensure the independence of the transmission company in the electricity market and trading structure. If remaining in transmission company's activities may be franchised or leased to a private operator;
- (iv) The transmission company will buy ancillary services (e.g. Reactive power, black start capability etc) from generating companies under specific contracts;
- (v) All generation in stations of more than 20MW or more will be centrally dispatched;
- (vi) The transmission company will have the responsibility for network expansion planning and load forecasting. It will work with generation and distribution companies for the planning of increases in generation capacity.

### **4.3.3 Distribution and Sales (Marketing)**

- (i) There will be a number of distribution companies connected to the grid which will both distribute and sell in their franchise (but with separate licences and separate businesses for (a) distribution and (b) power sales). Distribution companies will be responsible for managing network power lines below 132KV.
- (ii) Distribution companies should, if possible, all be privately owned. Special arrangements may be needed for any distribution and sales franchises that are expected to be chronically loss making in the longer term;
- (iii) Distribution companies that are connected to the grid will retain a monopoly sales franchise to all final customers, large and small, but will be required to operate their retail sales (marketing) activities as separate businesses operating under separate licenses;
- (iv) Distribution companies will be prohibited from building or owning generating plants other than very small scale embedded generators (below 20MW).
- (v) There will be a number of off-grid small distribution and sales companies most of which will have their own generator or other power sources;
- (vi) Users will continue to be allowed to meet their power needs from their on-site generators;
- (vii) Distribution companies may initiate generator capacity expansion, in consultation with the transmission company.

### **4.3.4 Ownership and Cross-Ownership Issues**

- (i) All non-core NEPA business activities will be separated out and, if possible, privatized as soon as possible (i.e. all business activities not directly related to the transmission, generator, distribution or sale of electricity, e.g. Engineering businesses, electricity goods retailing, etc).
- (ii) Neither distribution nor generating companies will be allowed to own share in the transmission company;
- (iii) Generating companies will not be allowed to own shares in distribution/sales (marketing) companies and vice-versa.
- (iv) NERC will monitor the exercise of market power in the sector with a



view to preventing mergers and cross mergers a) amongst generating companies, b) amongst distribution/sales (marketing) companies and c) between generating and distribution/sales (marketing) companies, that would restrict competition.

- (v) In cases where NERC considers that there is abuse of market power, it will refer these to an Anti-Trust Commission. Prior to the establishment of such a Commission, the NERC will undertake the responsibilities of the Commission with regards to the ESI. The ownership structure of off grid and mini-grid electricity suppliers will be as flexible as possible and allow for public, private, co-operative and mixed ownership arrangements.

#### **4.4 The Long-Run Competition Structure: Key Features**

The long-run is defined here as the point at which:

- (i) There is no longer a generation deficit (and there exists a normal capacity reserve margin).
- (ii) The transmission and distribution grids have been rehabilitated and reinforced so that there is no more than the normal level of network constraints.
- (iii) Payment discipline has been fully established from generation through to retail customers.
- (iv) On average, electricity prices cover the full economic costs of supply, including the expectation of a reasonable, risk-adjusted rate of return on capital.
- (v) For each class of grid-connected consumer, the price of electricity at least covers the full costs of supply to that class subject to a "lifeline tariff or other arrangements to protect low-income household consumers.
- (vi) Supply quality and standards are being met.
- (vii) Once these conditions have been met, sales (marketing) competition can be introduced without threatening the financial viability of the main participants in the system. This point might be reached in around 5-7 years time.

##### **4.4.1 Framework Modification**

Given these conditions, the medium-term framework shall be modified to introduce progressively more competition. The main steps, in increasing order of complexity, are:

- (i) Large industrial consumers are allowed to purchase directly from generators or from any other power supplier;
- (ii) Distribution companies lose their monopoly sales (marketing) franchise and the market for sales to final customers is opened up to a range of new companies who are allowed to compete in the sales of electricity to retail consumers;
- (iii) Combined distribution and sales (marketing) businesses are split into separate companies with limits on cross-ownership;
- (iv) A much fuller and deeper wholesale market is established, a wholesale tool, with formal membership rules, procedures, etc;
- (v) Full retail sales (marketing) competition is established with open access to the low voltage distribution network.

#### **4.4.2 Off-grid Systems**

The proposed clear separation of business activities between generation, transmission, distribution and sales (marketing) would not apply to off-grid systems. They could continue as vertically integrated systems and without any imposed separation of functions or cross-ownership restrictions.



## RESTRUCTURING AND PRIVATISATION

### 5.0 General

The center-piece of the proposed reform is the unbundling of NEPA into:

- a. A number of competing, privatized generation companies;
- b. a number of privatized distribution and retail sales (marketing) companies; and
- c. a company responsible for transmission and dispatch.

This will be accompanied by the encouragement of competition from new entrant companies initially in generation and later in wholesale and retail sales (marketing) of electricity. The companies will be issued new licenses by NERC designating their role and responsibilities in the liberalized market. The restructuring and privatization of the sector shall be of the highest priority, and market to attract private investment and intensify competition as outlined in this policy.

### 5.1 Strategy for Unbundling NEPA

Government shall set out the sequence for moving from the current NEPA structure to an unbundled and privatized structure in an effective and speedy manner as follows:

- i. creation of 100% state-owned holding company and subsidiary generation and distribution companies within it;
- ii. incorporation of subsidiary companies vested with their assets and liabilities by 2002;
- iii. privatizing the subsidiary companies leaving a transmission and dispatch company plus a residual 100% state-owned holding company by 2003;
- iv. development of trading arrangements among these companies which will evolve into a bulk power market;
- v. employing the Rehabilitate, Operate and Transfer (ROT) and similar schemes as early privatization options, with transfers going back to the Bureau of Public Enterprises and not NEPA;
- vi. commissioning of a restructuring study to provide the details of the

transition from the current structure to be privatization of the subsidiary companies.

The objective of the above sequence is to provide for an early privatization of the main elements of NEPA after the restructuring which allows for an effective market and trading structure that will support an efficient Nigerian Electricity Supply Industry (ESI).

## **5.2 Priority Actions to Enable the Unbundling and Privatization**

NEPA currently faces major problems, technical and commercial, addressed prior to or in parallel with the early stages of the unbundling process. The key areas in which the Government is committed to such action are:

- (i) Improvements in electricity supply through the conclusion of Emergency Power Programme (EPP) contracts;
- (ii) Putting out to tender some of NEPA's existing generation as Rehabilitate, Operate and Transfer (ROT) projects;
- (iii) Carrying out essential investments as proposed in NEPA's Action Plan, with agreement both on essential priorities and on what is to be financed by the Government, as opposed to what is to be financed by the new owners;
- (iv) Contracting out NEPA's billing and collection;
- (v) Repairing and upgrading the system control and communications facilities;
- (vi) Priority strengthening of the transmission network to be able to support the new contract markets for bulk power;
- (vii) Developing a strategy for the equitable treatment of NEPA's employees during the reform process; and
- (viii) Developing a public awareness and public relation strategy.

## **5.3 Negotiating Principles for IP Contracts**

The Federal Government of Nigeria recognizes the need to negotiate short term increases in generation capacity under Emergency Power Project (EPP) agreements. However, the need to conclude fixed-term EPPs must not and will not be allowed to impede the development of effective competition in generation in the medium to long term, nor to pre-empt resources needed for upgrading transmission and distribution. For this reason, the Federal

Government of Nigeria is determined that all IPP projects must be considered on their own terms following the guideline below:

- (i) NEPA shall only conclude contracts, before the establishment of corporatised transmission and distribution companies, if explicit reassignment clauses to the future interior of the contract (prior to majority privatization of distribution companies) and to future distribution companies (after their majority privatization) are provided;
- (ii) All Independent Power Projects (IPP), EPP R-O-T and other large projects must be competitively tendered;
- (iii) Consultations and discussions on proposed regulatory framework will be made with potential IPP partners as well as all Nigerian parties with an interest in the reforms;
- (iv) Government shall not provide guarantees against commercial risks.

**5.4 Privatization**

- a) It is the intention of the Government that management and ownership control in unbundled generation and distribution companies shall be transferred to the private sector with substantial participation by strategic investors with experience and resources in the electricity industry. The Government may retain minority non-controlling ownership interest in the short run. In which case the Government's shares should be under in the control of the relevant Government agency.
- b) The process and timetable for the privatization of these companies will be published by the National Council on Privatization (see <http://www.bpeng.org>) based on the recommendations on the privatization advisers. The privatization programme is guided by the primary objectives of achieving significantly increased resource mobilization and operational and economic efficiency in the ESI, as well as significantly increased access to electricity, while ensuring that the services are as affordable and technically advanced as possible.

**5.5 Nigerian Participation**

The Government shall ensure the unbundling and privatization of NEPA and make provision for:

- a. technological transfer from foreign participants;

- b. a substantial Nigerian role in the share ownership and management of the privatized companies; and
- c. effective national consensus building necessary for the success of reform.

### **5.6 NEPA Staff**

Government will have due regard for the interest of the staff of the companies to be privatized within the provisions of their conditions of service.

## ECONOMIC REGULATION

### 6.0 General

The objective of this policy is ultimately to establish a long-term electricity market structure in Nigeria in which multiple operators provide services on a competitive basis to the broadest range of customers. Under such a regime, competitive market forces would be the best determinant of the appropriate and sustainable levels of prices charged by various carriers for their services. Currently, Nigerian power prices to retail consumers are:

- \* very low on the average; and
- \* seriously unbalanced.

Household consumers pay around 3N/kWh or only 1.2N/kWh for the smallest consumers - significantly less than industrial consumers who pay 4-5N/kWh, even though the cost of supplying household consumers is significantly higher.

In addition, much of our electricity is unbilled and collection rates are low so that only 40-45% of revenues corresponding to these artificially low prices is actually received. The consequence is a grossly under-funded electricity system, which has major difficulties in covering its current costs and providing for essential maintenance. In consequence, it is obvious to all that it has been starved of investment for many years.

The Federal Government of Nigeria recognizes that breaking this spiral and ensuring sufficient revenue to fund the full economic costs of the system, including a reasonable rate of return on capital, is crucial for the success of the reform programme.

Experience in Nigeria demonstrates that people are willing to pay more than the current rates for efficient services. Many businesses, large and small, run generators that provide power at a cost many times higher than the level of NEPA prices. Similarly, many villagers pay significantly more for electric power from off grid sources than comparable households in villages connected to the grid. Both of these demonstrate a willingness to pay higher prices for a more reliable service.

It is likely that for some interim period active competition will not fully develop throughout the market, leaving one or more dominant operators with the power to

control pricing. In these circumstances, it is appropriate for the Nigerian Electricity Regulatory Commission to establish tariff regulation requirements for such dominant operators, which will ensure that service prices are cost-oriented, that consumers' and competitors' interest are protected, and that the industry develops in the most efficient manner possible.

## **6.1 Tariff Regulation**

- (i) The NERC shall establish tariff regulation rules for dominant operators providing basic and essential services to the public and to other, non-dominant operators. In this regard, the Commission shall determine appropriate definitions and criteria for identifying an operator's dominance in a service market, and the essential nature of the services provided.
- (ii) The tariff regulations that will apply to each operator shall be established at the time a license is issued. Similar tariff rules and requirements shall apply to operators in similar markets on a non-discriminatory basis.
- (iii) In determining a tariff regulation regime, the Commission shall be guided by the following principles;
  - a) Electricity service tariffs shall in all cases be cost-oriented, reflecting the actual cost required by operators to provide the services in question, including a reasonable rate of return on capital;
  - b) Tariff setting rules must be transparent to both operators and their customers, with stable, predictable, and understandable standards of current prices and for changes to those prices over time.
  - c) Electricity service tariffs shall generate sufficient revenues for regulated operators to compensate for their investments, while also seeking to be as affordable as possible to the broadest range of potential service customers;
  - d) Tariff will be structured to promote demand side management through time-of-use pricing, multiparty tariffs, etc.
  - e) In general, cross-subsides between services or service categories shall be prohibited. In certain cases, limited cross-subsidies required by government may be permitted, only in connection with an explicit public purpose such as the promotion of universal



access, and where such subsidies can be effectively targeted to accomplish that purpose at minimum cost. In such cases, the request shall be made by the Federal Government to NERC in writing, for a specific and defined purpose and published in the gazette and at least two (2) national newspapers. Cross-subsides by service providers shall require the approval of the NERC and shall be for cases that do not inhibit competition.

- (iv) To the extent that the present tariff levels of NEPA are found to be inconsistent with these principles, the NERC shall undertake a tariff review and rebalancing process, in co-ordination with the privatization and restructuring of the companies.

## **6.2 Tariff Adjustment Policy**

- (i) Any tariff adjustment policy must be on the basis of:
  - a) demonstrating improvements in service to customers;
  - b) sustained efforts to improve bill collection; and
  - c) changes in supply costs.
- (ii) All of the points above imply a medium-term strategy for tariffs with the achievement of higher average tariffs and major rebalancing of household tariffs relative to industrial tariffs over a reasonable period (e.g. 5 years). This is crucial;
  - a) given the expected reliance on IPPs for expansion of generation capacity.
  - b) given the massive investment needed both to restore and to extend the system.
- (iii) The Federal Government of Nigeria shall therefore ensure that the first objective should be to ensure that tariffs at least cover operating costs and the full cost (including a normal, risk-adjusted rate of profit) on new investments. The Government is committed to achieving this first objective by the time of privatization (i.e. by 2002-3).  
The second objective is to move to fully cost-reflective prices by customer groups over time. A particular milestone is when prices to households fully cover all cost of meeting their demand. Only after this has been achieved can competition in retail sales of electricity be introduced. Large industrial consumers and others can be (including

generators) without threatening with bankruptcy, the privatized distribution companies as their profitable industrial consumers are 'cherry-picked' by other suppliers. The Government is committed to achieving this objective as soon as possible and before 2010.

- (iv) To accompany this programme, Government will commission;
  - (a) a cost-of-service study to establish a base-line on the costs of supply of each element of the electricity supply and a first estimate of full economic costs;
  - (b) a tariff adjustment study to test and develop recommendations of this paper;
  - (c) a public information and education programme that will help explain the cost savings from more efficient use of energy and why higher prices are necessary if the amount and quality of electricity are to be improved; and will promote
  - (d) the introduction of peak and off peak tariffs and any other tariff design changes that will help provide better signals to consumers and producers.

### **6.3 Protecting Low Income Electricity Consumers**

- (i) The obvious questions that are inevitably raised in tariff adjustment strategy of the type proposed for Nigeria are:
  - a) affordability; and
  - b) regional differentials.
- (ii) These questions may be tackled by:
  - a) the introduction of a nationally uniform "lifeline" tariff, e.g. For the first 25KWH of household consumption per month;
  - b) the restricted use of subsidies, post privatization, for the promotion of universal access such as in;
    - b.1) connection subsidies for rural access
    - b.2) subsidies on distribution investments, if essential, e.g. For distribution zones that cannot be expected to be viable under sound business practices.
- (iii) The implications of the above provisions will be examined as priority issues in the proposed tariff strategy study.

## RURAL ELECTRIFICATION ARRANGEMENT

### 7.0 General

The primary objective of the Nigerian rural electrification policy (including semi-urban development) is to expand access as rapidly as can be afforded in a cost-effective manner. This implies full use of both grid and off-grid approaches, with subsidies being primarily focused on expanding access rather than consumption. It is assumed that private sector providers will be heavily involved in enhancing access through - both the new distribution companies to be formed out of NEPA and a range of other companies.

The Ministry of Power and Steel will continue to be responsible for laying down policy on increasing access and rural electrification, including (a) setting-out policy guidelines and (b) monitoring and evaluating the performance of the programme and its agencies.

### 7.1 The Rural Electrification Policy

The rural electrification policy shall:

- i) include a full menu of rural electrification options - grids and off-grid, mini-grid, non-thermal, renewable, etc;
- ii) ensure close co-ordination of rural electrification expansion with economic development objectives; and
- iii) encourage States, Local Communities and businesses to develop and contribute financially to rural electrification.

### 7.2 Strategies

The proposed way of achieving these objectives is to establish an independent Rural electrification Fund operated by a Rural Electrification Agency. The Fund:

- (i) will develop both grid-connected and off-grid rural electrification;
- (ii) will operate with funding from an electricity levy on consumers and/or Federal subventions, supplemented by funding from States, Private companies, community contributions, etc.

- (iii) will be open to bids from a wide range of organizations.
- (iv) will invite bids for funding of connections to supply (grid and off-grid) but not for consumption;
- (v) will only supply some proportion of the total funding so that other parties (distribution companies, local communities business groups, etc) would have to provide the rest.

### **7.3 Key Features**

To make the Rural Electrification Fund work well, the key feature shall be:

- (i) Clear policy guidelines within the Fund must operate particularly the criteria for selecting between applications;
- (ii) Transparent procedures for the operation of the fund and its bidding process; and
- (iii) Proper accountability of the Fund e.g., independent audit proper monitoring and reporting procedures, etc.

### **7.4 Rural Electrification Fund**

An access expansion for Nigeria will be developed based on the application of a Rural Electrification Fund. The Criteria which the Fund will use is to be developed by the Ministry of Power and Steel and this will need to give due weight to development benefits and cost effectiveness as well as to equity and regional balance. The implementation of rural electrification programmes should as far as possible encourage decentralization and diversity and make use of all resources (financial, technical and human) available at State and local levels. Such arrangements will need to be in place when the new distribution companies have been separated out of NEPA and privatized. The Government will commission a Strategy Study for rural electrification policy as soon as possible to start the process. This study should take for its starting point the rural electrification policy objectives and guidelines as set out above.

## Chapter Eight

# OBLIGATIONS TO CONNECT AND SUPPLY TO QUALITY STANDARD

### 8.0 General

In most countries, electricity distribution companies have an obligation to connect anyone within a certain distance of existing power lines or anyone at all unless the connection cost would be very high. Similarly, there is typically an obligation to serve (i.e. an obligation to maintain proper supplies of electricity) to anyone connected to the system.

### 8.1 Obligation to Serve/Connect

In Nigeria, in current circumstances, it is impossible to fully impose such obligations in the next few years. In specifying and enforcing any obligation to serve or connect, the NERC will take account of the stage of the development of the ESI, the needs to reinforce existing generation and networks, rural electrification arrangements and obligations on mini-grids and the long-term objective of establishing appropriate obligations to connect and to serve.

### 8.2 Quality Standards

The quality of electricity supply and service manifestly needs to be raised. Here also, Government will take proper account of the level of achievable quality standards and how rapidly they can, in practice, be improved in the long run. The quality standards for generation, transmission, distribution and supply will be laid down by NERC.

### 8.3 Quality of Service Study

To lay the basis for the establishment of a dynamic quality of service regulation for generation, transmission, distribution and sale services. Government will commission a quality of service study.

### 8.4 Enforcement

The NERC will be given powers under the new Electricity Law to issue, monitor and enforce codes of practice for obligations to serve and connect as well as for quality standards and to update and improve standards as supply conditions improve.

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## Chapter Nine

# ELECTRICITY-NATURAL GAS INTERFACE FOR POWER GENERATION

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### 9.0 General

The regional differential in access to electricity, particularly grid-provided electricity, are exacerbated by poor access to reliable supplies of natural gas. This also significantly affects the relative regional costs of electricity and, hence, the economic prices that would need to be paid in different areas and regions of the country.

In considering the future expansion of the electricity industry, the Government will consider jointly the potential for expanding the natural gas pipelines network and the electricity transmission grid and the location of new generation stations.

### 9.1 Fuel Mix

The Nigerian electricity fuel mix will, of course, continue to use and expand the use of hydro generation, renewable and will continue to use some liquid fuels. Nevertheless, natural gas (and the use of currently flared associated gas) represents the major likely fuel for the future expansion of generation. In addition, gas powered electricity generation is the most obvious growth market for the commercial development of gas markets and will be explored by the IPPs.

### 9.2 Potential Joint Development of Electricity and Natural Gas Industries

To transform the prospect for the development of both the electricity industry and the natural gas industry in Nigeria, Government shall explore the options for both on-grid and off-grid supply and reduce the costs of electricity in many areas of the country.

For this purpose, the Ministry of Power and Steel shall carry out a joint electricity and natural gas capacity expansion planning exercise alongside the proposed tariff strategy study. This proposed exercise should investigate how far there are commercial and wider economic benefits from developing gas powered generation and access to gas in regions of the country not currently served with natural gas.

## FINANCE AND FUNDING

### 10.0 General

Improving the availability, efficiency and affordability of electricity services in Nigeria requires considerable financial, human and technological resources. With the focus of Government on investing in the social sectors, the private sector is expected to be the primary promoter of development in the electric power sector.

The liberalization policy of Government shall be pursued vigorously to attract private sector participation in the electric power sector. The tariff structure shall be market- driven, enabling service providers and operators to recover their investments over a reasonable period of time, in an open and competitive manner.

### 10.1 Strategies for Finance and Funding

Government shall provide incentives to investors to enable them grow rapidly and efficiently.

Such incentives shall include:

- (a) Taxes and import duties which are no less attractive than those for essential engineering technology;
- (b) Fiscal incentives to encourage the local manufacture of electrical equipment and development of related software;
- (c) Simplification of procedures and requirements for the importation of electrical equipment.
- (d) Granting of pioneer status to qualified investors in the electric power sectors.

Regulatory procedures, including licensing and monitoring, will be kept as simple and as transparent as possible, consistent with the need for effective regulatory supervision of industry participants.

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## Chapter Eleven

# HUMAN RESOURCES DEVELOPMENT

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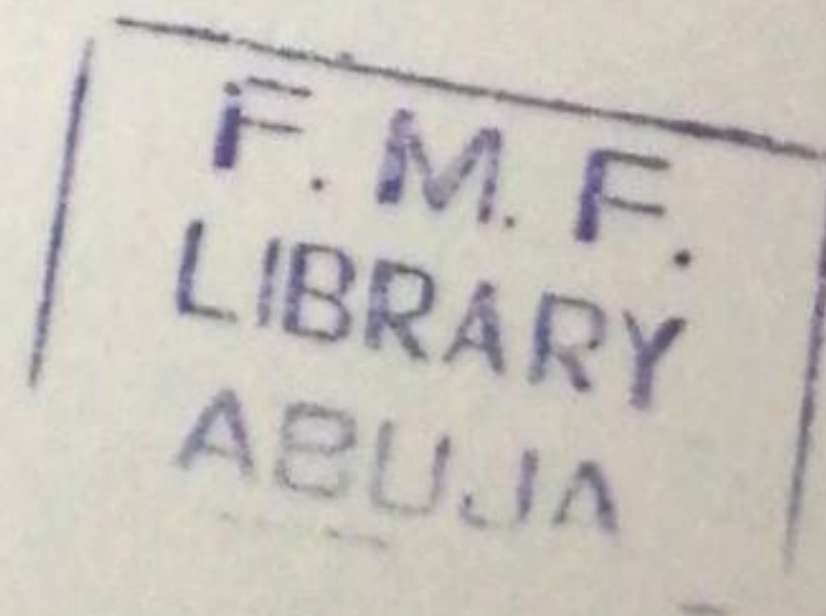
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### 11.0 General

Continuous education and training of personnel for the electricity industry is necessary to keep up with rapid technological changes. Government shall therefore support the establishment of suitable training facilities and encourage the provision of appropriate courses in tertiary institutions.

### 11.1 Strategies

- (i) Government shall support the establishment of a National Electricity Institute (NEI) for the training and development of requisite human resources.
- (ii) Electricity Sector companies shall be encouraged to train indigenous personnel and support the NEI.
- (iii) Universities, Polytechnics and Technical Colleges shall be encouraged to offer courses in electrical engineering and management. The National Universities Commission (NUC) and the National Board for Technical Education (NBTE) shall ensure compliance with this policy objective.





## Chapter Twelve

# RESEARCH AND DEVELOPMENT

### 12.0 Research

Research is necessary for the technological development of the nation. Government shall promote research and development (R&D) in Electrical Engineering Technology and encourage the operating companies and the NERC to support such efforts in relevant institutions.

### 12.1 Strategies

- (i) The National Electricity Institute shall have a research center to carry out R&D in Electrical engineering technology and infrastructure development.
- (ii) Government shall promote collaborative R&D efforts amongst NERC, the operators, educational institutions and international agencies.

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## Chapter Thirteen

# DOMESTIC HARDWARE/SOFTWARE DEVELOPMENT

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### 13.0 General

The domestic production of electrical hardware and software, desirable for national development and, in particular, the electricity industry.

Government shall therefore encourage domestic production electrical equipment, components and software to meet local and export demands.

### 13.1 Strategies

- (i) Government shall actively encourage the establishment and expansion of domestic capacity to produce hardware and software for the electricity industry.
- (ii) The NERC shall ensure that the domestic production of hardware and software complies with international technical standards and quality.
- (iii) Government shall encourage joint ventures between Nigerian and foreign entrepreneurs towards the production of electrical equipment and software;
- (iv) Government shall promote the development of the electric power sector as an integral part of the National Industry Policy of Nigeria; and
- (v) Government shall encourage the patronage of locally manufactured products.

## Chapter Fourteen

# SAFETY AND NATIONAL SECURITY

### 14.0 General

The protection of life and property rights as well as the promotion of national security are vital for overall economic development. According, Government shall ensure that electricity operators comply with generally accepted standards for provision of special services for safety, emergency and national security.

### 14.1 Strategies

- (i) Government shall ensure the protection of life and property of all citizens and safeguard electricity infrastructure;
- (ii) Government shall ensure the provision of electricity services for emergency and distress situations in all parts of the country (on land, sea and air) and support international co-operation in this regard;
- (iii) Government shall ensure that laws relating to electricity offences are kept under constant review and enforced; and
- (iv) All electricity matters relating to the defense and security of the nation shall be restricted to Nigerians only.

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## Chapter Fifteen

# INTERNATIONAL CO-OPERATION

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### 15.0 General

International co-operation in Electricity is essential for development of regional and international electricity markets and networks, setting of standards in the operation of electric power systems and it also affords countries the opportunity of taking advantage of the experiences of other nations in electricity development. Relevant international organizations provide suitable vehicles for the achievement of these objectives. Bilateral arrangements may, in addition, be explored for the same purpose.

The Government shall ensure that Nigeria meets its international obligations and participates actively in all international electricity activities whose objectives would promote electricity development in the country.

### 15.1 Strategies

Government shall:

- (i) accord priority to the country's participation in the various projects aimed at rapid development of the West African regional electricity network;
- (ii) ensure effective participation of Nigeria in the activities of various international organizations;
- (iii) encourage NERC and all operators to take advantage of the opportunities available at international levels to promote the achievement of their set goals and objectives;
- (iv) support the effort of the Economic Community of West African States (ECOWAS) in harmonizing electricity development in the region;
- (v) encourage and support the export of locally manufactured goods and services to other African countries;
- (vi) encourage and support other West African regional integration initiatives in electricity development, harmonization of the regulatory policy and promotion of interconnections.

## Chapter Sixteen

# POLICY IMPLEMENTATION AND REVIEW

### 16.1 Policy Implementation

The National Electric Power Policy shall be implemented through the following instruments;

- a) An implementation machinery shall be set in motion immediately after approval of the policy;
- b) A National Electricity Forum shall be organized by the Ministry of Power and Steel with the participation of relevant Organizations and stakeholders;
- c) Annual reports on electricity development in Nigeria shall be prepared and published by the Ministry of Power and Steel.

### 16.2 Periodic Review

The policy shall be reviewed from time to time by government to take cognizance of changes in standards, technologies, markets, and any other matters that may arise from its implementation.

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## Chapter Seventeen

### CONCLUSION

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The National Electric Power Policy presents, inter-alia, the policy objectives of the Federal Government of Nigeria in:

- a) promoting the deployment and utilization of electricity infrastructure and services;
- b) accelerating the socio-economic and political development of the nation; and
- c) enhancing the quality of life of the Nigerian citizenry.

The historical development and the present status of the electricity industry in the country are briefly described. The short, medium and long terms objectives are clearly spelt out. The industry structure, competition policy and economic regulation that are required for the effective implementation of the policy are highlighted. The guidelines and strategies for the achievement of the objectives of the policy are also clearly described.

The Federal Government of Nigeria is confident that if the policy is implemented, consumers will reap the benefits of improved and affordable electricity as the engine of growth of the national economy.

## APPENDIX I

### DETAILS OF THE POWER GENERATION STATIONS

The Authority has nine (9) power stations, nationwide, as follows:-

- i. Kainji Hydro Power Station**  
This Station located in Niger State along the River Niger is the first Hydro Power Station in the country. The 8 generating units were commissioned thus:
  - i. 4x80MW 1968
  - ii. 2x10MW 1976
  - iii. 2x120MW 1978
  
- ii. Jebba Hydro Power Station**  
This Station is located in Kwara State down stream of the Kainji Hydro Power Station. It has 6 units which were commissioned thus:
  - i. 6x95MW 1986
  
- iii. Shiroro Hydro Power Station**  
This Station is located in Niger State on the Shiroro Gorge along the Kaduna River. It has four generating units, which were commissioned thus:
  - i. 1x150MW 1989
  - ii. 3x150MW 1990
  
- iv. Afam Thermal Power Station**  
This Station uses natural gas and is located in the outskirts of Port Harcourt in Rivers State. The Station started operation in 1965. The 6 units were commissioned thus:
  - i. 2x10.5MW 1965
  - ii. 2x17.5MW 1965
  - iii. 4x23.9MW 1976
  - iv. 4x27MW 1978
  - v. 6x75MW 1982

**V. Delta Thermal Power Station**

This Station also uses natural gas and is located in Ughelli, Delta State. The Station started operation in 1966. The 6 units were commissioned thus:

- i. 2x36MW 1966
- ii. 6x20MW 1975
- iii. 6x20MW 1978
- iv. 1 x 100MW 1989
- v. 5 x 100MW 1990

**vi. Egbin Thermal Power Station**

This Station is located in the outskirts of Lagos State. The Station is the largest Thermal Power Station in the country. Its units were commissioned thus:

- i. 2x22MW 1985
- ii. 2x220MW 1986
- iii. 2x220MW 1987

**vii. Sapele Thermal Power Station**

This Station is located in Ogorode, Delta State. The Station uses both steam and gas turbines. These were commissioned thus:

- i. 6x120MW 1978
- ii. 4x75MW 1981

**viii Ijora Thermal Power Station**

This Station which is located in Lagos uses AGO fuel and has 3 units which were commissioned thus:

- i. 3x20MW 1978

**ix. Oji Thermal Power Station**

This Station which is located on the Oji River, Oji in Enugu State. Though presently non-functional, it's the only coal-powered station in the country. Its four units were commissioned as follows:

- i. 2x5MW 1956
- ii. 2x10MW 1956





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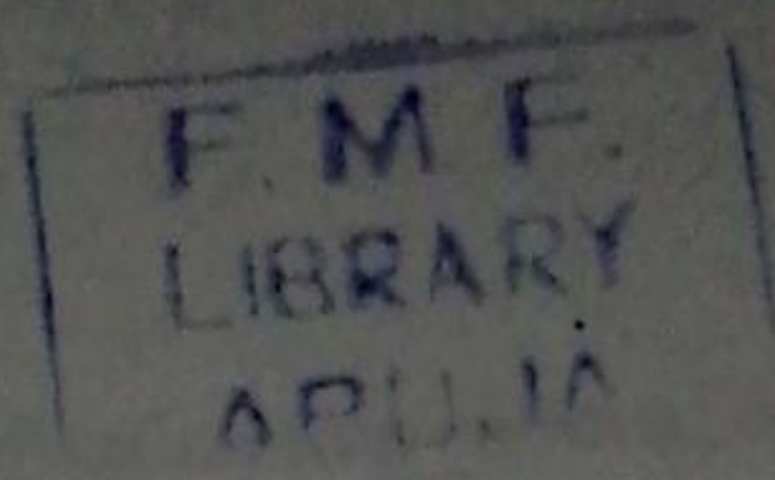
## **SECTION EIGHT**

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# **NATIONAL ENERGY POLICY**

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## FOREWORD

The nature and extent of energy demand and utilisation in a national economy are to a large extent related to the pace of industrialisation. Therefore, any country that aims to industrialise must give maximum attention to the optimisation of her national energy resources rather than a reliance on imported energy. Indeed, there is often a correlation between national economic problems and heavy dependence on imported energy sources.

It is therefore, clear that every country must put in place a National Policy on Energy that addresses the realisation of a coherent, co-ordinated and cost-effective blue print for the development and utilisation of the energy resources within the country. Moreover, since the exploitation of the conventional energy sources tend to have a measure of negative impact on the environment, such a national policy should promote clean and environmentally - friendly energy practices. Thus, a National Energy Policy should ensure the promotion of a judicious, cost-effective exploitation of the national conventional energy sources, while identifying and harnessing at the same time, alternative and renewable sources of energy.

Also, a National Energy Policy must address the issue of applicable technologies for the local development and manufacture of energy devices and facilitate, in the process, technological advancement as well as industrialisation. Furthermore, it is to be expected that apart from policy objectives that would capture the essence of a nation's energy needs, the policy evolved must incorporate comprehensive strategies for implementation which will take cognisance of the spread and diversity of available energy sources.

In order to come out with a policy document that meets the above stated criteria, the Ministry established, at the instance of the Presidency, an Interministerial Committee and assigned it the responsibility of preparing a National Energy Policy. In carrying out its assignment, the committee was to proceed by appraising a draft policy document prepared by the Energy Commission of Nigeria and was to consult with other Ministries, agencies and institutions, including professional associations, that were considered relevant and important to the evolution and eventual implementation of a National Energy Policy. The document arrived at, therefore, is a distillate of the contributions obtained through consultations at interministerial and specialised committee meetings. The highlights of the Policy Document include a strategy for systematic exploitation of Nigeria's energy resources, the development and effective use of national manpower for exploitation, and a strategy for effective energy funding.

It also incorporates planning and implementation strategies under three broad terms; short, medium, long-term measures.

It is hoped that this document will provide the necessary framework within which contributions to national advancement, from the energy sector of the economy in the context of VISION 2010 and associated plans, will be effectively accommodated.

Major-General

S.I. Momah, mni

Honourable Minister of Science and Technology

Abuja

## INTRODUCTION

1.1 Energy has a major effect on every aspect of our socio-economic life. It plays a vital role in the economic, social and welfare development of our nation. Inadequate supply of energy restricts socio-economic growth and adversely affects the quality of life. Improvements in standards of living are manifested in increased food production, increased industrial output, the provision of efficient transportation, adequate shelter, healthcare and other human services. Our future energy requirements will continue to grow with increase in living standards, industrialization and a host of other socio-economic factors. It is pertinent to note that the impact of energy goes beyond national boundaries. Energy supply can be used as an instrument of foreign policy in the promotion of international cooperation and development.

### 1.2 Socio-Economic Background

The nation's overall economic growth, as measured by the Gross Domestic Product (GDP) has grown by less than 3% annually over the last two decades. In recent years, the GDP has actually decreased. On a per capita basis, the growth has even been less impressive because of high population growth. The population is estimated to be 88.5 million (1991 Census). The population growth rate is over 3%, with a rural population of over 60%.

The general structures of the economy has changed significantly since independence in 1960. Agriculture was the most important sector of the economy, whose contribution to the GDP was above 54%. The contribution of the agricultural sector to the GDP has since declined and is now only a little above 30%. Correspondingly, agricultural exports, which has been the main source of foreign exchange earnings, have declined and food imports have increased from about 13% in 1960 to about 43% in 1991. A closer examination of this increase, however, reveals that the rise is not due to any major leap in industrial development, since the contribution of the manufacturing sector has virtually remained stagnant at about 10% during the period. What industry has gained is primarily due to increases in oil production.

### **1.3 Energy and the Economy**

Nigeria is blessed with abundant primary energy resources. These include reserves of crude oil and natural gas, coal, tar sands, nuclear and renewable energy resources such as hydro, fuelwood, solar, wind and biomass. However, since the late 1960s the economy has been solely dependent expenditures. In 1990, oil revenue alone accounted for over 90% of exports, 80% of total government revenue, with a contribution of about 30% to GDP

The dominant source of commercial energy is oil, accounting for over 70% since the early 1970s, natural gas production, which is mostly in association with oil production, is appreciable. However, about 70% of the natural gas produced is being flared. Up to the early 1960s coal production was significant and dominated the commercial energy supply. It was also the predominant source of energy for rail transportation and electricity generation. However, partly due to fuel substitution to oil and gas, coal production and utilization has dropped to an insignificant level. In 1990, coal's share of the total commercial energy consumption was less than 1%. With respect to the renewable energy resources, hydro power plants entered the Nigerian energy scene in the 1960's, presently hydro is the second largest energy source for electricity generation in the country, contributing about 37 percent of the total installed electricity generating capacity.

Currently, fuelwood accounts for over 50% of overall energy consumption in the country and is the dominant source of energy in the domestic sector. It is also used in other sectors of the economy, such as cottage industries. Over the years the fuelwood supply/demand imbalance in some parts of the country has adversely affected the economic well-being of the people. On the national level, increasing fuelwood consumption contributes to deforestation with consequent desertification and soil erosion.

Solar energy intensity is generally high in the country. Solar energy is widely used in the country for drying, most especially for agricultural products. But it is normally lumped with the informal sector which is not included in the national accounts. Nevertheless, solar energy has great potential for the provision of power for rural development.

### **1.4 Energy Security**

Over-dependence on oil has slowed down the development of alternative fuels.

Diversification to achieve a wider energy supply mix will ensure greater energy security for the nation. The domestic demand for petroleum products is growing rapidly. The development of alternative fuels from locally available energy resources should therefore be vigorously pursued.

The rural populace, whose needs are often basic, depend to a large extent on traditional sources of energy; mainly fuelwood, charcoal, plant residues and animal wastes. This class of fuels constitutes over 50% of total energy consumption in the country. Fuelwood support/demand imbalance in some parts of the country is now a real threat to the energy security of the rural communities. Hence special attention needs to be paid to the diversification of the energy supply mix in the rural areas.

Even when there exists adequate and diversified energy supply options in the country, the problem of unreliability of supply constitutes a huge drain on the national economy. Therefore attention must be given to adequate production levels and a reliable distribution network for all fuel types to ensure steady economic growth.

### **1.5 Institutional framework**

Given the vital role of energy in national development and its impact on every aspect of our life, energy planning must be viewed as an integral part of national development planning such that energy development decisions are not taken as isolated sectoral plans; but rather, closely linked and reconciled with those of the rest of the economy.

A necessary condition for the optimal development of the energy sector is the effective coordination of the various energy sub-sectors because of their interrelatedness. It is also necessary to coordinate the energy related activities of the non-energy sectors of the economy. In this respect, the establishment of the Energy Commission of Nigeria as the governmental organ for the coordination of energy sector activities and the implementation of a comprehensive and integrated energy policy is a major development. This development must however be complemented by promoting cooperation between the Energy Commission and relevant Federal Ministries and other Federal Parastatals such as NEPA, NPC, Nigeria Coal Corporation etc. it is important to realise that in order to increase the efficiency and effectiveness of energy delivery in the country there is a need to develop the technological

capabilities of these parastatals to cope with the challenges of future energy development.

There should also exist at state and local government levels units responsible for energy matters./ these would provide necessary links for the formulation of national energy policies, plans and programmes as well as for the execution of some of the programme. The successful implementation of the energy policy will require the active participation of the private sector. Therefore the input of the organized private sector is essential in the formulation of policy and implementation of strategies.

### **1.6 Objectives of Energy Policy**

The policy objectives and implementation strategies have been carefully defined with the fundamental guiding premises that energy is crucial to national development goals, and that government has a prime role in meeting the energy challenges facing the nation. Furthermore, the dependence on oil can be reduced through the diversification of the nation's energy resources, aggressive research, development and demonstration (R,D & D), human resources development, etc. consequently the overall energy policy objectives may be summarized as follows:

- i. To ensure the development of the nation's energy resources, with diversified energy resource options, for the achievement of national energy security and an energy delivery system with an optimal energy resource mix.
- ii. To guarantee increased contribution of the energy sector to national income and to productive activities.
- iii. To guarantee adequate, sustainable and reliable supply of energy at appropriate costs and in an environmentally friendly manner, to the various sectors of the economy, for national development.
- iv. To guarantee an efficient and cost effective consumption pattern of energy resources
- v. To accelerate the process of acquisition and diffusion of technology and managerial expertise in the energy sector and indigenous participation in energy sector industries, for stability and self-reliance
- vi. To promote increased investments and development of the energy sector industries with private sector participation



- vii. To foster international co-operation in energy trade and projects development in both African region and the world at large.
- viii. To successfully use the nation's abundant energy resources to promote international co-operation
- ix. To ensure a comprehensive, integrated and well informed energy sector plans and programmes for effective development.

## Chapter Two

# ENERGY SOURCES

### 2.1 Oil

Crude oil was discovered in commercial quantities in Nigeria in 1956 while oil production started in 1958. The nation has a proven reserve estimate of over 22 billion barrels. The annual oil production peaked at about 840 million barrels in 1979 and thereafter declined to slightly over 600 million barrels in 1990.

Presently, Nigeria has a total installed refining capacity of 45,000 barrels per day. However, capacity utilization is low and consequently the annual consumption of petroleum products is not fully met by internal production and has to be supplemented by imports.

The nation is clearly over dependent on crude oil for its foreign exchange earnings; hence the economy is vulnerable to the unstable nature of the international oil market. Therefore there is a need to promote the expansion of the processing sub-sector to allow for the export of value-added petroleum products. Furthermore, it is desirable to diversify the domestic energy mix away from ever-increasing consumption of petroleum products in order to avert any possible conflict between domestic and export requirement.

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

#### 2.1.1 Policies

- i. The nation shall engage intensively in crude oil exploration and development with a view to increasing the reserve base to the highest level possible.
- ii. Emphasis shall be placed on internal self sufficiency in and export of petroleum products.
- iii. The nation shall encourage indigenous and foreign companies to fully participate in both upstream and downstream activities of the oil industry.

### **2.1.2 Objectives**

- i. To improve the reserve to production ratio
- ii. To adequately protect the country from the vulnerability of oil price fluctuations
- iii. To ensure adequate and reliable supply of petroleum products to meet the demand of the domestic market.
- iv. To derive more economic benefits from the nation's crude oil resources.
- v. To accelerate the process of technology acquisition and diffusion in the oil industry.
- vi. To ensure indigenous capability in such a vital industry to national security.

### **2.1.3 Strategies**

- i. Investing in and intensifying crude oil exploration and production
- ii. Maximizing and expanding the refining capacity in the country to cater fully for local consumption and export of petroleum products.
- iii. Ensuring the establishment of research and development outfits in the country.
- iv. Taking appropriate measures to ensure that Nigerians are put into key decision-making positions in the oil industry.
- v. Providing appropriate fiscal incentives to attract investment and ensure reasonable returns.
- vi. Ensuring the availability of adequate strategic reserves of storage capacity for refined products for at least 90 days of forward consumption.
- vii. Encouraging local engineering design and fabrication of equipment and spares in Nigeria.
- viii. Emphasising the processing of crude oil for export to withstand the adverse effect of crude oil price fluctuations.

## **2.2 Natural Gas**

Nigeria's natural gas reserves estimated at about 164 trillion standard cubic feet are known to be substantially larger than its oil resources. Gas discoveries in Nigeria are incidental to oil exploration and production activities. At present, about 70% of the gas produced (mainly associated gas) is flared.

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 more environmentally friendly because gas is a cleaner fuel than oil.

Given the current reserves and rate of exploitation, the expected life-span of Nigerian crude oil is about twenty five years. 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 consistent with the level of domestic gas exploitation and our international obligations with regards to the environment.

### **2.2.1 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 engage intensively in gas exploration and development with a view to increasing the reserve base to the highest level possible.
- iii. The nation shall put in place necessary infrastructure and incentives to encourage indigenous and foreign companies to invest in the industry.

### **2.2.2 Objectives**

- i. To eliminate the flaring of associated gas.
- ii. To expand the utilization of natural gas as industrial and domestic fuel.
- iii. To increase the use of natural gas as industrial feedstocks for petrochemical and fertiliser plants, etc.
- iv. To use gas to diversify the foreign exchange earning base of the nation.
- v. To accelerate the process of technology acquisition in the gas industry.
- vi. To encourage indigenous entrepreneurial capability in the gas industry including the development of end-use devices.

### **2.2.3 Strategies**

- i. Encouraging the oil producing companies to gather and to utilise associated gas in order to eliminate flaring.
- ii. Imposing appropriate and effective penalties to discourage gas flaring.
- iii. Encouraging the establishment of the necessary infrastructure for the effective gathering, transmission and distribution of gas.
- iv. Providing incentives to encourage industrial and domestic consumers to use gas or to convert to gas.
- v. Subsidizing the cost of LPG appliances in areas not accessible to natural gas so as to encourage the consumer preference for gas.
- vi. Establishing suitable infrastructure for the export of natural gas.
- vii. Ensuring the establishment of gas related R & D outfits in the country
- viii. Formulating suitable urban and regional planning regulations needed for the effective distribution of natural gas to domestic and industrial consumers.
- ix. Providing necessary incentives to indigenous and foreign entrepreneurs to facilitate their participation in the gas industry.
- x. Ensuring that the price of natural gas is cost-effective while giving due attention to the effect on local consumption.

### **2.3 Tar Sands**

Tar sands are known to exist in Nigeria. The deposit is preliminarily estimated to contain a total reserve of about 30 billion barrels of oil equivalent. The heavy crude from the tar sands can be a major feedstock for Kaduna Refinery which refines heavy crude with similar properties that is now being imported.

Bitumen, which is derive 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.

#### **2.3.1 Policy**

- i. The nation shall encourage tar sands exploration, exploitation and development for full utilisation by the country.

### 2.3.2 Objectives

- i. To extract heavy oil from the tar sands for refineries
- ii. To conserve foreign exchange used in importing heavy crude oil
- iii. To acquire the technology for harnessing the tar sands.

### 2.3.3 Strategies

- i. Undertaking exploration activities for tar sands deposits in the country
- ii. Establishing infrastructural facilities for the acquisition of the technology for harnessing tar sands.
- iii. Intensifying R & D in the production of lubricants and other heavy oil products from tar sands.
- iv. Establishing heavy oil upgrading facilities near the tar sands deposits
- v. De-emphasising the importation of heavy crude oil as a way of encouraging the utilization of heavy oils from our tar sands.

## 2.4 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 production in Nigeria started in 1916 with an output of 24,500 tonnes for that year. Production rose to a peak of 905,000 tonnes in the 1958/59 year 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 of 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 100,000 tonnes in 1991, with part of it being for export. In 1980 coal contributed less than 1% to commercial energy consumption in the country as compared to 70% for oil, 25% for natural gas and about 5% for electricity.

Our coal deposits can be utilized for power generation, production of steam and hot air for process heat and drying applications, heat source and reducing agent for steel production, cement production, domestic fuel, source

of chemicals, liquid and gaseous fuels, feedstock for battery, carbon electrode and brick making industries, etc. all the above 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 production in Nigeria, the Nigerian Coal Corporation had been the only institution active in the coal industry. In 1990 the Federal Government approved the full commercialization of the Corporation. Consequently, joint venture arrangements with foreign partners have developed for the exploitation of some of the coal deposits. There is however the need for increased participation of indigenous companies 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 utilization is to be optimally exploited. One of the major problems is that of the low productivity of the coal mines and consequently the high cost of production of Nigerian coal. This is mainly due to limited mechanization of the coal mines.

Another problem relates to the lack of cost-effective transportation system for carrying the coal from the mines to consumers far away. Presently the price of coal doubles roughly every 100 km from the mines due mainly to high transportation costs. It is therefore imperative that the present national rail system and port facilities be expanded and made more effective to meet the needs of the coal industry.

#### **2.4.1 Policies**

- i. The nation shall continue to pursue vigorously a comprehensive programme of resuscitation of the coal industry
- ii. Extensive exploration activities to maintain a high level of coal reserves shall be carried out
- iii. The exploitation and utilization of the coal reserves shall be done in an environmentally acceptable manner.

#### **2.4.2 Objectives**

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

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- iii. To utilize coal in meeting the critical national need of providing a viable alternative to fuelwood in order to conserve our forests.

### **2.4.3 Strategies**

- i. Intensifying the drive for coal exploration activities.
- ii. Providing adequate incentives for the large scale production of coal stoves at affordable prices.
- iii. Providing adequate incentives to local entrepreneurs for the establishment of coal-based industries
- iv. Developing adequate infrastructure for handling and transportation of coal within and out of the country.
- v. Organizing awareness programmes for the use of smokeless coal briquettes as an alternative to fuelwood.
- vi. Encouraging R & D in the production, processing and utilization of coal.

## **2.5 Nuclear**

Nuclear energy is one of the major sources of base-load electricity generation the world today. The technology for harnessing nuclear energy demands great responsibility and therefore requires careful planning of the manpower development and material resources.

Coordinated approach to research, training and development in the areas of nuclear science and technology in Nigeria started in 1977 when nuclear energy research centres were established in two universities. Thus, the few trained personnel in the areas are concentrated in these two centres. There is therefore an urgent need to accelerate the manpower development programme in view of the diverse peaceful applications of nuclear energy.

Of importance to any nuclear programme is the availability of nuclear minerals such as uranium and thorium. In 1947, pyrochlore containing uranium was found in appreciable quantities on the Jos Plateau and its environs; but there is still no established method of commercial extraction of the uranium. By 1979, about 617,000 km<sup>2</sup> of land area had been covered by aerial radiometric surveys and another 90,000 km<sup>2</sup> had been covered by other surveys. At present there are on-going efforts to ascertain the extent of radioactive mineral deposits widely believed to exist in some parts of the country. There is also the need to extend investigations to other areas of the country suspected to have traces of



any of the radio-active minerals and to place the management and all scientific investigations under the control of Nigerians.

Uranium ores are complex assemblages of minerals and therefore differ widely in details of composition and texture. The characterization of the different uranium ore minerals in the country is being carried out. There is however the need to develop the extraction processes for each of them, on the basis of which a commercially viable pilot plant could be established. In addition to the generation of electricity, nuclear energy finds many other peaceful applications. Infact it has been in use in the country for decades for various peaceful applications in health care delivery system, agriculture, food preservation, animal husbandry, pest control, industry and mineral exploration. All these applications will be enhanced by the acquisition of a nuclear research reactor. There is also the need for a law regulating the use of radioactive substances and machines capable of producing ionizing radiation in order to protect the populace from the hazards of radiation.

### **2.5.1 Policy**

The nation shall pursue the exploitation of nuclear energy for peaceful purposes.

### **2.5.2 Objectives**

- i. To pursue the introduction of nuclear power into the generation of electricity
- ii. To apply nuclear science and technology in industry, agriculture and medicine
- iii. To pursue the exploration of nuclear mineral resources in the country.
- iv. To institute nuclear safety and environmental protection measures
- v. To promote the development of nuclear science and technology.

### **2.5.3 Strategies**

- i. Intensifying manpower development in the utilization of nuclear energy for peaceful purposes.
- ii. Evolving appropriate laws and regulations to ensure adequate protection for the public and the environment.
- iii. Intensifying research and development efforts in nuclear science and

- iv. Developing an appropriate institutional framework and infrastructure for the development of nuclear science and technology in the country.
- v. Creating incentives for career development campaigns on applications of nuclear technology.
- vi. Identifying accurately the availability and the extent of nuclear fuels and other materials.
- vii. Providing adequate funding for the development of nuclear science and technology.
- viii. Fostering co-operation with the International Atomic Energy Agency.

## **2.6 Hydropower**

Hydropower is one of the major sources of base-load electricity generation. Despite its high initial capital cost, hydropower provides one of the cheapest and cleanest sources of electricity.

The country is well endowed with large rivers and some few natural falls which are together responsible for the high hydropower potential of the country. The Rivers Niger and Benue and their several tributaries constitute the core of the Nigerian river system which offers a renewable source of energy for large scale (greater than 100 MW) hydropower development. In addition, several scores of small rivers and streams do exist and can be harnessed for small scale (less than 10 MW) hydropower projects.

The total technically exploitable large-scale hydro-power potential of the country is estimated at over 10,000 MW capable of producing 36,000 GWh of electricity annually. Only about one fifth of this potential had been developed as at 1990. The small-scale hydropower potential is however yet to be established. There is the need to develop small-scale hydropower plants for the provision of electricity for the rural areas and remote settlements.

In Nigeria, hydropower generation accounts for a substantial part of the total electricity generation mix. In 1990, hydroelectricity represented over 37% of the total electricity produced nationwide.

### **2.6.1. Policies**

- i. The nation shall fully harness the hydropower potential available in the

- country for electricity generation.
- ii. The nation shall pay particular attention to the development of the mini - and micro hydropower schemes.

### **2.6.2 Objectives**

- i. To increase the percentage contribution of hydro electricity to the total energy mix.
- ii. To extend electrification to rural and remote areas, through the use of mini and micro hydro power schemes.
- iii. To conserve non-renewable resources used in the generation of electricity.
- iv. To diversify the energy resource base.

### **2.6.3 Strategies**

- i. Establishing and maintaining multilateral agreements to monitor and regulate the use of water in international rivers flowing through the country.
- ii. Ensuring increased indigenous participation in the planning, design and construction of hydropower stations.
- iii. Providing basic engineering infrastructure for the production of hydropower plants equipment and accessories
- iv. Encouraging the private sector, both indigenous and foreign, for the local production of hydropower plants and accessories
- v. Ensuring that rural electricity boards incorporate small-scale hydropower plants in their development plans.
- vi. Promoting and supporting R & D activities for the local adaptation of hydropower plant technologies.
- vii. Initiating and updating for the hydropower potential of our rivers and identifying all the possible locations for dams.

## **2.7 Fuelwood**

About half of the world's population depends on fuelwood for cooking and other domestic uses. By 1990 estimates, average daily consumption is about 0.5 to 1 kg of dry fuelwood per person, which is equivalent to 10-20 MJ per day. An average consumption of 10-20 MJ per day solely for cooking may seem

surprisingly large and is due to the widespread use of inefficient cooking methods the most common of which is still an open fire. This system has a very low thermal efficiency.

The rate of consumption of fuelwood far exceeds the replenishing rate to such an extent that desert encroachment is now a serious problem in the country. Also associated with this is soil erosion and loss of soil fertility.

The largest sources of fuelwood at present are from open forests, communal woodlots and private farmlands. Supply from natural forest regeneration is continuously being diminished due to the additional activities such as the clearing of forests for development projects agricultural and industrial activities. Since forests are essential for a healthy environment and as a check on wind and water erosion and desertification, and also serve as energy sources, it is essential that they are cropped on a rational basis.

### **2.7.1. Policies**

- i. The nation shall promote the use of alternative energy sources to fuelwood.
- ii. The use of wood as a fuel shall be de-emphasized in the nation's energy mix.
- iii. The nation shall intensify efforts to increase the percentage of land mass covered by forests in the country.

### **2.7.2 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 and deforestation.
- iv. To facilitate the use of alternative energy resources to fuelwood.

### **2.7.3. Strategies**

- i. Cultivating fast growing tree species needed to accelerate the regeneration of forests.
- ii. Developing appropriate efficient wood stoves in the short term.
- iii. Developing appropriate technologies for the utilization of alternative

- energy sources to fuelwood.
- iv. Encouraging the establishment of private and community woodlots for supply of fuelwood in the short term.
- v. Developing an appropriate pricing structure to encourage substitution from fuelwood to alternative fuel types.
- vi. Ensuring the availability and effective distribution of alternative energy sources to fuelwood at all times.
- vii. Organizing systematic public enlightenment campaigns on the problems of desertification and soil erosion arising from deforestation.
- viii. Ensuring the existence of effective forestry laws to stop the willful felling of trees.
- ix. Ensuring effective enforcement of the forestry laws.
- x. Increasing the area covered by forest reserves.
- xi. Setting up an effective system of forest regeneration.
- xii. Disseminating the alternative technologies to fuelwood through extension programmes, pilot plants e.t.c.

## **2.8 Solar**

Solar radiation is incident on earth at the rate of about  $7.2 \times 10^{15}$  MJ/day. Its intensity varies with location and at a given location, it varies with season, day of the month, time of day, instantaneous cloud cover and other environmental factors. However, the incorporation of efficient storage devices in solar energy conversion systems will take care of this intermittent nature of the availability of solar radiation.

Nigeria lies within a high sunshine belt and, within the country, solar radiation is fairly well distributed. The annual average of total solar radiation varies from about 12.6 MJ/m<sup>2</sup>-day in the far North. Solar energy is renewable and its utilization is environmentally friendly. Consequently, when the availability and environmental cost of the utilization of other forms of energy are considered, the competitiveness of solar energy in comparison with these other forms becomes very evident, particularly for low to medium power applications.

Solar radiation conversion technologies are generally either of the solar-thermal type (Solar heating, cooling, drying, thermal power plant, etc.) Or of the photovoltaic type (direct conversion to electricity). Areas of application of

solar thermal technologies are crop drying, house heating, heating of process water for industries, hospitals etc, air-conditioning, preservation of foods and drugs, power generation, etc. photo-voltaic (pv) power may be utilized in low to medium power applications and in remote areas, in such uses as communication stations, rural television and radio, water pumping, refrigeration etc, which require power of the order of 1-10 KW. It may also be used for power supply to remote villages not connected to the national grid. It is even possible to generate PV power for feeding into the national grid.

Most solar-thermal technologies can be supported by the technical expertise existing within the country. However the industrial infrastructure needs to be strengthened for effective utilization of the energy resource. Photo-voltaic system components require more sophisticated technologies for their manufacture, particularly as regards the photo-voltaic cells.

Apart from traditional open air drying, solar energy technologies are not much used in Nigeria. Nevertheless they have tremendous potentials. Much work needs to be done in the development and popularization of applications equipment and systems, solar and environmental data acquisition and development of standards for materials, design and equipment manufacture.

### **2.8.1 Policies**

- i. The nation shall aggressively pursue the incorporation of solar energy into the nation's energy mix.
- ii. The nation shall keep abreast with worldwide developments in solar energy technology.

### **2.8.2 Objectives**

- i. To develop the nation's capability in the utilization of solar energy.
- ii. To use solar energy as a complementary energy resource in the rural and urban areas.
- iii. To develop solar energy conversion technologies locally.

### **2.8.3 Strategies**

- i. Intensifying research and development in solar energy technology.
- ii. Promoting training and manpower development.
- iii. Providing adequate incentives to local manufacturers for the

- iv. production of solar energy systems.
- iv. Introducing measures to protect the local solar technology into the energy mix.
- v. Setting up extension programmes to introduce solar technology into the energy mix.
- vi. Providing fiscal incentives for the installation of solar energy systems.
- vii. Setting up and maintaining a comprehensive information system on available solar energy resource and technologies.

## **2.9 Biomass**

Organic, non-fossil material of biological origin is called biomass. 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.

Plant biomass can be converted to produce solid briquettes which can then be utilised 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.

The abundant energy available from biomass 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.

### **2.9.1 Policy**

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

### **2.9.2 Objectives**

- i. To promote biomass as a supplementary energy resource especially in the rural areas.
- ii. To promote efficient use of agricultural residues, animal and human wastes as energy sources.

### 2.9.3 Strategies

- i. Developing extension programmes to facilitate the general use of new biomass energy technologies.
- ii. Encouraging R & D in biomass energy technology.
- iii. Establishing pilot projects for the production of biomass energy conversion devices.
- iv. Providing adequate incentives to local entrepreneurs for the production of biomass energy conversion system.
- v. Training of skilled manpower for the maintenance of biomass energy conversion systems.
- vi. Developing skilled manpower and providing basic engineering infrastructure for the local production of components and spare parts for biomass system.

### 2.10 Wind

Wind is a natural phenomenon related to the movement of air masses caused primarily by the differential solar heating of the earth's surface. Seasonal and locational variations in the energy received from the sun affects the strength and direction of the wind. It is possible to convert wind energy to rotary mechanical energy and electrical energy for a variety of uses. Wind energy has been utilised for centuries for water pumping as well as for the milling of grains. For meaningful exploitation of wind energy, a necessary prerequisite is the optimization of the components of wind water pumping and wind electricity generation.

In view of the energy available in the wind, there is a need to embark on a wind energy development programme.

#### 2.10.1 Policies

- i. The nation shall commercially develop its wind energy resources 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 reasonable cost in the rural areas.

#### 2.10.2 Objectives

- i. To develop wind energy technology in areas where it is technically



- feasible.
- ii. To use wind energy for provision of power to rural areas and remote communities far removed from the national grid.
- iii. To develop wind energy to supplement other energy resources.

### **2.10.3 Strategies**

- i. Encouraging research and development in wind energy utilization
- ii. Developing skilled manpower for provision of basic engineering infrastructure for the local production of components and spare parts of wind power systems.
- iii. Intensifying work in wind data acquisition and development of wind maps.
- iv. Training of skilled local craftsmen to ensure the operation and maintenance of wind energy systems.
- v. Providing appropriate incentives to producers and consumers of wind power systems.
- vi. Developing extension programmes to facilitate the general use of wind energy technology.

### **11.0 Other Renewables**

Other renewable energy resources, which are not in common usage worldwide, include ocean waves, tidal energy, ocean thermal gradients, geothermal and hydrogen energy. There is still much more work to be done on these energy resources in Nigeria. They may in future make contributions to the energy mix of the country.

## Chapter Three

# ENERGY UTILIZATION

### 3.1 Electricity

Electricity is a form of energy, which enjoys considerable and diverse applications because of its flexibility, and ease of transmission and distribution. Availability of electricity remains a major factor in the location of industries and a strong instrument of social development. Its supply is however still inadequate in the country.

Commercial electricity is generated mainly from hydropower, steam plants and gas turbines in Nigeria. The installed capacity for electricity generation has almost quadrupled in the last two decades and by 1992 it stood at about 6,000 MW while only about 3,680 MW was available to the national grid. Over the years the availability varied from about 30% to 60% of the installed capacity. Besides, transmission and distribution (T&D) losses account for about 28% of the electricity generated.

The annual consumption of electricity has been increasing very rapidly over the last two decades. It increased from 1,148 GWh in 1970 to 7,854 GWh in 1990. 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 comparable to the installed capacity of the national grid.

In recent times, the domestic sector has accounted for about 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, there is a need to increase substantially the available installed capacity, and also decrease transmission and distribution losses.

#### 3.1.1 Policies

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

- the country.
- ii. The nation shall continue to engage intensively in the development of electric power with a view to making reliable electricity available to 75% of the population by the year 2020.
- iii. The nation shall encourage private sector participation in the electricity subsector.

### **3.1.2 Objectives**

- i. To provide electricity to all state capitals, local government headquarters as well as other major towns by the year 2010.
- 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.
- v. To broaden the energy options for generating electricity.
- vi. To attract adequate investment capital for the development of the electricity industry.

### **3.1.3 Strategies**

- i. Rehabilitating existing power plants in order to derive optimum power plants in order to derive optimum power from the installed capacity.
- ii. Completing on-going projects designed to enable the National Electric Power Authority (NEPA) satisfy the national demand.
- iii. Reinforcing the transmission and distribution networks necessary to allow consumers to enjoy steady and reliable supply of electricity.
- iv. Establishing basic engineering infrastructure for the local manufacture of electrical equipment, devices and materials.
- v. Encouraging research and development in the generation, transmission and distribution of electricity.
- vi. Reducing high import duties paid on generation, transmission and distribution materials.
- vii. Setting up a National Electricity Supply Training Institute and zonal training centres where the core of the middle level manpower and

- artisans, various cadres of professional technical officers, operators, linesmen and cable joiners are to be trained and groomed in the art of operation and maintenance of equipment for the generation, transmission and distribution of electricity.
- viii. 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 capability in the long term.
  - ix. Developing and implementing a programme for the participation of the private sector in the various sectors of the electricity industry.
  - x. Developing other potential sites for hydropower, gas and coal-fired power plants for electricity generation.
  - xi. Intensifying the national effort in training, research and development with a view to generating electricity using nuclear, solar, wind and other renewable resources in order to conserve our fossil fuels.
  - xii. Taking effective measures to ensure the security of electrical installations.
  - xiii. Providing appropriate incentives to entrepreneurs to ensure adequate returns on investment.

### **3.2 Industry**

The industrial sector is one of the major energy consuming sectors and it accounts for over 15% of total commercial fuels currently consumed in the country.

To sustain the expected fast pace of industrialisation in the future, reliable and appreciable supply of energy will be needed by Nigerian industries. The considerable energy resource base of the country is enough to satisfy the industrial energy demand under any plausible scenarios in the foreseeable future. The varied nature of the energy resource base allows for considerable flexibility in energy mix options.

#### **3.2.1 Policies**

- i. The nation shall ensure that an adequate supply of energy is made available to meet the full requirements of industrial activities.
- ii. Emphasis shall be placed on local sourcing of all the energy types to the

used by industries.

- iii. Optima utilization of the nation's available energy types for the various industrial activities shall be pursued.

### **3.2.2 Objectives**

- i. To encourage maximum capacity utilization by industries.
- ii. To ensure national security and self reliance.
- iii. To ensure a balanced mix in the use of the nation's energy resources.
- iv. To ensure long term availability of the nation's energy resources through the encouragement of energy conservation practices.
- v. To ensure overall development of the nation's energy resources.
- vi. To promote 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.

### **3.2.3 Strategies**

- i. Establishing a data bank on energy supply, demand and consumption in the industrial sector.
- ii. Intensifying R & D efforts to determine the appropriate energy types for different industrial applications.
- iii. Establishing institutional arrangement to encourage energy conservation and efficient use of energy in industries.
- iv. Providing adequate incentives to encourage industries to switch over to more appropriate energy types.
- v. Restricting the establishment of industries based on imported energy sources.
- vi. Ensuring strict compliance with energy related environmental pollution standards.
- vii. Ensuring the development of appropriate energy inputs for small scale rural industries.

## **3.3 Agriculture**

Nigeria is an agrarian country and up until the 70s, the agricultural sector formed the backbone of the nation's economy. Most Nigeria farmers, who

produce over 80% of the food needs of the country, live in the rural areas with little access to electricity and petroleum fuels and therefore rely mainly on manual techniques and solar energy in executing most pre-and post-harvest agricultural operations.

In developing an energy policy framework for the agricultural sector, the socio-economic status of the key players in the sector (i.e rural farmers) as well as the energy conservation parameters have to be in proper focus. However, the growing energy needs of large-scale mechanised agriculture should also be considered.

Advances and current knowledge in key areas of nuclear, solar and other energy resources as applied to crop and animal production, forestry, fisheries, food science and technology are not well developed in this country. There is therefore the need for the formulation of a well articulated agricultural energy development strategy which will achieve food security, using techniques offered by nuclear science and other energy resources. It should also address capacity building in energy science with rational management of available Nigeria and material resources and the protection for the environment.

### **3.3.1 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 utilised judiciously for the overall agricultural activities with minimum harm to the environment.
- iii. The nation shall emphasis the use of affordable, adaptable, reliable and sustainable agricultural technologies possessing flexible energy utilisation capabilities.

### **3.3.2 Objectives**

- i. To increase agricultural productivity and efficiency through the use of appropriate energy sources.
- ii. To exploit alternative sources of energy thereby minimising 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

- iv. the cumbersome manual methods of farming.  
To develop and promote technologies that would be flexible in their energy requirement.

### **3.3.3 Strategies**

- i. Supporting research and development activities for the evolution of appropriate technologies that can use available/multiple energy sources, including renewable energy sources.
- ii. Developing improved crops, and selecting for breeding such animals as buffalo, donkeys, horses, camels and bullocks that are adapted to different agro-ecologies and that can be used in animal traction.
- iii. Ensuring wider adoption of animal traction and developing simple agricultural machines that can use multiple energy sources.
- iv. Disseminating the developed technologies through extension programmes in the farming communities.
- v. Training the existing extension personnel in effective dissemination of the newly developed technologies
- vi. Ensuring adequate supply of energy for agricultural activities through the application of cost-effective measures, including incentives where necessary
- vii. Promoting the use of renewable energy resources for agriculture.
- viii. Establishing a databank on energy demand, supply and consumption in the agricultural sector.

### **3.4 Transport**

The transport sector, especially the road transport mode, accounts for the bulk of the nation's petroleum products consumption. This pattern in the nation's energy consumption is expected to continue. Furthermore, increased needs for road transport services contribute significantly to the higher energy consumption in the transport sector. The consequence of the above is increased pressure on the nation's available petroleum products and the need to ensure adequate and sustainable availability of these products, as well as strategies to harness alternative energy sources.

Fortunately, the nation has identified other alternative energy options such as natural gas, coal and electricity, which can be introduced into the

transport sector. These measures should be augmented with other cost-effective strategies that will cut down on the demand for oil products.

### **3.4.1 Policies**

- i. The nation shall vigorously pursue the development of an optimal energy mix for the transport sector.
- ii. The nation shall ensure regular and adequate availability of all fuel types for the transport sector.

### **3.4.2 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.

### **3.4.3 Strategies**

- i. Establishing a data bank on the energy consumption pattern of the transport sector.
- ii. Encouraging the use of diesel for commercial and mass transit transportation while petrol shall be preferentially used for private transportation.
- iii. Pursuing vigorously the introduction of compressed natural gas to the rail and road transport systems.
- iv. Maintaining adequate stocks of various transport fuels at levels that will ensure internal fuel security.
- v. Encouraging a shift towards more energy efficient transportation systems.



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## Chapter Four

# ENERGY ISSUES

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### 4.1 Environment

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 wood and reserves could be depleted within the next fifty years. These would result in negative impacts on the environments, such as soil erosion, 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.

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. Another source of air pollution is the continued flaring of large volumes of natural gas in the oil fields in the Niger Delta.

In addition to air pollution, there is substantial water and soil pollution occurring due to oil spillage during oil production and transportation. Over the years, oil spillage has had significant adverse impact on fisheries and marine life in the oil producing areas.

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

#### 4.1.1 Policy

The nation's energy resources shall be exploited in an environmentally safe and sustainable manner.

#### 4.1.2 Objectives

- i. To ensure that in the course of producing, processing, transporting and utilising energy, the environment is adequately protected.

### **4.1.3 Strategies**

- i. Strengthening the relevant regulatory agencies in order to ensure the enforcement of appropriate set standards
- ii. Ensuring monitoring of vital environmental parameters in the production, processing and utilization of energy.
- iii. Carrying out environmental impact assessments of major energy projects.
- iv. Providing viable alternatives to fuelwood in order to minimize deforestation and decelerate the rate of desert encroachment, erosion and deforestation.
- v. Utilizing appropriate technology in the exploitation of the various energy resources to minimize the harmful effects on the environment.
- vi. Encouraging R & D in the optimal utilization of various energy sources to minimize the associated adverse environmental impacts.
- vii. Encouraging the utilisation of environmentally friendly energy sources.

### **4.2 Energy - Conservation**

Presently, energy utilization in our national economy is far from efficient. Apart from direct losses, using energy inefficiently has three major implications to the national economy, namely, investments in energy supply infrastructure in excess of what is required with more efficient equipment and practices; increased environmental problems, and increased cost of goods. The potential for energy savings in the Nigerian economy is huge, especially in the three main energy demand sectors, namely household, industry and transportation. In the household sector, there is considerable energy loss due to inefficient traditional three-stone stoves, used for cooking mainly in the rural areas.

Similarly, there is considerable scope for energy conservation in the Nigerian industries. Energy audit studies have shown that as much as twenty five percent of industrial energy can be saved through simple housekeeping measures. Also, our transport sector has substantial opportunities for savings, most especially the road transport sub-sector.

It is therefore imperative to promote energy conservation and efficient energy utilization in all sector of the economy.

#### **4.2.1 Policies**

- i. Energy conservation shall be promoted at all levels of exploitation of the nation's energy resources.
- ii. Energy utilization shall emphasize the development and adoption of energy efficient methods.

#### **4.2.2 Objectives**

- i. To ensure the prudent exploitation of the nation's non-renewable energy resources.
- ii. To enhance energy security and self-reliance
- iii. To reduce the cost of production of energy-dependent goods and services.
- iv. To reduce adverse impacts of energy utilization on the environment.
- v. To increase the proportion of hydrocarbon resources available for special applications such as industrial feedstock and for export.

#### **4.2.3 Strategies**

- i. Ensuring strict adherence to the regulations of the petroleum industry, and relevant agencies on energy resource exploitation and environment.
- ii. Providing institutional arrangements for the promotion of energy conservation and the use of energy efficient methods.
- iii. Developing building codes so that buildings are designed to take advantage of climatic conditions in order to reduce energy consumption.
- iv. Encouraging the development and manufacture of the more energy efficient equipment and machinery.
- v. Reducing energy consumption by improving and expanding mass transportation and communication systems all over the country.
- vi. Promoting R & D activities in energy conservation and fuel efficiency including the development and importation of energy efficient equipment and machinery.
- vii. Encouraging the production and use of improved and more-efficient cooking stoves.
- viii. Taking appropriate measures to reduce energy storage, transmission and distribution losses.
- ix. Promoting public awareness about the benefits of improved energy efficiency.

### 4.3 Research, Development and Training

The crucial dependence of the sustainable socio-economic advancement of any nation on research, development and training 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, development and training are given adequate attention with regards to key issues such as energy resources development and utilisation.

#### 4.3.1 Policies

The nation's energy resources shall be developed and utilised on a self-sustainable basis through research, development and training.

#### 4.3.2 Objectives

- i. To initiate and promote energy related research and development programmes; and ensure that such programme 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.

#### 4.3.3 Strategies

- i. Developing and promoting local capability in the nation's Energy Centres and Research Institutes for the design and fabrication of efficient energy devices and technologies for the utilisation of renewable energy resources.
- ii. Promoting the demonstration and dissemination of renewable energy devices and technologies for their adoption and market penetration.
- iii. Monitoring and assessing international technological developments in all energy areas; and initiating and sustaining local capability for their applications in all sectors of the economy.
- iv. Initiating and promoting energy educational programmes and research activities in tertiary institutions and research institutes.
- v. Encouraging result oriented research and development in the energy sector by making expenditure on such efforts tax deductible, as may be determined by the Federal Ministry of Science and Technology.

#### **4.4 Bilateral, Regional and International Cooperation**

Nigeria is involved in bilateral, regional and international arrangements in the areas 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, joint management and equity participation in the development of energy sources are important aspects of our bilateral cooperation arrangements with other African Countries.

The nation's membership of sub-regional, regional and international organisations such as ECOWAS, APPA, OAU, UN, IAEA and OPEC provides opportunity for it to play a 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.

##### **4.4.1 Policies**

- i. Nigeria'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. Nigeria shall lay emphasis on fostering and strengthening energy cooperation and integration within the ECOWAS sub-region.

##### **4.4.2 Objectives**

- i. To enhance Nigeria's effective participation in international energy related organisations.
- ii. To facilitate the acquisition 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 utilisation of the region's energy resources.

### **4.4.3 Strategies**

- i. Working out a co-ordinate approach to regional and sub-regional energy planning based on co-operation and consultation among member countries of ECOWAS and other member of the Organisation of African Unity.
- ii. Facilitating the establishment of mechanisms within the ECOWAS sub region and other African countries to enhance energy trade and interchange of relevant technology and information.
- iii. Promoting favourable trading relationships with member countries of ECOWAS and the OAU, which will ease the financing of energy supply and other energy-related projects.
- iv. Working out viable cooperative arrangements to allow for the easy distribution of petroleum and gas within the region.
- v. Mobilising domestic capital within the community and creating a favourable investment climate to attract international financing for energy development projects.
- vi. Ensuring Nigeria's active membership in energy related regional and international organisations.
- vii. Pooling available human resources through networking of national energy training and research centres.
- viii. Encouraging the standardization of energy related plants, machineries and spares and the establishment of infrastructural facilities within the community for their production.

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## Chapter Five

### ENERGY FINANCING

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#### 5.1 Financing

Funding requirements for the entire energy sector is substantial. New investments are needed for exploration and exploitation activities. The required type of financing is long-term and involves both foreign and domestic financing resources. However, foreign earnings provide the greater proportion of needed of needed funds.

Considering the risk element involved in energy project, investments in the sub-sector should be capable of yielding high rates of return and fast pay back periods in order to attract investors. Owing to other competing needs, government alone cannot continue to provide the major finance for the energy sector activities. Hence private sector participation is necessary and imperative. To attract foreign investments in the energy sector, certain necessary conditions would have to be met. These include:

- (1) Improvement in the financial performance of the energy supply companies in the country.
- (2) A conducive environment for investment that also protects our national interests.

#### 5.1.1 Policies

- i. The nation shall explore and adopt all viable financing options from local and international sources for cost effective exploitation of its energy resources.
- ii. Investments in the energy sector shall be accorded high priority within the economic sector.
- iii. Government shall encourage private investment, both domestic and foreign in the energy sector.

#### 5.1.2 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 ensure that the energy supply options adopted are the most cost effective for the country.
- iv. To increase foreign exchange earnings through export of energy products.
- v. To encourage the local development of energy technology with a view to minimising the cost input of energy projects.

### **5.1.3 Strategies**

- i. Establishing an energy development fund for training, research, development and demonstration, and technology acquisition.
- ii. Providing fiscal incentives for prospective investors in the energy sector.
- iii. Increasing private sector participation in the energy industry.
- iv. Ensuring a reasonable return on investments through cost-effective energy pricing.
- v. Establishing guaranteed and dependable repayment schemes for loans invested in energy projects.
- vi. Establishing a favourable investment climate to attract investments in the energy sector.
- vii. Providing adequate infrastructural facilities to enterprises involved in the development of the energy sector.
- viii. Encouraging the establishment of offshore banking units to attract inflow of offshore investment funds, as well as activities of international investment banking and brokerage firms.
- ix. Furthering the internationalization of Nigeria's Capital Market by encouraging the stock of Nigeria's corporate units to be quoted in the international Stock Exchanges to attract inflow of foreign portfolio investment capital.
- x. Expanding the scope of venture capital financing to embrace investments in the energy sector.



# PLANNING AND IMPLEMENTATION

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### 6.1 Energy Planning

Energy issues are multidimensional in nature and there are strong interactions between factors that affect energy demand, supply and consumption which must be recognised in order to have an effective energy plan.

To ensure full consideration of all the factors, and avoid inconsistencies in energy plans, it is imperative that a comprehensive and integrated approach to energy planning be evolved. The planning must consider the interactions between the sub-sectors of the energy sector itself, and the plans within each sub-sector.

#### 6.1.1 Policies

- i. An integrated energy planning system shall be developed involving the energy related programmes and activities of the various sectors of the economy.
- ii. The energy planning system shall be comprehensive, covering the resources exploitation, Processing, and consumption activities
- iii. The energy plans and programmes shall be consistent with the overall national development goals.

#### 6.1.2 Objectives

- i. To ensure coherence in the energy plans and activities of the various sectors of the economy due to their inter-relatedness
- ii. To provide a framework for national decision making in energy related matters.
- iii. To ensure adequate supply of energy to different sectors of the economy.
- iv. To optimize the supply and utilization of the various energy resource types.
- v. To provide a system for the development of indigenous capabilities in energy conversion technologies.

- vi. To provide vital input into national development of the energy sector.

### **6.1.3 Strategies**

- i. Strengthening co-operation between the Energy Commission of Nigeria and the other bodies active in the energy sector.
- ii. Encouraging formal discussion and collaboration between institutions in the energy sector whose activities are inter-related.
- iii. Establishing energy planning and implementation units at state government levels and assigning responsibilities for energy related matters at local government levels.
- iv. Establishing a national energy information system which will involve consistent data gathering and processing of energy resource inventory, consumption pattern, energy technologies, and other relevant socio economic parameters.
- v. 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.
- vi. Instituting an accelerated and effective manpower development programme.

## **6.2 Policy Implementation**

No policy can succeed without proper implementation. To achieve the stated policy objectives and successfully implement the strategies, various instruments including economic measures, information and education, legislative measures and institutional arrangements need to be used.

Policy programme realisation is often hampered by bureaucratic bottle-necks and delays. These problems shall be effectively addressed for the successful implementation of this Energy Policy.

### **6.2.1 Policy**

The Energy Commission shall be the focal point for the coordination of the implementation of the nation's energy policy.

### **6.2.2 Objectives**

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

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

### **6.2.3. Strategies**

- 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.
- 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.
- iii. Instituting a system of carrying out regular checks and receiving reports on the implementation of the approved policy by all sections of the energy sector.
- iv. Ensuring that approved fiscal measures which are necessary for the achievement of set objectives of the policy are promptly carried out.
- v. Dedicating a certain percentage of the nation's income from conventional energy sub-sector to support research and development, and training activities in the energy sector.
- vi. Creating regular fora for public awareness, education and participation in the realization of the goals and objectives of the energy policy.
- vii. Enacting a set of necessary legislations to enforce targets about energy efficiency, energy information gathering, and fuel mix of the national energy consumption, amongst others.
- viii. Integrating energy studies into the curricula of secondary and tertiary institutions, while emphasizing their multi-disciplinary nature.

### **6.3 Implementation Strategy**

The implementation process of the Energy Policy, as presented, requires strategies that allow for a number of factors including priority setting, policy continuity and a clear focus on key issues.

Accordingly, such strategies should be based on realistic targets, a defined time frame as well as effective target evaluation.

The advantages of this approach are two-fold.

- (i) It will enable planners and implementing organs to include the cost of each strategy in their respective budgets, as they fall due; and

(ii) It will aid monitoring organs to assess the progress of implementation of the various strategies. In this regard and, in line with usual planning horizon, it is expected that short term measures are those that could be evaluated within 1 to 2 years. A 5-year period is advocated for medium-term activities. With this perspective, the recommended activities are as indicated below.

### 6.3.1 Short Term Measures

#### General

- (1) Establishment of necessary guidelines and regulations on energy efficiency,
- (2) Development and implementation of the necessary machinery for constant monitoring of the implementation of the approved energy policy and compliance with the guidelines and regulation on various energy matters by all sectors of the economy.
- (3) Ensuring the implementation of fiscal measures necessary for the achievement of the set objectives of the energy policy.
- (4) Rehabilitation of refineries, petroleum products distribution infrastructure, power plants, transmission and distribution network.
- (5) Continuation of the promotion of the establishment of local services companies for the oil, gas, electricity, etc sub- sectors and encouraging their patronage by the energy companies.
- (6) Increased patronage of indigenous engineering and applied research groups in the execution of projects right from feasibility studies.
- (7) Development and implementation of appropriate packages to enhance the utilization of renewable energy to solve rural energy problems and to make possible the extension of commercial energy and the associated technology to the rural sector.
- (8) Energy audit in the agricultural and industrial sectors 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 the industrial enterprises.
- (9) Strengthening of all relevant regulatory agencies in order to ensure the enforcement of appropriate set of standards and procedures, including in particular standards and procedures on exploration, production and utilization of energy.

- (10) Establishment of a programme for the liberalization and privatization of the energy sector.
- (11) Development and implementation of appropriate and dynamic pricing and tariff structures for petroleum products, gas, electricity and other energy types, which will encourage private sector participation, by ensuring a reasonable return on investments while giving due attention to the needs of the target markets.
- (12) Improvement of the effectiveness of energy planning and implementation by establishing energy planning and implementation units at state government levels and assigning responsibilities for energy related matters at local government levels.
- (13) Establishment of a national energy information system which will involve consistent data gathering and processing of energy resources inventory, consumption pattern, energy technologies, and other relevant socio-economic parameters.
- (14) Intensification of action on the development of an energy master plan.
- (15) Encouragement of interaction within existing for a for formal discussions and collaboration between institutions in the energy sector.
- (16) Encouragement of private sector participation in the energy sector through liberalisation and privatization of the sector, as well as fiscal and other appropriate measures.
- (17) Establishment of a strategy for the public awareness, education and participation in the realization of the goals and objectives of the energy policy.
- (18) Monitoring and assessment of technological developments in all energy areas and development of capabilities to apply them, as appropriate in the various sectors of the economy.
- (19) Establishment of a plan which will encourage increased placement of Nigerians in all positions in the energy producing, service and processing companies, including especially in key decision - making and technical positions in oil, gas, nuclear and other relevant energy industries.
- (20) Strong encouragement of the energy producing and processing companies to set up R & D outfits in the country and to make use of R & D institutions in Nigeria.

- (21) Increased furnishing to appropriate agencies for the provision of energy related manufacturing infrastructure.

### **Oil**

- (22) Easing of the constraints on the importation of essential but scarce materials for the manufacture of engineering equipment's and spaces on
- (23) Updating of the memorandum of understanding to ensure that it contains appropriate incentives that will attract investment in intensified crude oil exploration and development.
- (24) Maximisation of petroleum production and processing efficiencies.
- (25) Improvement and promotion of the provisions put in place for the establishment of export refineries.

### **Natural Gas**

- (26) Review of and improvement of existing incentives to producing companies to encourage them to gather and utilize associated gas.
- (27) Review of existing penalties for gas flaring and ensuring that they achieve the desired effect.
- (28) Establishment of appropriate arrangements to ensure the implementation of the incentives and penalties to discourage gas flaring.
- (29) Setting of a target date for the termination of gas flaring.
- (30) Establishment of appropriate guidelines, regulations and incentives for the participation of indigenous and foreign entrepreneurs in the establishment of the infrastructure for, and business in gas gathering, transmission and distribution.
- (31) Provision of funding for the establishment of an infrastructure for gas gathering, transmission and distribution.
- (32) Review and sustenance of the implementation of incentives to industrial and domestic consumers to use gas or change over to gas.
- (33) Sustenance and expansion of the measures presently in place for the establishment of infrastructure and markets for the export of natural gas.
- (34) Formulation of suitable urban and regional planning regulations needed for the effective distribution of natural gas to domestic and industrial consumers.

### **Tar Sands**

- (35) Undertaking of more detailed geological studies for the tar sands deposits of the country.

## **Coal**

- (36) Development and implementation of appropriate measures for large scale production of coal stoves at affordable prices and for the establishment of coal-based industries, by local entrepreneurs.
- (37) Provision of adequate funding to enable intensified coal exploration activities.

## **Nuclear**

- (38) Intensification of Research, Development and Training in Nuclear Science and Technology for peaceful applications.
- (39) Evolution of a rational nuclear development programme and institutional arrangements.
- (40) Implementation of the institutional arrangement and regulation for Nuclear Radiation Protection.
- (41) Acquisition and operation of pilot-scale gamma irradiation facilities for food industrial applications.
- (42) Regular public enlightenment campaigns on peaceful applications of nuclear technology.
- (43) Intensification of exploration activities for materials for nuclear fuels.
- (44) Fostering of co-operation with the IAEA through encouragement of the national counterpart agency to actively participate in all IAEA programme.

## **Hydropower**

- (45) Constant review and improvement of multilateral agreements for monitoring and regulating the use of water in international rivers flowing through the country.
- (46) Increased patronage of indigenous entrepreneurs involved in the planning, design and construction of hydropower plants.
- (47) Establishment of appropriate fiscal measures as incentives to indigenous and foreign entrepreneurs for the local production of hydropower plants and accessories.
- (48) Establishment of appropriate institutional arrangements, regulations, and guidelines for the development of small scale hydropower plants.

## **Fuelwood**

- (49) Cultivation of fast growing tree species needed to accelerate the regeneration of forests.

- (50) Development of smokeless coal, sawdust, biogas and other energy technologies as alternatives to fuelwood.
- (51) Improvement of the efficiencies and performances of existing improved woodstoves and ovens.
- (52) Encouragement of the establishment of private and community woodlots for the supply of fuelwood.
- (53) Ensuring the availability and effective distribution of kerosene as an alternative to fuelwood in the interim.
- (54) Promotional activities, such as extension and pilot projects, to disseminate solar, biogas and other alternative technologies to fuelwood.

### **Environment**

- (55) Organisation of systematic public enlightenment campaigns on the problems of desertification and soil erosion arising from deforestation.
- (56) Review and enforcement of forestry laws to effectively stop the willful felling of trees in prohibited zones.
- (57) Dissemination of information on existing energy efficient and environmentally friendly technologies in the exploitation of various energy resources.
- (58) Development and implementation of guidelines and regulations on appropriate technologies for the exploitation of energy resources to minimize harmful environmental effects.
- (59) Intensification of research development in more efficient and environmentally friendly utilisation of various energy sources.
- (60) Encouragement of the utilisation of environmentally friendly energy resources and technologies.

### **Solar, Biomass and Wind**

- (61) Demonstration and pilot projects as well as workshops and public education campaigns on solar energy, biomass, biogas, wind and other renewable energy resources to ensure their adoption and market penetration.
- (62) Establishment of appropriate fiscal measures as incentives for the utilisation of solar, wind and other renewable energy systems.
- (63) Establishment of a set of regulations and guidelines to promote and sustain the local solar, biomass and other renewable energy industry.
- (64) Development and implementation of training packages for skilled



craftsmen and technicians on the production, operation and maintenance of solar, wind, biomass and other renewable energy systems.

### **Other Renewable Energy Resources**

- (65) Gathering information on the advances in less developed renewable energy resources. Extension of the energy information acquisition, storage and dissemination activities to them.

### **Electricity**

- (66) Completion of on-going short term projects designed to satisfy national demand for electricity.
- (67) Expansion of the existing electricity transmission and distribution networks.
- (68) Intensification of research, development and training in alternative sources of energy for the generation of electricity.
- (69) Establishment of a programme for the liberalisation and privatisation of the electricity subsector.
- (70) Development of appropriate infrastructure, guidelines and regulations for the management of a liberalised and privatised electricity subsector.
- (71) Commercialization of electric utility agencies and granting them managerial and financial autonomy to enable them operate efficiently.
- (72) Review and strengthening of existing incentives for them encouragement of local manufacture of electrical equipment and devices.
- (73) Establishment of effective measures to ensure the security of electrical installations and improving the operational efficiency of the electricity sub-sector, particularly the distribution activities.

### **Industry**

- (74) Development and implementation of appropriate measures to encourage fuel substitution in industries.

### **Agriculture**

- (75) Intensive promotion of the utilization of renewable energy in agriculture through demonstration, pilot projects, workshops, etc.
- (76) Intensification of research and development activities for appropriate agricultural technologies that can use available and multiple energy resources, including animal traction.

## **Transport**

- (77) Periodic review of transport fuels storage capacity, in accordance with developments in the transport sector, with a view to updating the storage capacity guidelines and storage infrastructure.
- (78) Comprehensive study of the transport fuel distribution systems and development of recommendations for their improvement.
- (79) Initiation of discussions with relevant institutions in the transport sector to identify appropriate energy efficient transport systems, strategies and equipment that should be introduced.
- (80) Encouragement of the relevant agencies to introduce fuel efficient transport management systems
- (81) Encouragement of the relevant agencies to improve and expand mass transportation and communication systems country-wide.

## **Energy Conservation**

- (82) Development of codes, standards, regulations and guidelines on energy conservation and use of energy efficient methods, equipment, machineries and technologies in agriculture, industry, building design and construction, etc.
- (83) Establishment of appropriate institutional arrangements for the promotion and monitoring of energy conservation and use of energy efficient methods

## **Research, Development and Training**

- (84) Provision of increased funding to research institutes, centres and tertiary institutions who are undertaking R & D work on renewable, nuclear, coal and other energy resources to ensure productive R & D and the establishment of appropriate infrastructure.
- (85) Development and implementation of a programme of R & D in energy conservation and efficiency.
- (86) Promotion of the development and introduction of integrated energy and environment curricula and disciplines into the programmes of tertiary institutions.
- (87) Taking measures to ensure adequate institutional capacity for the production of adequate numbers and quality of high level and skilled technical and managerial manpower for the energy sector.
- (88) Establishment of the necessary machinery to provide adequate funding

from conventional energy sub-sectors to support research, development, demonstration and training in energy.

- (89) Development and initiation of the implementation of an accelerated and effective manpower development programme for the energy sector.

### **Finance**

- (90) Provision of appropriate measures to encourage prospective investors in the energy sector.
- (91) Expansion of the scope of Venture Capital Financing (National Risk Fund Plc) to embrace investments in the energy sector.
- (92) Establishment of quaranted and dependable repayment scheme for loans invested in energy projects.

### **6.3.2 Medium Term Measures**

#### **General**

- (1) Continuation of short-term activities
- (2) Development of other potential sites for hydropower, gas and coal plants for electricity generation.
- (3) Monitoring and ensuring the progress of the plan for achieving the placement of Nigerians in key decision making positions and other responsibilities in the energy industries.
- (4) Establishment and sustenance of the implementation of a national energy master plan.
- (5) Increasing the priority given to the provision of facilities for the production of ferro-alloys and flats for the manufacturing industries.

#### **Oil**

- (6) Ensuring the attainment of a reserve target of 25 billion barrels and a production capacity of 2.5 mbpd.
- (7) Commercialisation of the operations of existing refineries while taking steps to promote private sector participation in the refining business.
- (8) Expansion of transmission and storage facilities for petroleum products to achieve the 45-day strategic reserves.

#### **Natural Gas**

- (9) Review of progress as well as incentives and penalties established towards the termination of gas flaring and revision of the target date if necessary.

- (10) Sustaining funding for the expansion of the infrastructure for gas gathering, transmission and distribution.
- (11) Intensification of promotional activities for the use of gas and change over to gas by industrial and domestic consumers.
- (12) Implementation of urban and regional planning regulations for effective distribution of natural gas.

#### **Tar Sands**

- (13) Continuation of detailed exploration activities and mapping of the Tar Sands deposits in the country.
- (14) Establishment of appropriate institutions, guidelines, facilities and regulation for the development and harnessing of Tar Sand.

#### **Coal**

- (15) Review, improvement and effective implementation of measures for the production of coal stoves and the establishment of coal-based industries.
- (16) Establishment of smokeless coal pilot projects for the promotion of the use of smokeless coal as an alternative to fuelwood.

#### **Nuclear**

- (17) Acquisition of nuclear research facilities and expansion of their applications in manpower training, agriculture, medicine and industry.
- (18) Commencement of the exploitation of the nuclear mineral resource deposits in Nigeria.

#### **Hydropower**

- (19) Introduction of alternative technological options to reduce the impact of water shortage on hydropower plants.
- (20) Establishment of basic engineering infrastructure for the production of hydropower plants equipment and accessories.

#### **Fuelwood**

- (21) Ensuring the availability and effective distribution of kerosene and other viable alternatives to fuelwood.
- (22) Conferment of reserve status on greater acreage of forest and establishment of an effective system of forest regeneration.
- (23) Development of appropriate pricing structure to encourage substitution from fuelwood to alternative fuel types.

#### **Solar, Biomass and Wind**

- (24) Continuation of the establishment and monitoring of renewable energy pilot projects and other overflow short term activities.

- (25) Establishment of pilot projects to assist local entrepreneurs in the manufacture of biomass energy conversion devices.
- (26) Setting up pilot workshops for the manufacture of renewable energy equipment and devices such as solar cells, PV panels and systems, wind energy equipment and biogas generators, etc.

### **Other Renewables**

- (27) Continuation of data gathering, Storage and dissemination activities while encouraging R & D activities in the less developed renewable with a view to possible exploitation.

### **Electricity**

- (28) Implementation of the programme for the liberalisation and privatisation of the electricity sub-sector.

### **Agriculture**

- (29) Ensuring wider adoption of animal traction and simple agricultural technologies that can use multiple energy resources.
- (30) Training of existing extension personnel in the effective dissemination of the newly developed energy technologies for agriculture.

### **Transport**

- (31) Rehabilitation and expansion of the road rail and river transport network as well as port facilities for the handling of coal.
- (32) Development and implementation of appropriate strategies to attract investments in natural gas pipeline networks and to promote conversion to natural gas for road, river and rail transportation.
- (33) Encouragement of the building of natural gas filling stations as part of road, river and rail networks.
- (34) Implementation of the approved recommendations of the study of the transport fuel distribution system.
- (35) Implementation of the approved recommendations from the investigations on the appropriate energy efficient transport systems, strategies and equipment.

### **Energy Conservation**

- (36) Implementation of the codes, standards, regulations and guidelines on energy conservation and use of energy efficient methods, equipment, machineries and technologies in agriculture, industry, building design and construction, etc.

- (37) Establishment of expand use of energy efficient mass transportation and communication system.

### **Research, Development and Training**

- (38) Establishment of a National Electricity Research, Development and Training Institute to undertake R, D & T activities in generation, transmission and distribution of electricity, and Zonal Training Centres for the training of various cadres of professional and skilled manpower for the electricity sub-sector.
- (39) Development, through adequate funding, or the capabilities of the petroleum training institutions to include R & D activities on oil and gas related issues and on tar sands for the production of lubricants and other heavy oil products.
- (40) Adequate provision of equipment for the energy related research, development and training institutes, and centres to enable them provide the necessary facilities and services needed by enterprises involved in the development of the energy sector.

### **Finance**

- (41) Establishment of a special risk fund scheme for the commercialisation of new and emerging energy technologies, such as renewable energy technologies.
- (42) Encouraging the attraction of long-term financing from international finance institutions comprising international capital markets and brokerage firms and allowing international brokerages firms to establish and operate in Nigeria.
- (43) Encouraging the establishment of off-shore banking units to attract regular inflow of off-shore funds.

### **6.3.3 Long Term Measures**

#### **General**

- i. Review, improvement and sustenance of medium-term measures
- ii. Effective Nigerianization of the personnel in the energy industries.
- iii. Review, strengthening and sustaining of the implementation of the national energy master plan.
- iv. Full integration of renewable, nuclear and conventional energy resources into an optimal energy mix.

## **Oil**

- v. Maintenance of a minimum crude oil and condensate reserve of 25 billion barrels,
- vi. Complete privatization of the petroleum processing industries.
- vii. Further expansion of the transmission and storage facilities for petroleum products to achieve at least a 90-day strategic reserves.

## **Natural Gas**

- (viii) Termination of gas flaring
- (ix) Putting in place an effective infrastructure for gas gathering transmission and distribution, and for the export of natural gas.
- (x) Exploration for natural gas.

## **Tar Sands**

- (xi) Continuation of exploration activities to identify and quantify areas with tar sand deposits in Nigeria.
- (xii) Establishment of a tar sands production and processing industry in the country.
- (xiii) Development and implementation of strategy for discouraging the importation of heavy crude oil.

## **Nuclear**

- (xiv) Encouragement of the wide-spread construction of mini-and micro - hydropower plants.

## **Hydropower**

- (xv) Encouragement of the wide-spread construction of mini- and - micro hydropower plants.

## **Solar, Biomass and Wind**

- (xvi) Encouragement of the wide spread production and installation of renewable energy system.

## **Electricity**

- (xvii) Establishment of the infrastructure for the local manufacture of electrical equipment, devices and materials.

## **Finance**

- (xviii) Internationalization of Nigeria's capital market to enable Nigerian cooperate units' stocks listed in the international stock exchanges to attract inflow of foreign investment capital.

## APPENDIX

APPA	-	African Petroleum Producers Association
ECOWAS	-	Economic Community of West African States
GDP	-	Gross Domestic Product
Gwh	-	Gigawatt-hours
IAEA	-	International Atomic Energy Agency
Kw	-	Kilowatts
Kg	-	Kilograms
Km <sup>2</sup>	-	Square Kilometers
MW	-	Megawatts
Mbpd	-	Million barrels per day
NEPA	-	National Electric Power Authority
NNPC	-	Nigerian National Petroleum Corporation
OPEC	-	Organization of Petroleum Exporting Countries
PV	-	Photovoltaic
R&D	-	Research and Development
R,D&D	-	Research, Development and Demonstration
R,D&T	-	Research, Development and Training
UN	-	United Nations