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## ABBREVIATIONS AND ACRONYMNS

ADB	African Development Bank
AFD	Agence Francaise de Development
ASP	Agricultural Services Project
BADEA	Arab Bank for Economic Development
CAS	Country Assistance Strategy
CILSS	Organisation for the Control of Drought in the Sahel
CRD	Central River Division
DANIDA	Danish International Development Agency
DCD	Department of Community Development
DGIS	Director General for International Cooperation of the Netherlands
DOSTIE	Department of State for Trade, Industry and Employment
EDF	European Development Fund Electricite de France
ERP	Economic Recovery Programme
EU	European Union
FVA	Fuelwood Vendors Association
GAMTEL	Gambia Telecommunications Company
GBA	Greater Banjul Area
GDP	Gross Domestic Product
GEAP	Gambia Environmental Action Plan
GGFP	Gambia-German Forestry Programme
GMD	Gambian Dalasi
GOTG	Government of The Gambia
GREC	Gambia Renewable Energy Centre
GTZ	German Technical Assistance Agency
GWh	Gigawatt-hr
HFO	Heavy Fuel Oil
IDB	Islamic Development Bank
IFAD	International Fund for Agricultural Development
IPP	Independent Power Producer
KPS	Kotu Power Station
KV	Kilo Volt
KW	Kilowatt
KWh	Kilowatt-hr
LI	Lehmeyer International
LPG	Liquefied Petroleum Gas
LRD	Lower River Division
MHC	Moukhtara Holding Company
MT	Metric Tonne
MWh	Megawatt- hour
NAWEC	National Water and Electricity Company
NBD	North Bank Division
NGO	Non-governmental Organisation
OECD	Organisation for Economic Cooperation and Development
OMVG	Organisation for the Development of the Gambia River Basin
OP	Office of The President
PRSP	Poverty Reduction Strategy Paper
PSD	Programme for Sustainable Development
PV	Photovoltaic

RE	Renewable Energy
RPTES	Review of Policies in the Traditional Energy Sector
TCP	Technical Cooperation Package
TOE	Tonnes of Oil Equivalent
UNCCD	United Nations Convention to Combat Desertification
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
URD	Upper River Division
VHF	Very High Frequency
WARP	West African Replenishment Programme
WB	World Bank
WD	Western Division
WGP	West African Gas Pipeline
WPP	West African Power Pool

# **1. INTRODUCTION**

## **1.1 Energy Crisis and Major Challenges Facing the Energy Sector**

The availability of a reliable system of energy supply that is efficient, affordable, and environmentally sound is one of the vital components and prerequisites for any meaningful socio-economic development. Energy resources play an important role in stimulating and facilitating development in all sectors of the economy. Primary energy resources apart from serving the day-to-day needs of the household sector, drive the productive sectors, value-added industries, and services that contribute to economic growth.

No country in the world has succeeded in shaking loose from a subsistence economy without the widespread access to electrical services which modern energy provides. Electricity has been identified as one of the prerequisites to facilitate social development and fuel growth. Energy development must precede economic development. People in developing countries spend 12% of their income on energy, compared with an average of just 2% in OECD countries (WB: Energy Data: 1999).

An assessment of the Gambian energy sector shows that the energy resource base is limited and the supply unreliable. Electricity power supply has over the past fifteen years been grossly inadequate, expensive, erratic and extremely unreliable, negatively impacting on investment and production; the over-reliance of the city and the major urban centres on fuel wood and charcoal is destroying the country's forest resources and natural vegetation cover, causing general environmental degradation.

The main pre-occupation of the Gambian government over the past two decades has been to find ways and means of tackling the energy crisis. One of government's primary objectives as enshrined in Vision 2020 is to overcome the existing bottlenecks and to ensure a reliable and adequate supply of energy both conventional transitional and renewable energy at affordable prices.

To achieve these objectives government has taken cognisance of the enormous task and challenges that it currently faces in attempting to address the energy "crisis." The major challenges include:

- 1.1.1. Lack of investment in new assets and inadequate maintenance of old and ageing electricity power facilities which have led to a progressive decline in the reliability, cost effectiveness and efficiency of service to the general populace;
- 1.1.2. Rapidly growing demand for all forms of energy;
- 1.1.3. Heavy reliance on imported petroleum products to meet the country's energy requirements, placing a heavy burden on the foreign exchange reserves;
- 1.1.4. An institutional framework for the energy services characterised by fundamental weaknesses including a fragmented policy-making process;
- 1.1.5. The over-exploitation of the forest for domestic fuel with negative consequences on the environment.

The above challenges coupled with the current weak macro-economic environment make the task formidable, but not insurmountable. It is in this context that government has decided to formulate and design a comprehensive national energy policy and strategies that will ensure

in the long-term an efficient and reliable supply of energy to support economic development in an environmentally sustainable way.

This document presents a comprehensive framework for the National Energy Policy objectives and action plan of the next five years and beyond. Part I provides a comprehensive review of the energy sector, while Part II of the Policy document deals with the policies and strategies of the government in the sector, the institutional and legal framework and the Action Plan.

## **2. MACRO-ECONOMIC ENVIRONMENT**

### **2.1. General Economic Situation**

The Gambia is small but a densely populated country with 1.02 million inhabitants (1993 census). National growth rate is estimated at 4.1 percent per annum, and the population is projected to surpass the 2 million mark by year 2020. Per capita income is estimated at US\$ 302 which makes it one of the poorest countries in the World.

The country is not well endowed with important natural resources and the economy depends largely on agricultural production and a fast growing services sector. Agriculture plays an important role in the economy contributing about 20% of GDP and provides the main source of income, employment and food supply to over 80% of the population. Groundnuts and its by-products contribute over 90% of export earnings; fishing resources exists, however, on-shore processing is limited.

Outside agriculture, the Gambia has a rapidly growing tourism industry and a well-developed commercial sector; the latter is engaged primarily in the re-export of consumer goods to the neighbouring counties.

The principal manufacturing activities is processing of groundnuts and few other modest resource based processing enterprises, mostly located in Greater Banjul Area.

The country depends heavily on imports for about a third of its food and for all of its modern fuels; capital goods and other manufactured products account for 85%-90% of total export earnings.

The Gambia's small size, undiversified production base and open trade practices makes the economy highly vulnerable and susceptible to shortfall in agricultural production, shifts in the terms of trade and external shocks.

### **2.2. Recent Trends in the Gambia's Economy**

In recent years the Gambian economy has experienced serious economic downturns due to combination of several adverse factors; these include:

2.2.1. Rapidly growing government fiscal deficits due to heavy domestic and external borrowings at a time when traditional donor-aid was declining;

2.2.2. Increased public debt;



- 2.2.3. Significant decline in agricultural production;
- 2.2.4. Marked decline in tourism arrivals;
- 2.2.5. Reduction in the re-export trade.

In 1998, GDP growth rate was 4.7%. It decreased to 4.2% in 1999 and increased to 5% in 2000. In 1998 agriculture contributed 20.4% of GDP as opposed to 33.9% for services, 6.7% for tourism and 3% for manufacturing and industry.

### **2.3. Macro-economic Policy Objectives**

The macro-economic policy objectives over the medium-term, as contained in the Poverty Reduction Strategy Paper (PRSP), have been defined as follows:

- 2.3.1. Continuing to pursue prudent fiscal and financial policies;
- 2.3.2. Strengthening, monitoring and control of public expenditure;
- 2.3.3. Strengthening the policy capacity of economic management;
- 2.3.4. Designing and implementing efficiency based divestiture programme;
- 2.3.5. Keeping low inflation and a stable nominal and real effective exchange rates, thereby protecting the purchasing power of the population;
- 2.3.6. Promoting foreign investment policies;
- 2.3.7. Ensure the availability of reliable, efficient affordable and environmentally sound energy for the country;
- 2.3.8. Pursuing private sector development;
- 2.3.9. Promoting pro-poor and equitable sustainable growth.

### **2.4. Targets Set for Improvements in the Socio-economic Indicators**

The overall macro-economic and social targets for the medium-term are set as follows:

- 2.4.1. Increase the real GDP to 6% per annum;
- 2.4.2. Contain inflation to about 2.2% per annum;
- 2.4.3. Keep the external current account (excluding official transfers) to below 10% of GDP by year 2003;
- 2.4.4. Maintaining gross external reserves to about 5.3 months of import cover;
- 2.4.5. Reduction of population growth rate to 3% per annum;

- 2.4.6. Increase electricity generating capacity to 70 megawatts by the year 2003 in the GBA;
- 2.4.7. Reduction of extreme poverty by 25% within the next five years.
- 2.4.8. Implementation of the rural electrification programme

In addition to the monetary and other targets, budget deficits must be maintained at sustainable levels, keeping in mind the sizeable level of the domestic debt of about 26% GDP at the end of 1999.

Promotion of foreign investment will also be coordinated with the creation of a framework for private sector led growth.

### **3. ROLE OF ENERGY IN THE GAMBIAN ECONOMY**

#### **3.1. Overview of the Sector**

One of the key determinants of the success or otherwise of socio-economic development is the availability of reliable supply of affordable sources of energy. Past experiences suggest a close relationship between energy use and sustainable economic growth. For many countries energy consumption per capita has become one of the key indicators of modernisation and progress. The availability of a reliable, efficient and affordable energy supply is an important component of the Gambia Government's priorities and is a *sin qua non* for providing the necessary enabling environment for private sector led and sustainable growth, and development strategy.

The Gambia's access to modern energy is at best stagnant, while traditional fuels become increasingly sparse and more labour intensive. In some areas access to electricity is actually declining from its current low level, as existing systems flounder for lack of maintenance, and extensions of the service fail to keep pace with population growth. As a result, an ever-increasing number of Gambians are shut out of the development process.

The Gambia, like many other developing countries, is heavily dependent on imports to meet its requirements of petroleum products, including the importation of diesel fuel for generating electricity. In 1998 The Gambia spent D133 million on energy imports. This amounts to 7% of total imports and constitutes an increasing burden on the country's foreign exchange reserves. Domestic export for the same period amounted to D171 million. Under these circumstances, export revenue is not enough to pay for oil imports. The country therefore depends on balance of payment support and external borrowings to cover its need for imported petroleum products. As a result, development efforts have been curtailed especially in the rural areas with adverse consequences for economic development. The current high cost of electricity and petroleum products also negatively impacts on the economy. Higher energy prices and disruption in supply increase inflation, reduce investments, productivity, profits and employment.

The Gambia's energy supplies come exclusively from four sources viz. firewood, petroleum products, butane gas and solar. Firewood is the most important source of energy in the country and accounts for an estimated 80% of the country's primary consumption. The

population collects firewood from the forest without any regard for sustainability. Given the current rate of consumption and high population growth, future shortages of firewood are inevitable and will lead to further depletion of the natural forest cover, with serious negative consequences on the environment.

According to the National Accounts, in fiscal year 1992, the forest sector in The Gambia accounted for only 0.5% of GDP. This share has remained almost constant over the last eight years. The modern energy sector, which accounted for only 0.6% in 1992, also displayed a low share of GDP. The total share of traditional energy in 1992 only accounted for about 1.5% GDP.

In 1998 about 71% of petroleum products were used for transport, 15% for thermal power generation by NAWEC and the remaining percentage for agriculture, industry, commerce and domestic household. The electric power system is small and provides electricity coverage to only 20% of the population in the Greater Banjul Area (GBA) and a small share to semi-urban centres.

Report on the value of current oil imports show that fuel for household use account for an insignificant share. LPG accounts for about 2% of total import values in 1998 almost 5% of total kerosene import goes to domestic consumption.

### **3.2. Energy Balance**

The gross energy consumption of the Gambia in 1998 was 308,100 tonnes of oil equivalent TOE which represents 0.28 TOE on a per capita basis. The gross energy consumption per capita in 1996 was 0.6 TOE for Africa and 1.68 TOE for the World. The net energy demand for the country in 1998 is estimated at 287,100 TOE, which was met from firewood (225,500 TOE), petroleum products (61,600 TOE) and electricity (6,300 TOE) (source: *Appraisal Report on the Rural Electrification Project, by the African Development Bank, June 2000*).

The two biggest energy consumers are households and the transport sector.

The Energy balance also highlighted important trends, including:

- 3.2.1. An increase in the consumption of petroleum products for energy generation and transport;
- 3.2.2. An increase on wood fuel share of the total consumption between 1983 – 1994 (and rising);
- 3.2.3. An increase in fuel wood consumption by households; huge increases in electricity demand; gradual emergence of LPG as a substitute for fuel wood energy; and a relative reduction in charcoal consumption due to the 1980 ban on the production of this fuel source in the country.

The ban has, apparently, been relaxed by the Department of State for Fisheries, Natural Resources and the Environment and its Forestry Department. Charcoal is currently being marketed in street corners, particularly in the GBA.

From the consumption trends in the different sectors, the energy balance also underlines the following:

- a. The share of petroleum (which accounts for approximately 30.9% of the primary energy consumption) is mainly used in transport, industry and households, in the form of electricity.
- b. There is a relatively small role for agricultural residues and gas in the energy balance.

### **3.3. Energy Demand and Consumption**

With rapid population growth driven by a declining mortality rate and influx of migrants from the sub-region, the population of The Gambia increased from 200,000, in 1950, to 1.02 million (1993 census). The National population growth rate is estimated at 4.1 percent per annum. Population density has increased six-fold, to its current level of 96 persons per square metre. Large-scale population shifts from both internal and cross-border immigration have further increased population density in the GBA. The effects of the two generations of rapid population growth are reflected in the age pyramid. Over half of the population is under 15 years of age and there are 40% more girls under 15 years than women between 16 – 35 years. As girls reach maturity, the number of women of child-bearing age will increase dramatically. Despite the anticipated decline in fertility rates, resulting from the population programmes (current and future programs), rapid future population growth is likely to surpass the two million mark, by the year 2020.

The Gambia is already one of the most urbanised countries in Sahelian West Africa, and urbanisation is estimated to be expanding at nearly 7 percent per annum. Due to the rural – urban migration and immigration from neighbouring countries, the population of the Greater Banjul Area (GBA) is increasing at an alarming rate with about 19.6 percent resident in the GBA. At the current rate of urbanisation, The Gambia will be over 60 percent urbanised by the year 2020.

The Gambia relies almost entirely on biomass (wood fuels) and imported petroleum products to meet its energy requirements. The energy options are very limited in the face of the rapid depletion of our forest resources through (bush fires, farming, grazing activities and exploitation). Because of the high cost of imported petroleum products which constitute an increasing burden on the country's foreign exchange reserves, the Government / NAWEC is finding it increasingly difficult to service the growing oil import bills particularly for electricity generation. The problem has worsened in recent years due to the declining groundnut production, poor performance of the tourism sector and the very high international price of oil which consequently has put pressure on the cost of foreign exchange.

According to Table 1, below, the total consumption of electricity in the year 2000 was 77.5 GWh. Approximately 60% of this was consumed by residential consumers and small-scale industries. Hotels and larger industries consume approximately 30%. The remaining 10% is consumed by Government and NAWEC. The suppressed demand as at 1993 was estimated at 5 MW. There is a much larger demand now that is severely suppressed due to expansions in the tourism sector, increased commercial activity and settlement patterns in Greater Banjul.

**Table 1: Consumption and Sales Statistics (Electricity)**

	1996	1997	1998	1999	2000	2001
GBA	KWh- 46486603	KWh-59297023	KWh -68917164	KWh -79637366	KWh- 73305627	KWh-41318200
	D92, 233,005.06	D120, 445,343.97	D144, 771,189.34	D161, 743,838.70	D148, 811,985.72	D83, 697,341.90
Provinces	KWh- 2,204,320	KWh-2, 705,477	KWh-2, 713,398	KWh- 3,763,750	KWh- 4,247,015	KWh- 2190849
	D4, 100,737.79	D5, 129,209.01	D5, 198,757.11	D7, 174,789.40	D8, 190,374.76	D4, 269,199.45
Total	KWh- 48690923	KWh- 62002500	KWh- 71630562	KWh- 63401116	KWh- 77552642	KWh- 43508918
	D96, 333,743.66	D125, 574,522.98	D149, 969,946.45	D168, 918,628.10	D157, 002,360.48	D87, 966,276.73

\* Year 2001 up to 20/08/01 Source: NAWEC

### **3.4. Energy Access Rate by Beneficiaries**

As at 1991, the total installed capacity nationwide was approximately 26MW. Kotu Power Station has a capacity of about 22.7 MW for Greater Banjul Area and less than 3 MW for the rest of the country.

In spite of the high cost of production, sales continued to increase from the early eighties till 1988 when they reached a little less than 50 GWh/year. After this period it declined due to the use of expensive light fuel oil. With the installation of a new generator operating on heavy fuel oil cost of production decreased by the beginning of 1991.

As at 1990 the number of domestic and commercial connections in Greater Banjul was about 14,000. However, there is the need to increase the number of high voltage/low voltage substations to extend the service to many urban and semi-urban areas in Greater Banjul in order to make the service accessible to as many beneficiaries as possible.

In the rural areas the total number of consumers that have access to electricity is estimated at 2,638 as at 2000.

## **4. SECTOR OBJECTIVES**

The energy sector particularly the power sub-sector is faced with a number of constraints which impact negatively on the economy.

The Gambia Government's primary objective for the sector is the availability of a reliable system of energy supply that is efficient, affordable, sustainable and environment friendly.

To achieve this objective, the government in recent years has put in place policies and strategies to facilitate realisation of the objectives.

## **4.1. Electricity**

To improve the energy supply system by ensuring:

- Addition of heavy fuel oil (HFO) capacity near a port facility.
- Private sector participation in electricity generation;
- That NAWEC and all Independent Power Producers (IPPs) perform their functions efficiently;
- That NAWEC is financially viable to be able to meet shareholder obligations;
- Adequate generation capacity.

Improve access and provide an affordable energy service through:

- Ensuring the rehabilitation of the transmission and distribution system;
- Embarking on the rural electrification project to cover the 46 towns and villages identified;
- Encouraging the use of energy efficient generators optimise electricity production costs;
- Exploitation of sub-regional and regional initiatives directed at augmenting local capacity to develop energy resources.

## **4.2. Domestic Fuels**

Reduce the heavy dependence on wood and charcoal as a source of energy by:

- Encouraging and popularising the use of energy-saving cooking methods;
- Introducing a forest management controlled programme;
- Transferring management responsibilities for forests to local communities.

## **4.3. Renewable Energy**

Enhance the renewable energy potential base by:

- Encouraging the introduction of wind pumps for water lifting, for energy conservation purposes;
- Introducing solar water heaters in institutional facilities, hotels and private households;
- Popularising the use of Solar PV systems in the provinces to provide power for health and veterinary clinics and telecommunication facilities.

## **4.4. Petroleum Products**

Secure future energy supplies by:

- Encouraging oil exploration activities through the creation of a policy environment that is friendly to investors;
- Arranging for relocation of the Half die Fuel Depot to a more suitable site for safety and capacity considerations;

- Encouraging the private sector to build a new port terminal for petroleum and LPG;
- Regulating and monitoring the pricing structure of petroleum products;
- Popularising the introduction of kerosene burners for cooking in the rural areas.

#### **4.5. Liquefied Petroleum Gas (LPG)**

- Adopt a regional approach for the popularisation of LPG as cooking fuel in the urban areas;
- Regulate and monitor the pricing structure for LPG;
- Encourage private sector participation in the provision of infrastructure to improve storage capacity and popularise the use of butane gas as an environmentally- friendly source of fuel.

### **5. REVIEW OF THE SUB-SECTORS**

#### **5.1. Electricity**

##### **5.1.1. Overview**

The power supply sector has been experiencing several problems in meeting the nation's energy demand. The major issues in the current power crisis include inadequate capacity in all segments of the value chain to meet the demand, the high technical and non-technical losses in the power system and the excessive electricity tariffs (some of the highest in the World) for all categories of consumers. Although the availability of generating plants is satisfactory, network accessibility and reliability rates are low, given the limited distribution network capacity and the high frequency of outages. Low total power system losses and tariff optimisation are key to attaining sub-regional competitiveness in electric energy supply.

The National Water and Electricity Company (NAWEC), currently under the purview of the Office of The President (reflecting the importance attached to this area by Government) should, ideally, meet the needs of up to the 100,000 customers it has the potential to serve but, due to the limitations highlighted, it serves only about 36,000 customers. Also, on account of the numerous constraints faced in the provision of power supply, the Company is unable to meet the desired 100% coverage especially in the Greater Banjul Area.

For the Sub-sector to play its rightful role, in terms of competitiveness, it is imperative that private sector investment complements public sector efforts, and the prerequisites for this type of intervention include a review of the existing institutional framework, legal and regulatory provisions and participation in sub-regional and regional energy-related initiatives.

##### **a. Generation**

The current power supply situation can be considered as precarious with some improvements envisaged at the end of this year. The current available capacity at Kotu Power Station is 46 MW against a suppressed peak power demand of 28 MW given that several hotels and overloaded 11KV Feeders are load shed on a daily basis.

The injection of 18MW will increase installed production capacity to 46 MW at Kotu Power Station.

## **b. Transmission and Distribution**

The transmission network includes three 33kv lines derived from Kotu Power Plant feeding Banjul, Serrekunda and Brikama.

A 10 MVA line financed by DANIDA currently serves Banjul. The old 33kv Interconnector has been discontinued and its transformers currently complementing the 10 MVA, 33KV line to Latrikunda Sabiji which was financed and built by NAWEC in 1998. The line currently serves part of Serrekunda and the nexus of towns stretching out to Brikama.

The 33 kV DANIDA line is stepped down at Mile 2 sub-station into three 11kv feeders of three overhead lines and underground cables that serve the city of Banjul. Out of the 5MVA, 33KV Latrikunda Sabiji sub-station are two 11KV feeders that fan out into Serrekunda and Brikama.

In addition, five 11KV Feeders (F1 to F5) are sourced from the main Bus Bar at Kotu Power Station distributing power within the GBA including Brikama. Given that the KPS system bus bar has a capacity of 1250Amps, 11KV, there exists a growing capacity constraint on the transport and distribution networks. As a result of this capacity constraint, NAWEC recently contracted a \$15 million project for the rehabilitation and expansion of the medium and low voltage network. The said project will include the upgrading of the system bus bar from 11KV to 33KV and 2500A.

In general, the physical condition of the MV/LV sub-stations can be characterised as unsatisfactory, particularly in the masonry-sheltered sub-stations. Some sub-stations are overloaded, whereas others have overloaded circuits that cause daily transformer and circuit fuse failures and pillar unit meltdowns that render them unsafe to operate. The safety of NAWEC personnel and of the public warrants the prioritisation of network rehabilitation.

In addition, a total of 15 km of 11KV transmission lines transfer energy from the power distribution stations at Mansakonko, Farafenni, Bansang and Basse to 15 distribution transformers from where low voltage networks supply distribute power to the customers.

NAWEC has already upgraded the transmission and distribution network with the installation of a new 33KV ring in the greater Banjul Area. This would indeed reduce the current high network losses.

## **c. Power System Losses**

NAWEC carries a level of technical and non-technical losses amounting to several times the industry norm. Various analyses conducted on the transmission and distribution system have placed the compounded losses at 35-45%. The Company launched a pre-payment metering system – Cash Power 2000 in 1998 in an effort to arrest non-payment of bills and also address the issue of non-technical losses.



### **5.1.2. Electricity Supply and Demand, and Electrification Rate**

NAWEC's current supply capacity of 30 MW against a suppressed peak demand of 24 MW leaves it with zero reserve capacity thus exacerbating the daily load shedding currently in practice. The recent addition in 2001 of 18 MW of generating capacity financed by the Taiwanese Government, has been key in minimising the capacity shortfall. This has resulted in a positive outcome and has reserved the situation in the short-term. The issue of ageing generators to be retired i.e. G1, G2 and G11 warrant immediate planning and action. In addition, the suppressed demand within the existing networks' coverage, embargoed Sub-stations and overloaded feeders is undefined. However, it is projected that where the transport capacity is increased, and embargoes lifted, electricity demand within the GBA would negate the projected reserve capacity.

### **5.1.3. Sources of Generation**

The NAWEC operates several thermal power stations that run on either diesel and/or heavy fuel oil. The hydropower potential of the Gambia River can only be harnessed in the upper reaches of the river through the OMVG projects, in the long-term.

#### **a. Kotu Power Station**

The heart of NAWEC's generation system is Kotu Power Station equipped with six (6) generators that can generate a maximum power output of 30 mw Table 2, below, profiles the composition of generators at Kotu Power Station.

**Table 2: Composition of Generators at Kotu Power Station**

	<b>Description</b>	<b>Type</b>	<b>Capacity</b>	<b>Fuel</b>	<b>Age (yrs)</b>	<b>Manuf.</b>
1	G1	4 stroke	3.0 mw	Diesel	20	MB
2	G2	4 stroke line	3.0 mw	Diesel	20	MB
3	G3	4 stroke	3.4 mw	Diesel/HFO	10 (4)	MB
4	G6	2 stroke	6.4 mw	Diesel/HFO	11	MAN B+W
6	G4	4 stroke, V	6.0 mw	Diesel/HFO	-	Deutz
6	G7	4 stroke, V	6.0 mw	Diesel/HFO	-	Deutz
6	G8	4 stroke, V	6.0 mw	Diesel/HFO	-	Deutz
5	G11	4 stroke, V	8.5 mw	Diesel/HFO	26 (4)	Peelstick

*Generator Data, NAWEC, Kotu Power Station, Aug, 2001*

#### **b. Provinces**

NAWEC operates six (6) small scale power systems in the provincial centres of Basse (640KW), Bansang (420KW), Jangjanbureh (270KW), Mansakonko (400KW), Farafenni (400KW), Kerewan (142KW); Juffureh and Kamuna are smaller stations that serve NAWEC's water reticulation systems in their respective areas. These power stations operate diesel fired generation that feed into isolated medium and low voltage networks which when available, supply electricity for 12 to 15 hours per day. Besides serving a small customer base of 2638 customers, the provincial power stations provide the vital electricity supply for the

water reticulation systems in Basse, Bansang, Jangjanbureh, Mansakonko, Farafenni and Kerewan respectively.

#### **5.1.4. Demand**

The analysis of energy demand has been fairly elaborated in the Energy Master Plan (EDF 1993) and NAWEC's Corporate Plan (1999 – 2003) projecting an annual growth in demand of 6 – 8.5%.

The key factors shaping electric energy supply and its use in the future are: -

- Population growth;
- Economic and social development;
- Financial and institutional conditions;
- Local/regional and global environmental concerns;
- Efficiency of energy supply and use;
- Technological innovation and deployment; and
- Access to sufficient modern energy in a developing economy,

The current electricity customer base in the GBA and provinces is 30,267 customers (Source: NAWEC). The electrification rate of the GBA and provinces average below 20%, except for Banjul where the rate stands at 70%. The number of households for the GBA now stands at 115,000 households and is rising.

##### **a. Peak Power Demand**

The current production (capacity) power transport and network are insufficient to serve customers at peak demand periods, thus the continuous load shedding in the GBA. The recent EDF network study pegs the maximum power demanded at 24 mw (recorded peak load at KPS) + 6mw load shed plus 10mw of standby generators = 40 mw. Given that the suppressed peak measured now stands at 24MW and given the transport capacity constraints, a revised maximum power demand as at today is 40MW (Source: NAWEC: 2001).

##### **b. Technical and Non-technical Losses**

Although several figures have been presented as the integrated losses of NAWEC (e.g. the EDF MV network study – 39.3%), a comprehensive study on system losses and detailed accounting for its discrete components is yet to be carried out. Tables 3 and 4, below, present the annual generation data (less own consumption at production) and electricity sales data for the GBA and provinces (Basse, Bansang, Mansakonko, Farafenni, Jangjanbureh, Kerewan) respectively.

**Table 3: NAWEC Electricity Production/Sales Data in kWh  
Greater Banjul Area (GBA)**

<b>Year</b>	<b>Electricity produced</b>	<b>Electricity sales kWh</b>
1996	103,976,740	46,486,603
1997	105,329,900	59,297,023
1998	116,446,170	68,917,164
1999	121,242,400	79,637,366
2000	111,464,420	73,305,627

**Table 4: NAWEC Electricity Production/Sales Data in kWh, Provinces**

<b>Year</b>	<b>Production (kWh)</b>	<b>Sales (kWh)</b>
1996	3,023,180	2,204,320
1997	3,052,400	2,705,477
1998	2,743,800	2,713,398
1999	4,186,572	3,763,750
2000	N/A	4,247,015

*Source: Data- NAWEC*

### **5.1.5. Accessibility/Availability/Acceptability**

**a. Accessibility** is the provision of reliable and affordable modern energy services for which payments are made. Commercially viable electricity is unaffordable to many people, yet at the same time a socially-affordable price would not attract sufficient investment. The current tariff levels are among the highest in the World. The current cost of connection to the grid (minimum D2,057) and the average weighted tariff of D2.08/kwh are prohibitive. The current policy of full cost recovery plus margin on service connections should be reviewed to enhance accessibility to electricity.

**b. Availability** covers both quality and reliability of delivered electricity. Unexpected power cuts bear a high cost for society that cannot be ignored. The world's growing reliance on information technologies makes reliability even more critical. The electricity sector has been plagued with capacity availability problems since September 1977. The recently commissioned 6mw generator and the additional one of 12mw scheduled to come on stream in October 2001 will signal a major turning point in the Gambia's history of the electricity sub-sector.

**c. Acceptability** addresses environment goals and public attitudes. NAWEC has, of recent, abandoned the incineration of HFO sludge, a practice replaced with the recycling of the sludge. The degradation of the Kotu Power Station (KPS) grounds and environment has been significantly reduced.

### **5.1.6. Use Locations**

The use locations of electricity can be best described as countrywide. NAWEC's concentration of service is determined by default areas of use. However, the need for electricity supply is countrywide, stations like Sapu, health centres, tourist resorts to name a few are located around the country and auto produce. The dominant users of electricity with respect to NAWEC's customer base are domestic consumers followed by commercial users, as shown in Table 5 below.

**Table 5: NAWEC's Customer Base by Category**

	<b>Category</b>	<b>No. of Customers</b>
1	Domestic	36 620
2	Commercial	4 334
3	Central Government	110
4	Agricultural	54
5	Local Government Authority	1 045
6	Maximum Demand	944
	Total	43 107

### **5.1.7. Energy Resources and Technology Options**

With a 100% oil-based thermal generation of electric power, NAWEC has been hard hit by a crippling increase in the price of fuel. The soaring price of diesel fuel oil in the World market and the slide of the Dalasi have seen the cost of diesel surge from a record low of D1.37 per litre to D4.78 per litre, without duty (NAWEC Budget 2000). For heavy fuel oil, a swing from D1.32 to D3.20 between 1997 and 2000, raising the production cost to a level higher than the baseline tariff for domestic customers. Should the current price level of fuel not subsidize sufficiently, NAWEC will not be in a position to finance its purchase and meet other financial obligations satisfactorily, given that 80% of NAWEC's operating expenses are on items procured from abroad.

The country has limited number of energy resources consisting of wood, sunlight (solar) and wind. According to studies carried out nearly 43% of the land area of the country is classified as indigenous forest, which provides firewood. The country receives 2500 hours of sunshine yearly and the daily solar energy potential is an average 2.5 kJ per square centimetre area (2.5KJ/cm<sup>2</sup>). Average wind speeds countrywide is 2.5 metres per second, which is too low for productive electricity generation.

### **5.1.8. Impacts of Programmes/Projects**

#### **a. Prepayment Metering – Cash Power 2000**

A project was launched in 1998 with 1000 Cash power 2000 electricity meters. The number of customers has now grown to 4,793 resulting in total prepaid sales on average of D700, 000.00/monthly including arrears recovery. NAWEC carries a total of D140 million in arrears, equivalent to seven months sales. The cash power customers have accrued zero debt and for indebted customers on Cash power, recovery is as per a percentage of every purchase. Therefore certainty in the recovery of debt is assured. With Cash power there is: **no reading of meters, no billing or distribution, and no disconnection.**

#### **b. Generation Capacity 3 x 6MW Deutz Generators**

By adding 18mw of generating capacity, NAWEC will double its heavy fuel-generating stock and meet the demand with some reserve in the short term. The network capacity and its transfer efficiency, limit the power-reaching customers. The injection of 18MW significantly alters the supply-demand equation, solving the chronic capacity shortfall, thus affording NAWEC some respite for planned capacity additions.

## **5.1.9. Current Initiatives and Expectations**

### **a. Capacity Expansion on the Local Transmission and Distribution Network**

On the GBA electricity system, actions are being taken to reduce the technical and non-technical losses and solve the power shortage problem. A study to rehabilitate the medium voltage networks has been recently completed by the Electricite de France (EDF) financed by Agence Francaise de Development (AFD).

The EDF study has defined the following elements geared towards the optimisation of the power system network: -

- Treatment of reactive energy transported over the network;
- Re-absorption of electrical overload constraints;
- Reduction of losses on the 11 kV network;
- Capacity expansion of the medium voltage network with three feeders;
- Re-absorption of electrical overloads constraints on the 33 kV network and saving of losses;
- Rehabilitation and upgrading of the main system BUS BAR substation.

Subsequent to this study, NAWEC has contracted a US \$15 million project to rehabilitate and extend the transmission and distribution networks and construct a 33 kV Bus Bar at Kotu Power Station.

NAWEC has allocated funds from its own budget to rehabilitate parts of the distribution network.

### **b. Energy Development Under the Sub-regional Project of the Organisation for the Development of the Gambia River Basin (OMVG)**

The African Development Bank (ADB) has extended a Technical Assistance Grant to the Organisation, for the development of the River Gambia (OMVG), for conducting a feasibility study on the development of hydropower plants (225mw) and the transmission (interconnection) of the power networks of the member countries – Guinea, Guinea-Bissau, Senegal and The Gambia. The feasibility studies for Sambangalou Hydroelectric Site (90MW) and the electric network interconnection project is at the selection-of-consultant phase funded by ADB.

A regional perspective to energy markets and sector development offers significant benefits. Interconnection of national power markets will help encourage private investment through expanding market size, thereby helping investors to manage commercial and political risks. Interconnection also encourages global-scale projects, which lowers supply costs through a reduction in supply reserves, and decrease strategic risk by increasing countries' supply options.

A sub-regional transmission power grid and generation power pool will harness the above benefits and complement the West African gas pipeline project, which stretches from Nigeria to Ivory Coast. Given the vast gas reserves of Nigeria, the potential for large-scale power generation projects for the region is feasible in medium to long-term goal.

**c. The West African Power Pool (WAPP)**

As is the case with most other developing countries, the bulk of countries in West Africa are cash-short and credit-poor and, consequently, cannot self-finance the expansion of their power generation systems to meet felt needs. Other constraints include their inability to raise significant amounts of investment capital, their small size and investor perceptions of the Region's high risk. The Energy Ministers of ECOWAS States seek to mitigate these constraints through the creation of the WAPP which, it is hoped, will be more appealing to international lenders and investors. The initiative will seek to assess and harness the energy generation potential of member-states, and ensure rational use through a common grid linking the different states.

The next steps in furthering the initiative include development of WAPP's legal provisions, institutional and technical designs, and operating rules and procedures.

**d. The West Africa Gas Pipeline (WAGP)**

The WAGP Concept, which was also initiated by the ECOWAS Energy Ministers, under the umbrella of the West Africa Regional Energy Project, seeks to define the Sub-region's integrated energy resources to meet the energy needs of the countries within. One of the aims of the Project is to develop a network to market the product.

**5.1.10. Support Anticipated from Donors/Development Partners**

The World Bank's Africa Energy Team is committed to strengthening its contribution to each Country Assistance Strategy (CAS), in an effort to remove the bottleneck in the development process.

The World Bank (WB) has financed the energy reform and infrastructure project. Sub-components of this project have been completed namely: -

- "The Institutional, Legal and Regulatory Framework Study" by Stone & Webster Management Consultants, Inc. – May 2000
- "Hydrocarbon Sector Study: The Gambia" by Aker Geo, Upstream Management and Norwegian Oil and Gas Production Support – July 2001

The development of a policy framework for the electricity supply industry and the definition of stakeholder roles are encapsulated in the draft Electricity Law (May 2000) and the draft multi-sectoral Regulatory Bill (September 2000) currently under review.

**5.1.11. Constraints**

The development of the electricity sub-sector is handicapped by two major constraints. The shortage of finance, resulting in limited investments in new generators, transmission and distribution networks required to improve the capacity that is necessary to satisfy the demand. It has also prevented adequate maintenance of the existing transmission and distribution networks leading to irregular and inefficient electricity supply. The lack of maintenance has resulted in highly lossy lines (losses being more than twice the industry norm).

Another constraint is the present institutional set up of the sub-sector. The country presently lacks the institutional capacity to articulate the strategic framework and regulation to guide investors and independent power producers in the sector.

The total electricity demand in the country cannot be satisfied because of the mismatch between peak demand and capacity and in the provinces, the deficiency is aggravated by the unreliability of the generators. The output of power stations in the provinces is much less than the estimated annual demand of 10,000 MWH.

**a. Existing Institutional and Regulatory Framework**

NAWEC was incorporated as a company limited by shares under the Companies Act in May 1995. The share capital of the company is D100,000,000.00 (One hundred million Dalasis only), shares valued at D10 each.

The Social Security and Housing Finance Corporation, Gambia Ports Authority and Gambia Telecommunications Company each hold one (1) percent of shares and the remaining 97% held by the GOTG according to the NAWEC statute. However, the current Board of Directors does not include corporate representation from any of the three firms holding a one-percent stake.

NAWEC, jointly, with SOGEA incorporated Gampower - the first Independent Power Producer (IPP) in the Gambia and Africa, in 1997. Gampower owns and operates a power plant of 8.5 MW and sells its power to NAWEC governed by a Power Purchase (sales) Agreement.

The responsibility for formulating policy, regulation and implementation of programmes in the power sector is fragmented. There are several agencies and Departments of State involved in the formulation of policy with regard to the electricity sub-sector. The Organisation has for the last 18 months been under the policy direction of the Office of the President, whereas the Energy Department remains part of OP. The question that needs to be answered being what the role of the Board of Directors is in the dynamic policy decision-making environment.

**The principal functions of the DOS as regards the electricity sub-sector, as contained in the NAWEC Act, are as follows;**

- Establish Policy that promote an environment conducive to attracting investments in the construction and rehabilitation of the electric sector in the short, medium, and long term;
- Promote the restructuring and privatisation of state enterprises in the electric sector and the establishment of a competitive electricity market;
- Support scientific research and education in electricity sector matters, promote efficiency in the production, transmission, distribution, and marketing of electricity, and create a comprehensive electricity conservation program for the Gambia;
- Monitor and recommend policies regarding the effect on the environment of all electricity activities, and incorporate national environmental protection goals in formulation and implementation of energy programs;

- Establish policies to promote the establishment of relationships between Licensees and electric sector entities in foreign countries, and promote the establishment of transit and import/export relationships in the electric sector;
- Establish policies regarding direct subsidies for electric supplies to specific customer classes and policies regarding priority consumers of electricity;
- Establish a strategy for electric sector emergency situations; and
- Establish policies to enhance The Gambia’s energy security.

The recently concluded, Institutional, Legal and Regulatory Framework study, conducted by Stone and Webster identified and defined the need for reform with reference to the restructuring of the electricity sub-sector. The GOTG has recently enacted a law instituting the Gambia Divestiture Agency (GDA) in an effort to articulate a divestiture policy/programme of public enterprises including NAWEC.

Furthermore, Stone and Webster report has put the electricity sub-sector on the fast track to privatisation, given that three key preparatory steps have been taken:

- i. **Regulatory design** based on the unbundling of NAWEC;
- ii. **A draft Electricity Law** is currently being reviewed by Cabinet; and
- iii. **Licences** for all operators in the electricity supply chain.

#### **5.1.12. Electricity Law**

A draft Electricity Law has been formulated and is currently being reviewed by Cabinet. The objectives and purposes as stipulated are:

- Effect a transition to a private investor controlled and operated sector in which, through competition, where feasible, and regulation in non-competitive markets, prices accurately reflect production, transmission, dispatch, distribution and commercial costs;
- Establish cost effective and reliable electric supplies for all classes of consumers; and
- Encourage private sector investments in electricity sub-sector activities.

The draft Gambian Electricity Law further elaborates its purposes as follows;

- Assign responsibility for overall policy development in the electricity sector to the Department of State responsible for electricity matters (the “DOS”), and relieve the DOS from regulatory, ownership, and operational responsibilities in the sector;
- Establish a framework to regulate the electric sector and establish an autonomous regulatory body (the “Regulatory Commission”) for these purposes;
- Promote energy efficiency (Demand Side Management);
- Assure sufficient and reliable electric supplies for the population and the economy at just and competitive rates;
- Encourage domestic and foreign private capital participation in the electric sector; and
- Promote competition in The Gambia’s electricity markets.



### **5.1.13. Donor Assistance**

Over the years a number of donor interventions have been received primarily to improve the reliability of the supply and the efficiency of its distribution system. The source and nature of this assistance are varied and limited. Assistance received so far was:

- African Development Fund }  
Rural Electrification
- IDB & BADEA
- DANIDA Grant – Provision of a 8 Mega Watt (MW) Heavy Fuel Generator
- Japanese Grant – Provision of 6 a MW Light Fuel Generator
- Agence Development de France – Study on Rehabilitation of Transmission and Distribution Network.
- Republic of China – Provision of a 6 MW Generator

With regards to LPG, the only assistance received was from the EEC and was in respect of the regional butane gas project. This intervention was intended to popularise the use of butane gas in the Gambia by providing 30,000 gas cylinders and accessories.

## **5.2. Rural Electrification**

### **5.2.1. Overview**

During the last decade, many countries in sub-Saharan Africa have been engaged in implementing sound macroeconomic policies and structural reforms geared to raise per capita incomes, reduce inflation, and narrow the financial imbalances. Despite these reforms, poverty remains widespread and the development process sidelines many people. The development process should be inclusive if it is going to be sustainable. One key aspect of the inclusiveness is the engagement of the rural areas, where the majority of the populace reside, into the mainstream of development.

Improving the access to health services and education is important. It is also important to raise employment and productivity in the rural areas by increasing access to energy. Traditional forms of delivery have not been effective at this task and access to electricity has been mostly limited to the urban areas. Along with other rural development actions, rural electricity can bring economic prosperity to rural areas and help lay the foundations of a stable, inclusive and brighter future for the Gambia.

## **5.2.2. Rural Electrification (RE) Project**

In 1993, Electricite de France (EDF) prepared an electrification master plan for the GBA and the rural provinces, which basically envisaged the electrification of towns within 80-km radius from two proposed central power stations in the rural centres of Mansakonko and Bansang.

Lahmeyer International (LI) was commissioned by NAWEC in 1997 to prepare an “Engineering Study” for economically feasible rural electrification projects based on the EDF conclusions and recommendations of the 1993 master plan.

The LI study presented recommendations with respect to the location and size of the power plans and the associated transmission network to electrify the fifty settlements that met the selection criteria.

### **a. Project Description**

The project consists of:

- Construction of six power stations;
- Supply, installation and rehabilitation of six transmission and distribution networks;
- Compensation;
- Supply and installation of environmental monitoring equipment;
- Consultancy services for Supervision and Audit.

### **b. Project Objectives**

The primary objective of the project is to encourage economic growth in the country by providing continuous power supply to 46 towns and villages thereby contributing to the reduction of poverty in the project area. The project aims to develop the initial stage of a national power grid, which will eventually be connected to the Greater Banjul system.

### **c. Project Cost and Sources of Finance**

The total cost of the project net of taxes is estimated at GMD 223 million of which GMD 190 million will be externally funded by the ADB, BADEA and the IDB. The remaining amount is to be funded locally by NAWEC in local currency.

The ADF funds will be utilised to finance part of the networks, the Environmental Marketing Equipment and the consultancy services. BADEA will finance the foreign exchange cost of the power stations component while, the IDB will provide all the foreign exchange funds for part of the networks. NAWEC will finance the entire local cost of the project amounting to D33 million.

The proposed project is a major element of government’s economic policy, which is aimed at the stimulation of growth and the improvement of the social conditions of the population by bringing basic services to the rural areas. When it becomes fully operational in 2016, 289,000 rural inhabitants will have access to regular power supply.

Its implementation will enhance the economic opportunities of the populace in these areas and improve their social well being thereby assisting in the reduction of poverty. Consequently, rural migration to the GBA will be reduced.

The total installed capacity of 2.272 MW at power stations in the provinces is often less than the total instantaneous demand, whose peak is estimated to be about 2.8 MW in 1999.

## **5.3. Petroleum Products**

### **5.3.1. Overview**

A GOTG study – “Hydrocarbon Sector Study” - was completed July in 2001, as part of the World Bank Energy Reform and Infrastructure Project, by Aker Geo Petroleum Services, Upstream Management and Norwegian Oil and Gas Production Support. The Study produced findings and recommendations on each of the following activities:

- a. Legal and Institutional arrangements;
- b. Banjul Harbour, oil storage and power plant facilities;
- c. Market, Common Carrier of petroleum products;
- d. LPG, import and distribution;
- e. Petroleum products’ pricing and tax structure;
- f. Environment protection;
- g. Oil and Gas Sub-regional Conference in Banjul

Regarding upstream activities (oil and gas exploration), it is noteworthy to mention that The Gambia imports all its petroleum product requirements. Currently, the issues facing the Gambia’s Petroleum Products Sub-sector can be broadly defined as follows:

- a. The demand for a reliable and stable supply of high quality petroleum products at competitive prices;
- b. Activities within the value chain of the Sub-sector should be performed within a well regulated framework in conformity with health, safety and environmental standards;
- c. The need to be prepared for emergency response to oil spills, and also mitigate the risks of fire/explosions.
- d. The need for strategic reserves of petroleum products has also manifested itself in the current stock-outs of products.

### **5.3.2. Supply and Demand Situation, and Access Rate by Beneficiaries**

The petroleum requirements of the country consist of gasoline (premium and regular), diesel oil (gas oil), kerosene, LPG and aviation (jet) fuel. The consumption of liquid products grew from 89,459 metric tons in 1998 to 96,129 metric tons in 2000. There was a steady growth in the demand for HFO (3.6%), diesel (11.3%), gasoline (0.9%) and a decrease in the demand for kerosene/jet fuel (13.9%). The main petroleum consuming sectors are transport, construction and electricity generation.

The supply of petroleum products to the Gambia in the early 1960s was through the West African Replenishment Program (WARP). Under the WARP system deliveries to The Gambia and several other countries in West Africa were handled jointly by several international companies and each of these companies delivered products into petroleum storage depots at ports along the West African coast on a three- month rotation. Subsidiary oil marketing companies in each country then lifted products from these depots to meet their individual market shares. The system functioned efficiently and substantially improved the logistics of supply to the region. However, in the early part of the 1970s the larger countries in the region opted out of the WARP pooling arrangements in favour of new arrangements, which included establishing national refineries.

Currently petroleum products are supplied by two major international companies (Shell and Elf) and recently Castle and the start up of Elton Oil. The existing facilities for handling petroleum supplies and distribution are:

- a. An oil pipeline for discharging tankers at the Banjul Port;
- b. A storage depot located at half die;
- c. Over 43 retailing stations countrywide.

The petroleum storage depot covers an area of about 10500 square metres situated in the heart of Banjul with a total capacity of 17,000M3.

### **5.3.3. Supply Sources**

The main sources of supply of petroleum products are as follows:

- a. United Kingdom (principal supplier);
- b. Senegal;
- c. Ivory Coast;
- d. Mauritania;
- e. Gabon.

### **5.3.4. Quantities Used**

The use of petroleum products for the past years has increased tremendously due to growth in the overall economy of the country. Table 6, below, shows a brief statistics of quantities imported.

**Table 6: Imports of Petroleum Products (Metric Tons)**

Metric Tons

YEAR	Petrol (Gasoline)	Kerosene (Jet fuel)	Diesel	HFO	TOTAL
1998	11,348	16,798	38,286	23,027	89,459
1999	10,079	12,897	35,484	23,853	82,313
2000	11,550	12,455	47,416	24,708	96,129

### **5.3.5. Marketing**

The marketing of petroleum products is basically carried out by the petroleum companies through the retail stations owned and operated by private dealerships, which are financially independent of the marketing companies.

### **5.3.6. Accessibility and Access Modalities**

Distribution of petroleum products is done as follows:

- Through oil tankers for quantity imports from overseas;
- In-country distribution to retailers by lorries (10 tons and above).

The accessibility and access modalities are of great concern to the oil companies in terms of security and environmental concerns. A pool of about 70 tanker-trucks is currently serving the Shell operated depot.

### **5.3.7. Use Locations**

Pumping stations for petroleum products are located strategically all over the country providing a 24-hour retail service to customers. A fuel dump is provided at the Banjul Airport for storage and supply of jet fuel to aircraft.

### **5.3.8. Impacts of Past Programmes on Energy Demand, the Infrastructure and Institutional Framework**

The following are some of the impacts of past programmes/projects on energy demand as outlined above.

#### **a. Joint UNDP/World Bank Energy Sector Assessment Program (November 1983)**

Finance for this work has been provided, in part, by the UNDP Energy Account, and the work has been carried out by the World Bank.

The main impact of this programme among others was that the Mission recommended for an evaluation of petroleum product import arrangements to establish the relative costs of present and other alternatives.

**b. IDA Energy Technical Assistance Credit (August,1983)**

**Impacts**

Exploration promotion services for:

- Retrieving, compiling, and integrating geological and geophysical data;
- re-processing of seismic data; and assistance to GOTG for negotiating and
- monitoring exploration contracts;
- Legal services to review legislative and contractual framework for exploration;
- Training of designated Gambian staff and upgrading facilities of Geological Unit;
- Completion of basin study (in cooperation with Senegal and Guinea-Bissau)

**c. Petro Canada International Assistance (Corp) (August, 1983)**

**Impact**

- 800 km marine seismic survey;
- Legal services for petroleum exploration
- Technical training for personnel of Geological Unit

**d. Petro Canada (1987)**

**Impact**

- Acquired 1097 km 2D offshore

**e. Petro Canada (1988)**

**Impact**

- Conducted regional interpretation of offshore data

**f. Petro Canada (1990)**

**Impact**

- Acquired 300 km land 2D seismic data

**g. Petro Canada (1991 to 1992)**

**Impact**

- Acquired 320 km land gravity and magnetic data
- Conducted review of onshore prospecting

**h. IKODA (1998 to 1999)**

## **Impact**

- Conducted technical review of deep-water area
- Petroleum prospectivity study

### **I. Fusion Oil and Gas (1999)**

## **Impact**

- Acquired 1000-km offshore deep-water and ultra deep-water and reprocessed 2430 km of previously acquired 2D seismic data.

### **j. The World Bank Energy Reform and Infrastructure Project “Hydrocarbon Sector Study” (July 2001)**

## **Impact**

The study outlined the following issues in detail:

- Upstream Sector
- Legal and Institutional arrangements in the Downstream Sector
- Banjul Harbour, oil Storage and Power Plant Facilities
- Marketing and Common Carrier
- LPG Import, Storage and Distribution
- Pricing and Tax Structure
- Environmental Protection

### **5.3.9. Existing Institutional and Regulatory Framework**

The promotion of hydrocarbon exploration is coordinated by the Department of State for Trade, Industry and Employment.

The Office of the Commissioner for Petroleum is headed by a Commissioner for Petroleum assisted by an Assistant Commissioner and Petroleum Data Assistant. The mandate of the office includes the promotion of the country’s hydrocarbon potentials, negotiating the award of exploration and production licences, negotiating bilateral and multilateral cooperation agreements and developing policies and strategies to enhance the development of the industry.

The petroleum sector is effectively unregulated in the Gambia, except for the price formula for market stabilisation. The sector is largely self-regulated by the two major companies, ELF (now Total Fina ELF) and Shell, with regulatory oversight relying principally on the goodwill of both companies to conduct their activities according to high ethical and professional standards.

Castle Oil is a recent player in the petroleum sector and there is a new entrant - Elton Oil. However, given the limited size of the market and the few players, some regulation is needed to avoid the potential for abuse or collusive tendencies. With retail prices fixed, most of these concerns can be addressed through regulation in the form of a licence for each discrete activity (i.e. imports, wholesale and retail sales, storage, transportation and distribution). The

government has legitimate responsibility for ensuring public safety and protecting the nation's environment. Consequently, all petroleum storage facilities, the Shell Depot, the aviation tanks and product tankers should have licences that define the standards under which they should operate.

It is also the case that government should have rules and regulations relating to the off-loading of fuel at the port, its transportation and conditions of storage.

### **5.3.10. Existing Constraints**

The key constraints affecting the use of petroleum products are as follows:

- The small size of imports mainly due to the size of the market
- The expected lower levels of import/export trade activities
- Lack of competition in the market (NAWEC pays on average US\$80000 more than SENELEC for a heavy fuel oil consignment of 5000MT)
- Overall narrowness of economic activities
- There is only one primary depot managed by a Marketer (Shell Marketing Gambia Limited)
- There is a lack of regulation/laws governing the sector
- Shell determines the rate of through-put and capacity allocation (usage)
- Inadequacy of foreign exchange recently resulted in a petrol stock-out in the market. This aspect threatens the stability and continuity of the fuel supply system. The combined exchange rate loss of ELF and SHELL in year 2000 was D26million.
- The failure of major consumers to settle bills on time
- Limited storage capacity
- Dead-weight cost of shipping, given the limited size of consignments
- Single pipeline, limits type of cargo (cannot discharge heavy fuel)
- Ownership of storage depot

### **5.3.11. Future Outlook**

The future outlook for the sector is to anticipate significant contribution to GDP. The emergence of new players like Elton Oil and the prospect of a more competitive market complemented by adequate regulation would create a stable environment and maximise customer value.

**Strategic Reserves:** The Gambia is totally dependent on imported oil and gas and the only reserves being marginal. The GOTG in partnership with the Oil companies should review the Legal Stock and Insurance Stock levels required to build a strategic reserve.

**Storage Depot:** Several studies have been conducted with regards to the health, safety and environmental issues of the Shell Depot and the issue of relocating the depot. NAWEC is currently working on a 10 000MT heavy fuel oil storage facility in the vicinity of Banjul Port given that a pipeline link is required.



## **5.4. Liquefied Petroleum Gas (LPG)**

### **5.4.1. Overview**

The Government of The Gambia has expressed concern over deforestation and has become interested in promoting substitutes as a way to reduce fuel wood consumption.

Government intervention includes promoting the use of crop residues, kerosene and LPG, in particular, as cooking fuel in both rural and urban areas. In the fight against desertification and drought in the Sahel Region, the depletion of natural resources (forest cover) arouses great concern. Forest resources are being used at an increasing rate for provision of firewood. In an attempt to stem this development, it was decided at a meeting of CILSS Council of Ministers in Praia, Cape Verde, in October 1986, that part of the EDF-supported regional programme on the fight against desertification and drought in the Sahel Region would be allocated to a programme for the promotion of LPG (Butane gas), particularly in the urban and rural areas, in order to minimise the use of fuelwood. The Gambia participated in that programme but it was unsuccessful due to many administrative and logistics problems.

At present, firewood appears to be cheaper than gas and, consequently, the demand for LPG by Gambian households is low. Current use of LPG is about 1,500 Mt. per year. The users almost exclusively belong to the high-income strata of the society, as LPG is more convenient to use than firewood.

For the lower strata, the use of LPG is not popular because too much capital outlay is required for investment in gas bottles and business/support infrastructure and because LPG is only available in limited quantities requiring an outlay far exceeding the cost of a bundle of firewood which is still relatively cheap.

What is now required is a storage depot to make the filling stations operate at optimum capacity as well as supplying the specialised gas tankers.

The government commissioned a study to assess the feasibility of constructing a sea terminal for the reception and storage of LPG. According to the study, the estimated cost of the terminal would be about US \$30 million.

The Gambia participated in a regional approach for the introduction of Butane (LPG) or bottled gas as a cooking fuel in urban and semi-urban areas. Currently butane is brought over land from Dakar, Senegal and sold for 10-12 Dalasis/kg. This puts the price of butane gas beyond the reach of most urban and semi-urban users. Accordingly, there is an urgent need to build a sea terminal to facilitate the importation and storage of large volumes of LPG in the country.

In the long run the substitution of Butane (LPG) for fuelwood, as a domestic fuel, would result in potential savings of up to 80,000 tonnes of fuel wood, annually, through the importation of only 7,000 tonnes of LPG.

Fuel wood can no longer continue to provide the energy requirements in urban areas. With a butane gas (LPG) project underway by a private company, there will also be a decrease in

carbon (green house gas) emission due to the combustion efficiency of LPG stoves used countrywide.

#### **5.4.2. Supply and Demand Situation**

The Government of The Gambia is active in attempting to replace ligneous fuels (firewood and charcoal) by petroleum products (liquefied petroleum gas-LPG) and to some extent kerosene. However, demand basically depends on two factors: economic growth and the corresponding increase of personal income that would permit consumers to switch fuels. LPG penetration is somewhat advancing in the Gambia. The dissemination of the product nationwide is however hampered by high import cost caused by inefficient and unreliable small quantities, absence of Trans-Gambian coordination of purchase and high transportation cost.

The experience with the regional LPG promotion programme, now discontinued, shows that the means utilised to accelerate the substitution process have not been effective.

From the available data provided by the Central Statistics Department, there are five companies that import LPG by truck-tankers from Senegal, namely:- Gam Gas, ELF, Shell, M&C and Touba Gas. In addition, unofficial importation of LPG is undertaken by small traders who buy small quantities of small-size cylinders (2.75kg and 6 kg) from Senegal, at a subsidised price, and sell them to the general public, in The Gambia, at the going prices fixed by the official importers.

**Table 7: The Gambia's LPG Imports**

<b>Year</b>	<b>Tonnage of LPG</b>	<b>Import Value (D'000)</b>	<b>Import Price (D/kg)</b>
1996	1,450	6,827,000	4.71
1997	1,124	5,300,000	3.40
1998	1,430	4,733,000	4.72
1999	1,380	6,130,000	4.71
2000	1,500	-	4.91

*Source: Central Statistics Department (excluding transportation cost)*

From Table 7, above, it can be concluded that official imports of LPG (butane) in the period 1996-1999 are on average about 1.350 tonnes annually. Based on interviews with the main distributors, official imports for the year 2000 have been estimated at about 1,500 tonnes. Information about unofficial imports of LPG has been estimated at 500 tonnes. Therefore, total demand of LPG in the Gambia is estimated at 2000 tonnes for the year 2000. However, due to lack of adequate storage facilities in the country it has not been possible to import LPG, in large volumes,

The demand of domestic and commercial use of LPG is expected to grow to 4,200 tons per annum, by the year 2020. In the worst case scenario, the demand could be 1,000 tons less, while an optimistic scenario gives a consumption of almost 6,000 tonnes by the year 2020.

### **5.4.3. Importation, Storage and Marketing**

The absence of storage facilities in The Gambia limits LPG imports to the volumes that can be transported by road-tankers from Senegal, which results in a relatively high import price. Also, the distributors' mark-up is believed to be rather high, possibly due to their limited turnover. However, it is hoped that bulk importation and storage of LPG, in the near future, would contribute to a reduction in the retail price.

As mentioned earlier in this chapter, there are only five local operators in the LPG business. Elf and Shell are multi-national companies, while the remaining three are locally owned and operated. M&C Gas operates a small filling station for mainly 3.5kg, 6kg and 12kg cylinders. The Company has three gas tanks, one of which has a capacity of 30-tons.

Shell Oil Company imports LPG directly from Europe in pre-filled 12kg cylinders. However, since the importation of LPG requires a high capital outlay and is time-consuming, Shell now resorts to refilling its empty bottles at Elf Oil's LPG filling depot in Kanifing, The Gambia.

Gamgas, one of the oldest LPG Companies in The Gambia, has installed 8 small spherical storage tanks, and has its own filling plant for all sizes of cylinders. The Company has a modern trailer-tanker that frequently transports its LPG from Senegal.

Currently, a local Company Moukhtara Holdings is constructing a modern LPG Storage and supply facilities at Bonto, in Western Division, away from the urban area, with access to safe anchorage and delivery of LPG by sea. It is hoped that, when completed and operational, the facilities would alleviate the LPG storage and supply problems in the country.

The Bonto Terminal will be equipped with a storage capacity of 2,200 metric tonnes, to be supplied by ocean going vessels. The bulk imports would, hopefully, enable distributors to retail LPG at lower prices.

LPG cylinder sizes marketed in The Gambia by the five retailers range between 2.75 and 52-kg. The rate at which the market will grow will depend not only on the increase in supply, but also an acceptable market price. Lowering retail prices will surely increase demand in The Gambia. Currently, the price of LPG sold to hotels in The Gambia is the highest in the sub-region. The hotels use LPG essentially for cooking and the advent of cheaper and more reliable supplies would certainly increase volumes sold to the hotel industry.

### **5.4.4. Current Consumption**

The Gambia's annual consumption of LPG was estimated at 1,350 tons for the period - 1996/1999, while the estimate for year 2,000 was approximately 2,000 metric tons. The share of household consumption, in total imports, is estimated at 85%, the remaining 15% represents consumption by the hotel industry.

### **5.4.5. Accessibility and Access Modalities**

Due to the recent increase in the number of companies participating in the marketing of LPG in The Gambia, accessibility has improved greatly in recent years, particularly in the Greater Banjul Area (GBA) where LPG is utilised as a second fuel source to firewood.

The access rate has also improved due mainly to the 30,000 cylinders that were made available to distributors by the EDF Supported Regional Programme on the fight against drought and desertification in the Sahel region in 1986. There will be improvement in the access rate after the proposed LPG terminal becomes operational, according to the feasibility study funded by the Export and Industrial Development Division (EIDD) of the Commonwealth Secretariat. The proposed size of this terminal will be based on the predicted market size and the economic parcel size for importation by sea. These considerations indicate the optimum storage to be around 2,000 metric tonnes.

#### **5.4.6. Use locations**

Because of the high initial cost involved in the use of LPG either as primary or secondary fuel, only the middle and high income urban and semi urban population actually utilise the product. Perhaps when the price of LPG drops to an affordable level, the rural population of The Gambia may start using it as a secondary fuel.

#### **5.4.7. Impacts of Past Programmes on the Energy Situation, Infrastructure and the Institutional Framework**

In the fight against desertification and drought in the Sahel Region, the depletion of natural forest cover is a major concern. In an attempt to stem this development, it was decided at a meeting of CILSS Council of Ministers, in Praia- Cape Verde, in October 1986, that part of the EDF-Supported Regional Programme would be allocated to a programme for the promotion of LPG (butane gas), particularly in the Greater Banjul Area. The programme significantly alleviated the serious shortage of cylinders and LPG faced by operators, by making available 30,000 cylinders with stands. The extra cylinders provided on the programme have significantly increased the availability of gas in The Gambia, as a result of which the LPG market expanded. The programme was, however, discontinued due mainly to some administrative and institutional problems. Unfortunately, the impact on wood fuel/charcoal consumption and deforestation in The Gambia was not assessed due to lack of detailed and reliable information on LPG consumption, especially in GBA. In any case, it would appear that the programme, to some extent, succeeded in convincing urban and semi-urban dwellers that use of LPG could be a more economical, healthier and environmentally friendly option of cooking.

Another LPG-related programme came in the form of a feasibility study funded by the Export and Industrial Development of the Commonwealth Secretariat, which provided estimate of the future demand and storage capacity needed.

The report also detailed a proposal for the setting up of a bulk storage facility in The Gambia. It contained all the data required for a financial and technical appraisal of the venture, including recommendations for internationally accepted safety standards for the storage terminal.

The study clearly stated the need for a sea terminal to be built (estimated to cost US \$3 million). It is anticipated that, with the provision of the terminal facilities, LPG supply would increase and subsequently the price of butane would fall to D9.00 per 3 kg. cylinder. The study further shows that, in the long run, the substitution of butane (LPG) for fuelwood, as a

domestic fuel, has a potential saving of up to 80,000 tonnes of fuelwood, annually, through the importation of only 7,000 tonnes of butane gas.

#### **5.4.8. Current and Future Initiatives and Assistance**

The LPG terminal being constructed at Bonto by Moukhtara Holding Company Ltd, constitutes the most recent initiative in the LPG area. The possibility to import large volumes would ensure access, by consumers, at a cost comparable to those of other countries.

#### **5.4.9. Transportation**

The transportation methods used for LPG expose people to great danger: LPG is highly inflammable (Typical flammability range is 1.9 - 9.4%) and its vapour pressure increases exponentially when the temperature vapour pressure reaches up to 40 degrees. Currently, transportation of the truck-tankers from Senegal, across the river to Banjul, is by passenger ferries which is vary hazardous.

#### **5.4.10. Existing Constraints**

In view of the fact that LPG is a highly volatile liquid, its use as a domestic fuel is not always preferred by many Gambian households, especially those living in rural areas. In addition, the cumbersome nature in utilising LPG cooking devices and the task involved in refilling supplies does not encourage users. To remove this fear, a massive promotional campaign is urgently required.

#### **5.4.11. Future Outlook**

The EDF project had significantly promoted the use of LPG, by sensitising Gambians on the advantages of the use of LPG as an alternative source of domestic energy,

The high cost of the product and the difficulties encountered in obtaining supplies continue to inhibit its acceptance nationwide.

The Consultant was informed by Moukhtara Holdings Company (MHC) that the on-going Bonto project will include, as part of its marketing strategy, an intensive nationwide promotional campaign that will help eliminate fears about the safety aspects of LPG use. The campaign will also elaborate on the cost elements of LPG use, vis-à-vis fuelwood. MHC is confident that the promotional campaign will facilitate widespread use of LPG.

## **5.5. Domestic Fuels**

### **5.5.1. Overview**

In view of the Gambia's socio-economic characteristics, its energy needs heavily depend on traditional energy sources, mainly fuelwood. 61% of gross domestic energy consumed comes from fuelwood (RPTES 1994). According to the African Development Indicators (The World Bank 1992) this is equivalent to 77% of the country's total consumption of oil products. LPG and kerosene, jointly, account for less than 2% of oil imports. The production and sale of charcoal was banned in 1980 (now relaxed). However, an estimated 20,000 tonnes per year (RPTES 1994) entered the country from Senegal in the early 1990s. According to the RPTES report on The Gambia, 485,000 tons of fuelwood are used annually to meet the energy needs of 90% of the population, 60% of total fuelwood used is consumed by the rural population. Only 5% of imported kerosene is use in households as a source of lighting. In 1993, traditional fuel suppliers recorded a turnover estimated at 136 million dalasis (RPTES 1993) and its contribution to GDP in that year amounted to about 1.5%.

The commercial extraction of fuelwood is estimated to be 180,730 tonnes per year. According to information from the Forestry Department (RPTES 1994), as much as 50-60% of fuelwood and a substantial proportion of the 21,000 tonnes of charcoal used are consumed in the Greater Banjul Area (GBA).

Government has attempted to protect the environment by prohibiting the manufacture of charcoal in The Gambia and by prohibiting the cutting down of green trees for use as firewood. However, it is evident that this policy is not enforceable in the absence of an adequate compliment of forest guards.

### **5.5.2. Institutional Framework**

The institutional framework for the traditional energy sector in The Gambia has been characterised by the participation of more than one Department of State with overlapping functions, which makes it difficult to achieve effective coordination. However, after the 1990 reorganisation of the sector, by GOTG, all energy matters were placed under the Office of The President (OP). OP is responsible for policy on fuelwood supply and demand, in collaboration with the Department of Forestry and the Department of State for Natural Resources. An Energy Division was created within DOSTIE to help coordinate the energy sector institutions. The Gambia Renewable Energy Centre is also placed within OP. The idea of creating a National Energy Commission under OP was also being muted.

Other Departments of State, institutions as well as NGOs are also involved in the traditional energy sector through the implementation of specific projects and programmes. Among the institutions are the Department of Community Development (DCD) in the Department of State for Local Government and Lands, which promotes use of improved wood stoves, in collaboration with the Department of Fisheries; the Women's Bureau and Forestry Department implement programmes on improved fish smoking ovens, with a view to conserving biomass; and the Gambia-German Forestry Project assists with forestry management, the preparation of national inventories of forest resources and wood fuel supply management.

The Fuelwood Vendors Association (FVA) was registered in 1996 as a charitable organisation. It has a loose structure and has a membership of approximately 3000, comprising people involved in the traditional fuelwood trade. Due to the continued dependence of a large part of the population on fuelwood, the FVA represents a powerful constituency and virtually controls the price of fuelwood, which appears to be remarkably uniform throughout the country. The Association plans to evolve into a “Trade Union” under which members would pay an annual subscription and be issued membership cards. Registered members would then be required to apply for licences to be eligible to purchase wood from the Forestry Department and/or from Community Forest Management Committees that have been set up to function as economically-viable units, deriving income from sustainable utilisation of forest products (including fuelwood).

### **5.5.3. Supply and Demand Situation**

#### **a. Demand**

Demand estimates for traditional energy, by urban and rural consumers, have not been very accurate due to the absence of reliable information. Supply estimates are available in the National Forest Inventory. Earlier demand estimates were based, mainly, on household surveys by consultants but, due to resource and logistical constraints; the sample size was too small to be representative. Access to fuelwood is becoming difficult due to limitations, such as lack of roads or legal restrictions in the exploitation of certain species. In rural areas most of the fuelwood originates from branch-wood collected by women and children, while the larger logs are collected by commercial suppliers and sold to urban markets.

The most recent surveys on demand are those carried out by a graduate student under the auspices of the Gambia – German Forestry Project (GGFP). The results of the survey were combined with the projected 1997 population census to give estimates of demand in the rural and urban areas.

#### **b. Supply**

Traditional energy in The Gambia is synonymous with fuelwood, the bulk of which comes from the natural forest and savannah areas. The potential supply of firewood is finite and rapidly decreasing, whereas demand is increasing with the rise in population. The present supply, relative to the demand, is unclear. However, in view of the Gambia’s socio-economic characteristics, it is understood that its energy needs heavily depends on traditional energy sources (mainly fuelwood). 61% of gross energy consumption comes from fuelwood (RPTES 1994). Nevertheless, according to the African Development Indicators (World Bank 1992), this percentage was 77% of the consumption of oil products. Liquefied Petroleum Gas (LPG and Kerosene jointly account for less than 2% of oil imports. The production and sale of charcoal was forbidden in 1980, but an amount estimated at about 20,000 tonnes per year (RPTES 1994) enters the country from neighbouring countries, as contraband, and is used mainly as a heat source for ironing and cooking. According to the RPTES report on the Gambia, 485,000 tonnes of fuelwood are used per year for consumption by about 90% of the population. 60% of the total fuelwood is consumed by the rural subsistence sector. Only 5% of imported kerosene is used in households as a source of lighting. The bulk of kerosene import is actually used as jet fuel.

### **5.5.4. Supply Sources**

The most significant market for fuelwood is the Greater Banjul Area (GBA). Steiner (1996) reported that 67% of fuelwood that entered GBA, in 1993, originated from Lower River Division, 20% from Western Division and 13% from Central River Division. Estimates from local traders suggest that a significant amount of the wood consumed originates from Cassamance (one estimate gave the proportion of fuelwood from Cassamance as high as 80%). While some of this wood is purchased in bulk from Cassamance and delivered in the Gambia by truck, some of it is transported across the border, by Ox cart, to the main Basse-Brikama trunk road where it is collected by trucks.

The Gambia complements its own supply of fuelwood with periodic importation from Senegal (Cassamance), given the limited fuelwood producer-licences issued annually.

### **5.5.5. Consumption Patterns and Rates**

The relatively high pattern of energy consumption in The Gambia is a function of population growth. The high consumption rate increases the elasticity of demand, and the impact of urbanisation on energy consumption is high prices. Due to the diversity of information on traditional energy demand, it is difficult to accurately estimate the total traditional energy consumption, given the unreliability of the available data. However, Tables 8 and 9, below, indicate the figures obtained from various surveys conducted in The Gambia, so far, on wood fuel consumption pattern and rates.

**Table 8: Summary of Fuel Wood Consumption Surveys**

Survey title	Year	Est. kg/capita/day				Total
		Rural	Urban	Rural	Urban	
OPENSHAW	1972/73	2.96	2.72	122	378	500
ORGATEC	1981	1.6	1.80	64	366	430
VON BULOW	1982/83	0.73	1.00	-	-	
COWI CONSUL	1983	1.00	0.62	-	-	
STEINER	1993	0.54	1.04	5	-	

**Table 9: Projected Demand of Fuelwood 1973 – 1999**

Year	Population	Corresponding estimated fuelwood Consumption (TOE)
1973	493,499	98,700
1983	687,817	136,632
1993	1,025,867	200,556
1995	1,120,638	218,813
1997	1,231,674	240,367

*Source: DEPT. OF ENERGY, OP*



### **5.5.6. Commercial Extraction and Marketing of Fuelwood**

The Gambia, being a former British Colony, has inherited and developed a profoundly different set of forestry, administrative and marketing policies from those of its neighbouring Francophone countries. Given its unique situation, the country has vast differences with neighbouring countries in policies relating to commercial wood. In the Gambia, cutting of fuelwood is almost entirely for commercial purposes (RPTES 1994). Law requires woodcutters, to obtain licences. The number of exploitation licences is limited to 40 per district and the permit for each licence holder is inclusive of a maximum of three assistants. Licences for the commercial extraction and marketing of fuelwood are issued by the Forestry Department subject to the provision of the Forestry Act and the regulation of 1997/78.

A licence issued for the extraction of fuelwood is for the exploitation of dead wood only.

The licence is not transferable and an Extraction Licence holder must pay D500.00 for his licence and D250.00 for each of his three assistants. A Wholesaler pays D500.00 for his licence and D200.00 per truckload. The Department of Forestry is adequately equipped to monitor the number of assistants employed per Fuelwood Extraction Permit. Furthermore, the licence is not valid for the exploitation of Keno (*pterocarpus erinaceus*) anywhere in the Western Division and has the following conditions attached:

- Billets intended for the conversion to fuelwood should not exceed one metre in length for transportation;
- For ease of inspection, fuelwood produced under a licence may not be transported in container vehicles and may only be removed with a valid removal permit issued by authorised Forestry Department personnel; and
- A royalty has to be paid, in accordance with current tariffs, for all fuelwood produced under a licence. The Licence Holder is permitted to cut and transport only five truck loaded (7 tonnes equivalent) of fuelwood per month. However, enforcement of this clause leaves much to be desired.

The fuelwood trade in The Gambia appears to be well organised. However, there are indications that large quantities of fuelwood still enter the GBA markets, undeclared; and, in spite of the prohibition, great quantities of keno wood are sold in markets as fuelwood.

Commercial extraction of fuelwood is currently estimated at 180,730 tonnes per annum. The Forestry Department issues 40 Fuelwood Extraction Licences per Division; a total of 84 people per Division are legally allowed to participate in commercial extraction.

Fuelwood in The Gambia has zero value at source. The cost to the consumer, therefore, only reflects the input needed to collect and process the wood, the cost of transport to the point of sale, the cost of the licence and royalties payable to Forestry Department. The price of fuelwood to the consumer is, remarkably, constant at D5 per bundle outside the Greater Banjul Area and at D10 per bundle, in GBA and Brikama. These prices have remained constant and the Fuelwood Vendors Association (FVA) plays a key role in regulating prices.

In the rural areas, households, by and large, meet their fuelwood needs by simply collecting (normally by women and children) from the forest or Savannah. It is mainly in the urban

areas, particularly in GBA, that fuelwood is a major traded commodity. Based on a survey carried out by Steiner in 1993, the price structure of fuelwood, at different stages of the distribution chain, was determined as shown in the Table 10, below.

**Table 10: Price Structure of Fuelwood (Dalasis/M<sup>3</sup>)**

	<b>Producer</b>	<b>Wholesaler</b>	<b>Retailer (KMC)</b>	<b>Retailer Banjul</b>
Licence	31.79	7.12	31.79	60.21
Royalties	0.00	169.47	0.00	0.00
Tools	5.93	0.00	4.33	4.33
Wages	715.00	0.00	0.00	0.00
Transport	639.83	1982.00	0.00	0.00
Loading/unloading	140.26	166.15	0.00	0.00
Transport Licence	0.00	200.00	0.00	0.00
Association	0.00	200.00	0.00	0.00
Rent	0.00	0.00	133.59	226.87
Wood	0.00	1781.00	5264.36	5552.57
<b>Total</b>	<b>1532.81</b>	<b>4506.44</b>	<b>5434.07</b>	<b>5843.98</b>

*Source: Adapted from Steiner (1996)*

The percentage breakdown of the fuelwood price is summarised in Tables 11 and 12, below. For the producer, there is a fairly even split of the cost of transport (in this case, off-road transport by ox cart) and costs associated with loading and wages paid to assistants. For the wholesaler, half the cost is also attributable to transport, with most of the other costs accounted for in the purchase price for wood from producers.

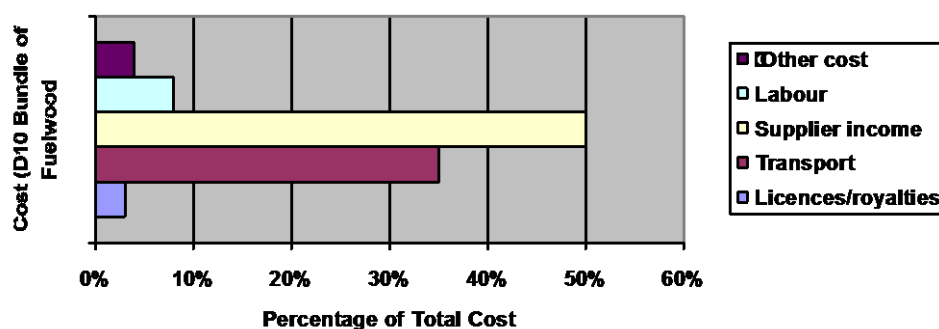
**Table 11: Cost Distribution for the Producer, Wholesaler and Retailer (%)**

	<b>Producer</b>	<b>wholesaler</b>	<b>Retailer</b>
Licences/royalties	2	4	1
Transport	51	52	0
Labour	47	0	0
Wood	0	40	96
Other	0	4	3
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>

For the urban consumer, the Chart-1, below, gives the breakdown of the proportional cost associated with the D10.00 per bundle of fuelwood. Approximately, half of the price is accounted for as income to the actors in the supply chain. These costs comprise labour and overhead costs of the entrepreneur, in addition to any operational cost.

**Table 12: Fuel wood Cost Distribution (%)**

	%
Licences/royalties	3%
Transport	35%
Supplier income	50%
Labour	8%
Other cost	4%



It should be noted that much of the trade in fuelwood is not officially accounted for, but as licence fees and royalties comprise only a small proportion of the total cost, the above analysis would represent the overall cost of fuelwood supply to GBA. The cost breakdown of fuelwood suppliers from Cassamance is also not expected to differ greatly from the above. According to the Fuelwood Vendors Association, Gambian producers provide labour and pay approximately D500.00 to local Senegalese vendors per truckload of fuelwood.

The supply-side profile of the traditional energy sector indicates that fuelwood issues are quite complex and involve a number of actors. The Forestry Department is responsible for the stewardship of the forest resources and the regulation of their use. The rural population partially depends on fuelwood resources for its subsistence needs, and the entrepreneurs involved in extraction and sale of fuelwood depend on it for their livelihood. Finally the urban consumers are the main force driving the commercialisation of the product. At the same time rural development activities, by other government agencies and NGOs, may also have various impacts, both positive and negative, on the energy supply situation.

### **5.5.7. Accessibility, Access Rates and Access Modalities**

In The Gambia, fuelwood is not yet in short supply, as it is in other countries in the Sahel. It is, so far, easily accessible. However, fuelwood is not evenly distributed in the country and the preferred species such as keno, one of the most valuable types of timber tree for furniture making in The Gambia, is listed as an endangered species and its use as fuelwood is banned.

With the exception of the Central River Division, where fuel wood is collected and transported by men depending on their ethnic group, the collection of fuelwood is usually carried out by women and children, aged between 5 and 14 years.

Although no monetary value is attached to the fuelwood and labour involved, women and children sometimes have to walk up to 5 km and spend many hours gathering fuelwood. Because of the small amounts of fuelwood collected, it is a regular practice to transport the wood by head-loads and donkey carts. However, for commercial uses, larger quantities are collected and transported on donkey carts from collection site to the household. These activities take place mainly in rural areas where wood fuel is collected for household consumption requirements.

Fuelwood is readily accessible at the subsistence level and does not require a licence from the Forestry Department, but restrictions regarding woodland management constrain the activities of the fuelwood collectors in most regions. Since most of the fuelwood is picked by hand from the forest, the equipment used by collectors comprises, mostly, locally made hand tools such as axes and cutlasses. The types of equipment utilised, the transportation system, time and distances covered limit the amount of fuelwood that a family can collect in a day. However, the aggregated effect of annual collection/consumption of about 281,289 tonnes, per annum, of fuelwood from our natural forest environment has a strong impact on accessibility and sustainability of production.

Although fuelwood supply is still abundant in areas such as Central River Division (CRD), Upper River Division (URD) and Lower River Division (LRD), it is relatively scarce in areas such as the North Bank Division (NBD) where people resort to creative methods including digging out tree-roots and cutting mangroves to cope with dwindling supplies. Table 13, below, provides annual consumption estimates, per Division, in both tonnes and Tonnes of Oil Equivalent (TOE), as well as provide figures on the population involved in fuelwood extraction at the subsistence level.

**Table 13: Fuelwood Consumption Estimates for Rural Households**

<b>Division</b>	<b>Quantity (ton)</b>	<b>Quantity (TOE)</b>	<b>No. Collectors</b>
Western	120,085	39,632	32,885
Lower River	19,913	6,572	14,234
Central River	31,108	10,267	13,469
Upper River	59,988	19,798	32,870
North Bank	50,195	16,566	31,459
Total	281,289	92,835	124,897

*Source: Interviews and personal communications by DOF Staff 1994*

### **5.5.8. Use Locations (fuelwood)**

The most significant market for fuelwood is the Greater Banjul Area with an estimated demand of 71,500 tonnes, in 1997. Steiner (1998) reported that 61% of fuelwood entering GBA originated from LRD.

### **5.5.9 Impacts of Past Programmes/Projects (Assistance Received) on the Energy Situation, Infrastructure and Institutional Framework**

The Gambia Environment Action Plan (GEAP) in a Technical Cooperation Package (TCP) has elaborated intervention strategies in various areas of the natural resources and environment sector. Although most of the strategies are yet to receive funding, the Department of Forestry, with assistance from GTZ, has been engaged in the implementation of various forestry inventory programmes since 1983. The programmes include species site trials, natural forest management, community forest management, training, forestry policy, development of forestry legislation and models for the management of natural forests in forest parks and in community forest reserves, in Western and Lower River Divisions. The activities have been taking place alongside government's public awareness campaigns on tree planting, fire prevention, forest plantation development and management.

A feasibility study was sponsored in 1996, by the Federal Republic of Germany to assess the Department of Forestry's financial and technical assistance needs for replicating the Gambian Forest Management Concept in forested areas of CRD, with plans to manage 7,230 ha of forest parks and about 11,000 ha of community forests.

In 1993 a five-year USAID/Gambia Government Agriculture and Natural Resources (ANR) Project was launched. It was designed to examine policy needs, manpower development and limited forest resource survey for the then Ministry of Agriculture and Natural Resources, and had an NGO grant component for funding NGO activities in community resources management. Within the scope of that Programme, an aerial photography survey was done, in 1993, providing up-to-date information on the available natural resources. However, the project was terminated, abruptly, in December 1994, following a US Government decision.

The World Bank and the International Fund for Agricultural Development (IFAD) launched an Agricultural Services Project (ASP), in February 1994, in the Ministry of Agriculture aimed at boosting agricultural productivity. The project, inter alia, trained polyvalent extension agents to address environmental and natural resources concerns.

The UNDP has supported an integrated "Range Land and Water Development Project", which has introduced a controlled rangeland management scheme within forested areas.

The EU financed a regional programme on the Introduction of Butane Gas (LPG) as an alternative to fuelwood. The substitution of firewood by butane gas was designed to reduce the demand for traditional energy and therefore reduce the exploitation rate of forest resources for domestic fuel in households. The EU also funded forestry activities such as the fencing of forest parks within the URD Integrated Programme.

#### **5.5.10. Technology Options**

The Gambia's technology options for utilising traditional energy resources (mainly fuelwood, and agricultural residues such as groundnut shells and cereal stalks) are very limited. It is estimated that fuelwood accounts for 84% of the country's total primary energy consumption. Until July 1980, when the production of charcoal from firewood was banned, both firewood and charcoal were important sources of energy, with most of the charcoal consumption occurring in urban areas.

### **5.5.11. Current and Future Initiatives/Assistance**

The Government of the Gambia has made several initiatives and has received some assistance to develop an adequate policy environment that is conducive to sustainable energy development and use. The Banjul Declaration, issued in 1977, pledged to protect the fauna and flora from further destruction. Some measures were introduced during the period such as the Forestry Act and Regulations of 1977 and 1978, and the Fuelwood Exploitation Licensing System. The production and marketing of charcoal was banned in 1980. In mid 1985, Government initiated an Economic Recovery Programme (ERP), which set the stage for the reorganisation of the energy sector institutions and partial privatisation of the electricity sub-sector. In 1990, the Programme for Sustained Development (PSD) was launched to reinforce the ERP policies. The recently launched Gambia Environmental Action Plan (GEAP), which has a strong domestic energy component, was adopted as an integral component of the PSD and is primarily intended to provide a framework for national action.

Inter-fuel substitution programmes (mainly the use of LPG) and demand management actions (improved wood stoves) were developed and are still being implemented. In 1992, the Technical Department of the Africa Region of the World Bank launched a proposal for a “Review of Policies and Programmes in the Traditional Energy Sector (RPTES), to be undertaken as a regional programme with Trust Fund Support of the Directorate General for International Cooperation (DGIS) of the Netherlands.

The core objectives of the Programme were to:

- Undertake retrospective evaluation of the objectives, scope and approach of work done on the traditional energy sector in The Gambia;
- Identify the principal critical inter-sectoral linkages that influence the operation of the traditional energy sector;
- Recommend a new policy direction for the development of the traditional energy sector;
- Identify projects and programmes as a follow up on policy recommendations; and
- Disseminate the operational results (concerning both sector policy and investment follow-up) among stakeholders and the donor community.

The RPTES was and still is the most comprehensive intervention in the Gambia’s traditional energy sector, particularly in terms of policy review. In May, 1995, at a Donors’ Conference held in Maastricht, The Netherlands, The Gambia made a comprehensive presentation of a well-developed project and investment programme aimed at responding, in a coherent manner, to the country’s needs in terms of developing traditional energy resources, following an in-country situation analysis. Unfortunately, donor response to the presentation was not very encouraging. However, faced with the problem of securing funding for the project after Maastricht, The Gambia mobilised a national team that internalised the RPTS process and sensitised decision makers in the country. The investment proposal for the project was refined and new documentation to the effect distributed to all line Departments of State. The government, through the Department of State for Trade, Industry and employment is still committed to the implementation of the already developed RPTES programmes.

## **5.5.12. Constraints to the Use of Traditional Energy Resources**

### **a. Natural Resources Constraints**

With a sub-humid tropical climate and a dominant natural vegetation of dense savannah woodland, The Gambia present a favourable natural environment for the production of fuelwood, as a source of traditional energy or for other purposes. The principal natural resource constraint affecting the abundance of supply is the current extent of the forest area and its rate of depletion. The latest available evidence indicates a decline in the extent of forest (including woodland) cover from 31% of the Gambia in 1972 to 6.4% in 1988. A relatively new forest inventory, carried out in 1997, provided a more accurate assessment of the current problem.

The main reason for the decline in forest area relates to the competition for land use and to previous over-exploitation of the forest. The Forestry Department seeks to address these problems through an extension of community responsibility for forest areas. Currently, because of the limited extent of forest areas, much of the new community forest areas will comprise tree and shrub savannah, which is in considerable need of rehabilitation. The declining trend in annual rainfall and the presence of shallow degraded soils of low fertility may also constrain rapid forest regeneration.

### **b. Socio-economic Constraints**

The principal economic constraint to traditional energy supply is that fuelwood is a commodity without a value at source. Faced with increasing pressure to use the land for economically productive activities such as agriculture or livestock rearing, the rural population is unlikely to give priority to preserving the forest cover. With an estimated population growth rate of 3.2% per annum in rural areas, pressure on land can only increase and the economic benefits of forest management must be made clear to rural populations.

### **c. Institutional and Policy Constraints**

The large number of institutions involved in the traditional energy sector, either directly or peripherally, is a constraint to rapid and efficient development. The Energy Division of OP (the Turn-key Institution) and the Forestry Department lack the capacity to fulfil their mandated tasks, although Forestry Department has been substantially strengthened by the Gambia-German Forestry Project and subsequent projects. The small size of The Gambia and the poor literacy rate often result in a shortage of qualified staff to fill posts and there is growing competition for competent staff by NGOs and the private sector, who often offer more attractive salaries and conditions than GOTG. While institutional strengthening is obviously required, the inability to create new posts may be a constraining factor.

Energy policy is fragmented and dispersed in several GOTG agencies. There is urgent need for a clearly focused energy policy to form the basis for coherent traditional energy-related programmes. By contrast, there is a well-articulated forestry policy, which has been approved, and the legislation to support this policy is due for approval by the National Assembly. Approval of both Acts is crucial to the success of the current community forestry strategy.

### 5.5.13. Future Outlook

- Priorities for action should flow from a clear definition of the desired objectives and targets set; the desired development objectives for Traditional Energy should be the establishment of economically stable, socially equitable and ecologically sustainable traditional energy markets. The recommendations for action should not negate the validity of previous interventions, and should take into account the existing human financial and institutional resource constraints in the country. Furthermore, any one of the three major policy options (demand-side, substitutions and supply-side interventions) requires involvement of both public and private sector participation.
- In weighing the merits of each potential action, the limitations of the public sector need to be clearly recognised. Public resources are scarce; therefore, the policy should be focused to ensure effective use of human resources.
- Viewed from the perspectives above, the priorities for government action in the traditional energy sector should follow on these lines:
  - On demand side, promotion of improved stoves should continue and should best be left to non-energy agencies which are better equipped to address the social and gender aspects, in cooperation with private sector agents;
  - Energy (fuel) substitution depends strongly on macroeconomic growth and rising incomes - factors that are, by and large, beyond government control. Artificial means for accelerating the process, such as petroleum fuel subsidies are unsustainable in a low-income country like the Gambia. At best, public sector agencies could consider selective and temporary subsidies of new traditional energy appliances during their introductory stage;
  - On supply side, the key recommendation is the transfer of exploitation rights of the forestry resources to the rural population and the promotion of agro-forestry. Such actions should be under-pinned by legislative reform establishing property and exploitation rights in conjunction with administration decentralisation.

The regional reports (RPTES, 1994) made the following main recommendations:

- Without revoking the ban on domestic production of charcoal, the legalisation of the import trade of charcoal should be encouraged, in conjunction with the means needed to monitor the product flow effectively;
- Government should legalise the transfer of management responsibilities for forests to local populations, thus permitting the multiplication of the existing community demonstration project;
- Harvesting of green trees for wood fuel should be permitted in zones that have been brought under community management (wood lots), under the provision of agreed management plans between the communities and Forestry Department;



- It is recommended to carry out another biomass inventory, which will permit the analysis of change in land use since 1980, and the establishment of permanent sample plots to measure productivity on a regular basis;
- To maintain a broad spectrum of consumer choice of fuels, every effort should be made by the private sector to reduce the cost of hydrocarbon fuels as substitutes, in particular by attempting to lower the cost of importing, storing and bottling of LPG. The prospects for kerosene as a cooking fuel should be further examined;

The energy division of the Office of The President (OP) should be adequately staffed and trained to take care of minimum requirements for coordination and liaison and to effectively supervise the establishment of a central energy documentation centre.

## **5.6. Renewable Energy**

### **5.6.1. Overview**

The Energy situation in The Gambia is characterised by a heavy drain on foreign exchange earnings caused by the country's need to import petroleum products and by the threat of vegetation depletion (deforestation) due to excessive fuelwood extraction and consumption. Consumption of fuelwood is more pronounced in the Greater Banjul Area (GBA). However, to help alleviate these undesirable trends, Government has adopted various measures, including the following:

- Encouraging private households, industry, trade, commerce and public institutions to conserve energy;
- Promoting the development and use of renewable sources of energy, such as solar energy for water pumping, lighting, water heating in hotels and other areas, to minimise imports of petroleum products;
- Intensifying efforts to promote fossil fuel prospecting in the country.

A number of supplementary components are planned for incorporation into the National Energy Policy, such as:

- The development and popularisation of wood-saving cooking devices (improved stoves) instead of extending the ban on the production and sale of charcoal to cover the non-limited use of biomass;
- Developing and popularisation of small-scale power generating systems to meet the Gambia's needs, such as biomass digesters for decentralised power generation. The Gambia's Energy Policy should, therefore, seek ways to develop such systems, through Gambia Renewable Energy Centre (GREC), in cooperation with similar institutions in the Africa region and elsewhere;
- Establishing South-South cooperation with countries endowed with considerable knowledge on the development and application of renewable energy technologies.

On the other hand, the Gambia does possess a conspicuous renewable energy potential based on;

- Solar intensity;
- Wind; and
- Biomass.

**a. Wind Energy**

The wind energy potential is characterised by low velocity during the rainy season and high velocity surface-wind during the dry season. The wind energy potential could, possibly, suffice for limited exploitation i.e. using multi-blade wind turbines for water pumping particularly along the coastal region of the country (coastal villages).

**b. Solar Photovoltaic (PV)**

PV or the direct conversion of sunlight to electricity is one of the most promising alternative renewable energy technologies for this country. For the rural areas, in particular, it may be the only way that basic electricity supplies can be provided in the foreseeable future.

In the Gambia, 52 public facilities (including refrigerators, community lighting) have been provided with solar PV systems. PV is also being used to power repeater-stations and exchanges as well as rural pay phones for GAMTEL. Many more PV installations in health and veterinary clinics and domestic water pumping for rural villages have been successfully implemented through various donor-assisted projects. Many more projects of this type and magnitude are urgently needed.

**c. Solar Water Heating**

The potential for tapping the Gambia's abundant solar energy resources for water heating was highlighted in the Energy Assessment Report of November 1983, (World Bank Solar Water Heating Retrofit for Hotels, 1985). Given the country's excellent solar regime, solar energy can be utilised efficiently in a number of sectors, at low cost, and with considerable savings in fuel consumption. From an environmental point of view, this can help reduce carbon dioxide emissions into the atmosphere, thus contribute to minimising global warming. The introduction of solar water heaters in Gambian hotels at an estimated cost of US\$50,000 would reduce annual fuel consumption by up to 350,000 litres or more.

**d. Bio-Gas**

According to expert estimates, The Gambia has a relatively small biogas generation potential. Hardly any cattle are penned to facilitate collection of cow-dung for biogas digesters, and there are only a few relatively small poultry farms with adequate excrement yield. These factors, coupled with the existing demand for farmyard manure in agriculture, militate against the acquisition of sufficient quantities of dung/excrement to feed biogas digesters. The slurry from biogas digesters is ready manure for absorption by plants. Both human and animal waste are utilised for biogas production.

**e. Hydro-Electricity**

Due to the country's geographical make up, The Gambia, unfortunately, has no useful hydropower potential within its territory. However, under the sub-regional programme – the OMVG, there are long-term plans to develop the upper reaches of the River Gambia Basin for hydro-electricity generation.

### **5.6.2. Supply and Demand Situation and Access Rate**

The significance of PV, or the direct conversion of sunlight to electricity lies in the extreme simplicity and reliability of basic power generation modules. But the high capital cost of PV systems has been affecting the demand for the technology. However, the product has the potential for growth in demand, in the future, because of the success registered so far in its use in the country.

A central issue for commercialisation of PV systems is access to credit, considering that typical household expenditure on kerosene, candles and disposable batteries is quite high and could permit a fairly rapid payback if credit is available.

The growth of the supply of renewable energy devices, especially solar PV systems, could be accelerated in The Gambia by the reduction or complete elimination of taxes and duties, which account for approximately 26% of the cost of the systems. This would help create a “level playing field” with conventional energy sources and would be a very important policy measure Government could easily adopt.

### **5.6.3. Supply Sources**

Suppliers of Solar PV systems in The Gambia include 5 locally based companies, namely:

- VM The Gambia Limited;
- Gambia Electrical Company;
- SWEGAM;
- Gam-Solar; and
- Dabakh Malick Energy Centre.

VM, the oldest and largest company, obtains its PV systems from SIEMENS Solar GmbH, in Germany, which company they also represent in the country. VM installs and commissions most, if not all, the systems it retails. It has, over the years, supplied PV systems for applications such as water pumping, refrigeration and community lighting under various projects including the CILSS Regional Solar Programme (RSP) funded by the European Development Fund (EDF). The other three companies also provide PV systems, imported from abroad, for domestic lighting.

Limited numbers of other renewable energy devices, such as wind pumps and solar heaters, were imported in the past and tested, locally, but only to a limited extent.

### **5.6.4. Quantities Used**

Data on the quantities of Renewable Energy (RE) equipment used in this country is not readily available. However, the growth of RE equipment, particularly PV Systems, has accelerated and will continue to grow in The Gambia because of their successful use on various applications, countrywide.

### **5.6.5. Marketing**

In Senegal the marketing difficulties for renewable energy devices, particularly for household PV, have been partially solved by their electric power Company - SENELEC. The Company makes available low interest loans for household PV systems, as one of the options applied to rural electrification. Gambia Government could include the SENELEC model in its list of options for promoting use of PV and other types of renewable energy technologies, including wind energy.

Current prices for PV equipment may be high but, with rapidly expanding production worldwide, they are likely to fall to an affordable level in the not-too-distant future. Promotion of this technology in The Gambia deserves very high priority. It is noteworthy, though, that provision of PV technology and any other renewable energy technologies should be accompanied by an effective maintenance and repair service.

### **5.6.6. Accessibility and Access Modalities**

Accessibility to PV systems has improved, over the years, with the increase in the number of locally established dealers in such systems, unlike the other renewable devices for which there are limited suppliers. However, the high initial cost of PV devices is one of the major limiting factors to their large-scale use. Some consumers procure devices from abroad where they could be readily available, although buying devices in small quantities from that source could be more expensive taking into account the risks in transit and costs of transportation and handling. Some renewable energy devices are also brought in from neighbouring Senegal where the use of such devices, particularly PV systems, is more advanced.

It could be said that most Renewable Energy devices, particularly PV and thermal systems installed in The Gambia, were provided through donor-funded projects and, although some private companies have shown interest in funding some PV projects, there is the tendency for donor-funded initiatives to continue for quite sometime.

### **5.6.7. Use Locations**

Due to the availability of electricity supply in the Greater Banjul, albeit unreliable, coupled with the fact that use of power generators and modern cooking and heating devices is fairly widespread, use of Renewable Energy technologies is rather limited in the Urban and Semi-Urban areas of The Gambia. However, rural dwellers of the Country rely heavily on Renewable Energy devices, especially PV for the low voltage electricity required by most rural households for various applications.

To most rural people, the PV systems would, for the foreseeable future, be the only means available for enjoying the benefits of basic electricity supplies.

#### **5.6.8. Impacts of Past Programmes/Projects on the Energy Situation, Infrastructure and the Institutional Framework**

A summary of past programmes is given in Table 14, below. The impacts these programmes have had on the various sectors have been significant. They have facilitated the popularisation of PV systems for various applications, countrywide. They have also created a substantial market for domestic community lighting systems. The future of renewable energy, particularly PV, seems very bright but government should provide the required policy framework and incentives for increased private sector participation in the development and marketing of Renewable Energy systems throughout The Gambia.

**Table 14: Summary of Past Programmes/Projects (Assistance Received)**

Donor	Telecommunications				Water Pumping				Health & Vet. Clinics				Estimated Investment
	1992		1996		1992		1996		1992		1996		
	NO	KW	NO	KW	NO	<u>KW</u>	NO	KW	NO	KW	NO	KW	Million US \$
UNDP/CDF	15	45	7	3	1	1	10	15	25	10	106	37	3.4
UNDP/DESD (DCTD)	-	-	-	-	1	1	10	15	-	-	-	-	0.2
UNICEF	-	-	-	-	-	-	-	-	27	11	-	-	0.5
EC	-	-	-	-	-	-	57	85	-	-	22	9	2.2
JAPAN	-	-	-	-	-	-	30	60	-	-	-	-	1.0
OTHER	-	-	9	18	1	4	-	-	2	-	-	-	0.3
<b>TOTAL</b>	<b>15</b>	<b>45</b>	<b>16</b>	<b>21</b>	<b>3</b>	<b>6</b>	<b>107</b>	<b>175</b>	<b>45</b>	<b>21</b>	<b>128</b>	<b>46</b>	<b>7.6</b>

1. Telecommunications, including repeater stations, exchanges, VHF links and rural phones
2. Water pumps – average around 1.5 kW, 2.0 kW for Japan and 4.0 kW for NORAD (under others)
3. 22 veterinary clinics have 200w for vaccine refrigerators and 200 w for lighting
4. Estimated investment based as far as possible on project budgets.
5. 1992 + 1996 figures are installed and are operating
6. Total installed PV in 1992 was about 72 kW peak, in 1996 is about 314 kW, for total investment of US \$7.6 million

### **5.6.9. Current Initiatives by the Government of The Gambia**

In mid-1984, the Government of The Gambia requested assistance from the Regional Centre for Solar Energy (CRES) in establishing a Gambia Renewable Energy Centre (GREC). CRES, in turn, applied to the GTZ GmbH to delegate a project exploration and project definition mission for the purpose of elaborating a project proposal for a Gambian Renewable Energy Centre (GREC).

The report prepared by the renewable experts on the basis of field studies carried out in the Gambia were incorporated into a project proposal and policy guidelines under the following headings:

- Potential renewable energy sources in The Gambia;
- Potential uses for renewable sources of energy in The Gambia;
- Identified, exploration-worthy project approaches for a Gambia Renewable Energy Centre
- Recommendations concerning the establishment of GREC as a research, development and promotional institution for Renewable Energy Technologies in The Gambia.

The main expectations on the establishment of GREC were as follows:

- GOTG to have a body that provides independent advice to government on matters relating to renewable energy;
- Assist OP in the preparation and implementation of projects falling within the scope of renewable energy technologies or exhibiting some such components;
- Preparing plans based on RE projects;
- Installation and testing demonstration facilities;
- Encouraging the production of RE systems and components in the Gambia;
- Providing training for the operation, maintenance and production of RE equipment, systems and/or components;
- Perform maintenance and repair work on RE systems;
- Initiating or participating in the popularisation campaign for RE equipment;
- Cooperating with comparable West African and other international institutions;
- Coordinating and/or participating in national RE projects particularly donor-funded projects.

The Regional Centre provided the entire funding for the establishment of GREC for Solar Energy (CRES), with GOTG providing funds for the headquarters at the GTTI premises in Kanifing. Due to inadequate capacity, GREC needs to be strengthened and given the visibility it requires to effectively carry out its assigned responsibilities.

### **5.6.10. Technology Options**

The various Renewable Energy Technology options in The Gambia have now surpassed their research/experimental stages. The technology and technical exploration of RE are excellent. Solar water heating, photovoltaic pumps and lighting systems, solar cookers and food dryers and solar powered generators for telecommunication facilities and dispensaries can all be expected to operate with a high degree of utility value.

**a. Wind Energy**

The wind potential in The Gambia, especially in the coastal areas, is characterised by periodic monsoon winds accompanied by sea breeze. But the extent to which wind velocities would suffice for technical exploitation will need to be further ascertained on the basis of long-term wind velocity data. However, from the little data currently available, it would appear that, for coastline villages, multi blade, wind driven pumping systems could be used for supplying villages with potable water, especially with the relatively strong winds during the season, for providing potable water as well as water for small-scale irrigation systems.

**b. Solar Photovoltaic (PV)**

In the purely renewable energy sense, PV technology is very promising and has been widely used in The Gambia, for several years, for certain applications, such as water lifting, community lighting systems and small-scale refrigeration.

**c. Solar Thermal Technologies**

Solar thermal devices such as solar water heaters have proved very effective in The Gambia. However, given the limited market and consequent need to import collectors, coupled with current increases in power generation capacity, the role of solar water heating in this country is, at present, rather limited.

Simple solar dryers for fish and salt drying need to be promoted. Solar cookers, especially the box type, appear to have potential but have not been used extensively, in The Gambia, probably due to cultural reasons. Solar distillers could also be used for desalination or production of distilled water.

**d. Biomass**

Biomass (exclusive of fuel wood and charcoal) also has very little potential in The Gambia. The most promising biomass energy resource, globally speaking, is from sugar cane, from which ethanol for motor fuel can be extracted and fermented, and the residue (bagas) burned to fuel steam or gas turbines. But, due to the absence of large sugar cane plantations, this option is not considered feasible, presently. However, a similar concept proved somewhat attractive during the operating days of the steam turbine plant at the Denton Bridge, in the early 90s, where groundnut shells were used as boiler fuel for power generation.

**e. Biogas**

Biogas or the anaerobic digestion of liquid organic residues such as animal dung, has had very little success in The Gambia. It might still be applicable to specific situations associated with the disposal of slaughterhouse wastes for example.

**f. Gasification**

Gasification of dry organic residues such as sawdust, corncobs and stalks, and coconut husks and corn stocks to fuel small internal combustion engines has, so far, been the least successful of the options available to The Gambia.



*g. Hydro-electricity and Geothermal Energy*

There appears to be little prospects for either geothermal or hydro energy in the Gambia (the Gambia River falls only 30m in 300 km), although there is a possible 200mw or so of power if the proposed barrages were built further upstream in Senegal. However, the sub-regional collaboration through OMVG may increase the potential for hydropower for The Gambia.

**5.6.11. Existing Constraints**

The lack of reliable and affordable energy has come to be considered one of the primary constraints to sustained economic and social development in The Gambia. The country has been particularly hit by the high cost of fuel for power generation and is beset by one or more of the following energy-related problems: -

- Dependence on high cost of petroleum imports with major impact on balance of payment and foreign exchange earnings;
- Rapid rate of biomass depletion and natural resources degradation, primarily associated with uncontrolled exploitation of natural forests (fuelwood) for cooking needs;
- Low agricultural productivity and insufficient improvement in the quality of life for low income rural and urban populations due, in part, to the absence of tools, equipment and systems, which could make more effective use of energy, including renewable energy.

In response to the constraints highlighted above, a wide range of renewable energy projects were conceived and implemented through various donor-assisted projects, namely, GAM/86/C001 (Solar-powered equipment for rural areas) funded by UNCDF, and “The Regional Solar Programme” (RSP), funded by the EC. Under both projects solar-powered equipment were installed primarily for the health, telecommunications, education and social development programmes for provision potable water in rural areas. The Consultant is convinced that it is only through such national donor-assisted projects that more experience could be gained and answers provided for the many questions, which often emerge concerning the extent to which these renewable energy technologies can actually address energy requirements, particularly for our rural population.

It is desirable to appreciate the nature and magnitude of energy-related problems and the potential contribution of renewable energy systems towards solving these priority problems. Constraints to the use of RE devices include the following:

- The human, physical and financial resources available for energy planning and management activities including further research development and promotion of Renewable Energy technologies is absent;
- The relationship of these RE resources to overall government priorities in relation to energy is unclear;
- The lingering question concerning the performance and cost-effectiveness of Renewable Energy systems, to meet end-user needs, is yet to be answered;

- The social and economic acceptability of RE technologies to complement the shortage of energy requirement leave much to be desired;
- Renewable energy technologies, systems and related professional and technical training of local technicians appears to be inadequately matched with national energy requirements and end user needs;
- The production and repair capabilities for RE equipment and systems is still limited throughout much of the country;
- The marketing and dissemination of RE systems for both agricultural and domestic requirements is currently grossly insufficient.

### **5.6.12. Future Outlook**

Throughout the Gambia, there is an urgent need to promote renewable energy technologies because of the possible impact it may have on the following aspects:

#### **Reducing Dependency on Petroleum**

The use of solar energy devices (photovoltaic) wind generators and thermal (water heating) systems, could have a remarkable impact on the reduction of the demand for oil fired electrical power generators.

PV and wind generators can provide cost-effective substitution for diesel pumping system where petroleum fuels are either too expensive or unavailable. However, savings will probably be quickly realised through improvement in energy-efficiency and better management of energy resources, particularly in the transportation, commercial and industrial sectors.

#### **Reducing Biomass Depletion**

The contribution of improved wood stoves to slowing down the rate of biomass depletion may be more limited than originally thought, but experience has somewhat confirmed in The Gambia that improved stoves have actually helped reduce deforestation rates in the country. Field demonstrations have actually supported this statement.

#### **Improving Quality of Life**

Renewable energy systems can provide some improvement to the quality of life of the low-income rural and urban population. A major need throughout The Gambia, is to reduce the time and effort required to obtain basic social amenities, PV and wind systems (and perhaps biomass fuelled systems) may be important in situations where water demand is high and the source is limited or difficult to access.

### **Use of Renewable Energy for Agriculture**

The use of water is vital for improvement of farming conditions for rural dwellers. Agricultural practices in The Gambia are very different in terms of gross output and quality/quantity due, primarily, to its heavy dependence on weather conditions. The installation of PV (Solar) small/medium scale irrigation systems could reduce these adverse effects.

### **Rural Health Care**

Most of the people living in rural areas of the Gambia have no easy access to conventional medicine. For instance, in order to have a simple vaccine, some people usually have to walk miles to the nearest health centre and in some cases they would prefer to ignore the timetable for their vaccination and when they do so, their health is compromised. The installation of a solar powered refrigerator/freezer that could preserve vaccines at a nearby health facility could help improve this situation and will positively improve the socio-economic development of villages.

### **Education and Training**

It is generally accepted that education and training are the key factors to social and economic development. This becomes urgent in the Gambia where the illiteracy rate is among the highest in the world. Therefore, it is an important goal for government to implement, within a reasonable period of time some measures to meet basic education needs such as: -

- Improving the supply of trained teachers in rural schools combined with the use of solar powered TV satellite systems in order to provide locally suitable adult education programmes.
- Utilising solar energy devices in setting up well-defined regional structures to promote periodic day as well as night-time training programmes at several levels (solar powered training centres) where people from neighbouring rural villages may come and acquire relevant knowledge and skills on specific tailor-made training courses especially in agricultural development.

### **Rural and Peri-urban Electrification**

Solar photovoltaic lighting systems are well adapted for use in rural areas. These typically include one or two solar modules 3-4 lights, a battery bank and a simple battery charge controller. Since agriculture is an important economic activity for a considerable number of people living in rural areas of the Gambia, it is necessary to conduct a major literacy campaign stopped at night in most cases. The installation of communal solar lighting system could very well influence the illiteracy level in each region of the Gambia.

The Gambian geographic location endows it with abundant sunshine. There are opportunities for far reaching applications of renewable energy technologies for various applications.

Therefore, Renewable Energy may be one of the most promising sustainable sources of energy production for The Gambia. For rural areas in particular, it may be the quickest and to some the only way that basic electricity supply can be provided for them in the foreseeable

future. Since rural development is one of the most crucial issues today, it is very important for government to act with maximum speed and effort to raise the standard of living and quality of lives for all Gambians particularly those living in rural areas. The provision of energy is a very crucial requirement for these purposes and that intimately bonds with all processes of rural development. Renewable energy technologies when utilised can go a long way in meeting some of the fundamental energy requirements of the Gambia population.

## **6. ENERGY IN THE CONTEXT OF ENVIRONMENT AND SUSTAINABLE DEVELOPMENT**

The crucial role of energy in sustainable human and national development cannot be over-emphasised. The provision of basic human needs is contingent, inter alia, on reliable energy supplies, while the level of confidence in and sustainability of the energy supply chain are some of the major indicators of successful energy policies. Energy impacts on most, if not all, socio-economic aspects including poverty, population, health, gender, the environment, investment in industrial and agricultural development and foreign exchange. A policy that targets the provision of sustainable energy supplies does facilitate the realisation of various other national development objectives.

Energy policies impact on food security and sustainable development. On this score, it is worthy of note that The Gambia is regarded as one of the most food insecure countries in Sub-Saharan Africa (Interim Strategy for Poverty Alleviation II, January, 2001). A very large proportion of the population continues to live in poverty due to a variety of factors including limited access to high quality energy, on a sustainable basis, for food production and other imperatives, to facilitate sustainable development. Currently, despite considerable assistance from various sources (bi-lateral and multi-lateral), over the years, the overall results in the development of the country's energy sector have not been encouraging. One of the principal reasons for this setback has, apparently, been that greater focus has not been placed on energy demand issues, as the point of departure, in the quest for sustainable energy strategies that could make a significant contribution to sustainable development.

Meanwhile, environmental concerns vis-à-vis energy development have intensified, over the years, with the adoption of some environment-related World Conventions, in 1992 – the United Nations Framework Convention on Climate Change (UNFCCC), and subsequently, the United Nations Convention to Combat Dessertification (UNCCD), and the Convention on Biological Diversity and other similar treaties.

### **6.1. Role of Energy Efficiency in the Energy Policy**

It is widely accepted that the current patterns of energy production and use are very inefficient and therefore not sustainable. The energy policy formulation process should recognise the fact that energy demand increases as population increases. In the traditional energy sub-sector, energy generation could lead to depletion of natural resources (forests etc) while, with thermal energy, emission of more Greenhouse Gases (GHG) that increase pollution of the environment would occur unless there are policy guidelines for mitigating these adverse effects and promoting efficient energy use to save energy resources and costs.

Energy Efficiency should be one of the basic criteria for selecting energy technologies. Research has shown that, with energy efficiency, both fuel and energy consumption are lower than without energy efficiency. To facilitate sustainable development, it is prudent to promote economic activities and technologies that are less energy consuming and less polluting, thus contribute to the following:

6.1.1. Energy savings at both the enterprise and national levels;

6.1.2. Promotion of renewable energy and energy substitution; and

6.1.3. Efforts targeting equilibrium between socio-economic benefits, quality of life and the environment.

The Energy Policy should emphasise energy efficiency and management that could contribute tremendously to solving The Gambia's energy problems through, inter alia, the following:

- Demand side management (e.g., with electricity - scrupulous management of energy use in buildings, industry, agriculture and appliances);
- Private sector involvement;
- Transport efficiency – taxis, cars, public transport, rail/river versus road development;
- Subsidies (if considered appropriate) – source, amount, timing and phasing.

The Policy should create the conditions that facilitate implementation and adoption of energy efficiency measures as tools for generating socio-economic benefits and mitigating greenhouse gas emissions. To this end the feasibility of implementing programmes for pilot and capacity-building activities should be explored.

## **6.2. Energy Policy vis-à-vis the Environment-related Conventions**

### **6.2.1. The United Nations Framework Convention on Climate Change (UNFCCC)**

Ideally, energy development policies should target the utilisation of energy sources and technologies that would result in the lowest possible GHG emissions, the principal gases being carbon dioxide, methane, nitrous oxide, Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and sulphur. Scientific evidence shows that the anthropogenic (human-induced) emissions of these gases absorb solar radiation and re-emit it to the earth, thus causing a rise in the earth's temperature. The adverse effects of the rise in temperature are predicted to include sea level rise, coastal erosion, inundation of low lying areas, drop in agricultural production and depletion of natural resources.

In adopting the United Nations Framework Convention on Climate Change (UNFCCC), in 1992, all the 179 Parties (developed and developing countries) affirmed “that responses to climate change should be coordinated with social and economic development, in an integrated manner, with a view to avoiding adverse impacts to the latter (economic

development), taking into full account the legitimate priority needs of developing countries for the achievement of sustainable economic growth and the eradication of poverty”.

The Convention also recognises “that all countries, especially developing countries, need access to resources required to achieve sustainable social and economic development and that, in order for developing countries to progress towards that goal, their energy consumption will need to grow, taking into account the possibilities for achieving greater energy efficiency and for controlling greenhouse gas emissions in general, including the application of new technologies on terms which make such an application economically and socially beneficial”.

Furthermore, signatories to the Convention are guided by various principles, including the following:

- Giving full consideration to the specific needs and special circumstances of developing countries, especially those that are vulnerable to the adverse effects of climate change; and
- Promotion of sustainable development, taking into account that economic development is essential for adopting measures to address climate change.

Thus, while the UNFCCC and its off-shoot – the Kyoto Protocol - seek to limit Greenhouse Gas (GHG) emissions of developed countries, they provide developing countries (including The Gambia) that are not endowed with “clean” energy resources or the technologies for generating clean energy, some flexibility in GHG emissions to enable them devise rational energy policies to facilitate sustainable development. However, due to the global nature of the adverse effects of GHG emissions, the long-term perspective for energy use in this policy should be the utilisation of technologies with limited GHG emissions.

### **6.2.2. United Nations Convention to Combat Desertification (UNCCD)**

The United Nations Convention to Combat Desertification (UNCCD) is conscious that sustainable economic growth, social development and poverty eradication are priorities of developing countries affected by drought and desertification, particularly in Africa, and are essential to meeting sustainability objectives. The Convention reaffirms, inter alia, “the Rio Declaration on Environment and Development which states (in its Principle 2) that States have, in accordance with the UN Charter and principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or areas beyond the limits of national jurisdiction”. This necessitates sub-regional collaboration in the utilisation of energy resources that traverse national boundaries.

It is noteworthy to mention that, under the Convention, The Gambia has the obligation to “address the underlying causes of desertification and pay special attention to the socio-economic factors contributing to the desertification process and to provide an enabling environment by strengthening, as appropriate, relevant existing legislation and, where they do not exist, enact new laws and establish long-term policies and action programmes”.

Furthermore, the Convention advocates national action programmes which ensure, inter alia, sustainable management of natural resources; sustainable agricultural practices; development and efficient use of various energy sources; and institutional and legal frameworks. These aspects should be considered in devising provisions in this policy for the exploitation of traditional energy sources such as firewood and charcoal.

Thus, the UNCCD sounds words of caution relevant to the exploitation of traditional energy sources.

Furthermore, while willingly participating in global prescriptions for energy development and use, under the World Conventions, this policy should be geared towards the use of energy sources that meet efficient and cost-effective systems that yield the desired benefits.

# **FINDINGS AND RECOMENDATIONS**

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## **1. GENERAL**

The findings and recommendations presented below are based on the Consultant's assessment of the current situation of the Sector, taking into account some of the views and recommendations presented in past studies conducted on the different sub-sectors. On institutional, legal, regulatory and reform issues, the Consultant acknowledges the relevance of the following Reports: Institutional, Legal and Regulatory Framework - The Gambia Energy Reform and Infrastructure Project (by Stone and Webster Management Consultants, Inc., May 2000); and the World Bank Energy Reform and Infrastructure Project- "Hydrocarbon Sector Study", The Gambia (by Aker Geo Petroleum Services, July 2001). Some of the recommendations of these two reports are included in the recommendations below.

The Consultant is also aware of the status of the following instruments that have a bearing on the Energy Policy being formulated herein:

- The Utility Regulatory Bill, prepared jointly by the Commonwealth Office (under Technical Assistance) and the Solicitor General's Office; and the Draft Energy Law (by Stone and Webster Management Consultants, Inc.) currently being reviewed by Government;
- The Divestiture Act, by which the Gambia Divestiture Agency (GDA) was set up, has already been passed by Government;
- A Draft Electricity Law also being discussed by a Cabinet Sub-Committee.

### **1.1. Policy Coordination and Monitoring of the Energy Sector**

- a. Due to the inter-relationship between the different branches of the energy sector (and, perhaps, between public utility sub-sectors), the limited size of the Gambian market and the limited resource situation in the Country, terms of finance, existing facilities and human resources, the establishment of a coordination/monitoring organ for the Sector is hereby recommended. The organ should have some level of competence in the work of the entire sector. Considerable gains are foreseen in the co-ordination of efforts in the sector both in terms of benefits from global planning for the coordinated use of resources, resource allocation and utilisation and resource management in day-to-day operations.
- b. The Energy Unit in the Office of The President (OP) responsible for the Energy Sector, should be strengthened and its human resources developed, adequately, to enable it effectively coordinate the Sector.

### **1.2. Utility Regulatory Agency**

- a. The proposed Utility Regulatory Agency (Multi-sectoral) should handle regulatory matters of the Energy Sector.

## **2. PETROLEUM PRODUCTS SUB-SECTOR**

### **2.1. Institutional, Legal, Regulatory/Monitoring Framework**

- a. There is need for regulatory procedures to ensure safety, security and delivery of high quality products and to, inter alia, avoid the tendency for abuse of procedures or collusive tendencies;
- b. Consideration should also be given to the institution of minimum safety and quality standards and the issuance of licences for the various activities in the import/supply/resale chain, such as for transportation, storage, and wholesaling/retailing and distribution operations.
- c. In instituting any legislation, it is imperative that a regulatory mechanism be put in place, within an institutional framework, to monitor and ensure compliance to make the legislation meaningful. Also, the mechanism must be free from external influences in administering its enforcement tasks. The Regulatory Agency shall ensure the following:
  - i. The petroleum sector acts safely in order to avoid unacceptable harm or danger to people, environment and/or assets;
  - ii. All required fiscal metering is performed in accordance with the regulations;
  - iii. The petroleum pricing mechanism functions in accordance with the regulations, resulting in open competition;
  - iv. The tax system functions in accordance with existing regulations;
  - v. Product quality measures up to international and national standards and in accordance with Gambian regulations.

### **2.2. Legislation**

- a. It is recommended that Government introduces legislation for the transportation, storage and use of petroleum products.

### **2.3. Unloading and Oil Spill Risks**

- a. Currently, the only facilities available are the Banjul Port unloading facilities and the Half-Die depot, shared by ELF and Shell, with Shell as owner and operator. Castle Oil receives petrol and Gas Oil at the Port direct into road tankers to feed into their distribution network and storage facility. It is a general perception that considerable cost-saving in distribution costs is possible by sharing distribution facilities.
- b. The overall conclusion of the inspection and survey conducted by the World Bank Consultants who did the “Hydrocarbon Sector Study” was that the Banjul Port is too exposed to oil spills from the pipeline. According to the Study, one metre length of the pipeline appears to be badly damaged/corroded, and approximately 10 of the pipe

supports are also seriously damaged. The damaged pipe supports are in the same area as the damaged piece of pipe, and only the visible part of the pipeline was inspected. It is recommended that the entire length of pipe be thoroughly inspected and any damage on it repaired to prevent spills.

- c. A Contingency Plan for the Port exists. The plan describes specific scenarios and related emergency preparedness. Furthermore, there is a list of telephone numbers to be used in case of any emergency. However, the plan, which was prepared in 1995, appeared to be in draft format and did not conform to international standards. Referenced requirements are given in standards for safety management such as the ISM Code, ISO 14000 related to Environmental Management or ISO 9000 series related to Quality Management. The Plan should be driven closer to these standards if it is to be taken seriously.
- d. Also, the Oil Spill Contingency at the Banjul Port is not dependable due to ill-maintained contingency plans such as oil spill equipment and dispersing chemicals not being readily available in an emergency, and furthermore lack of trained Oil Spill Contingency teams/personnel. The Gambia Port Authority (GPA) has Oil Spill Clean-up Equipment kept in a container in the Port area, but it is not easily accessible in an emergency. Hence, there is currently a serious risk that oil spills will not be cleaned up speedily enough to prevent the spread to environmentally sensitive areas such as nearby beaches. There is an urgent need for more adequate preparations for oil spills.
- e. **Oil spill/fire response:** The Fire and Ambulance Brigade is responsible for Emergency Contingency (emergency preparedness) for matters on land, while the Port Authority is responsible for matters at sea. The prevention of accidents should be enforced by regulations relating to the safe unloading and transportation of hydrocarbon products. Legislation should also be introduced concerning improvements in the inspection and control of transport vehicles and vessels.
- f. Guidelines for establishing and maintaining contingency plans are recommended to include detailed training requirements for individuals. It is also recommended that drills and exercises be executed at least twice a year to ensure that the team is able to muster and stop any severe oil spill/fire. Furthermore, the corroded piece of pipeline and pipe support needs immediate replacement.
- g. HFO is unloaded at the Port directly into trucks, which poses a lower risk than the unloading of lighter petroleum products. The potential spilled volume of HFO is much less, but the impact on the environment would be much more severe than for the lighter products.

## **2.4. Storage and Distribution**

Reports of various studies (including the World Bank Energy Reform and Infrastructure Project – the Hydrocarbon Sector Study, July 2001) on the Half Die petroleum storage depot concluded that although the probability of having significant fire/explosion is low, any major incidents there would have adverse consequences for the Gambia's national economy as well as cause multiple fatalities. As such, the safety and environmental risks related to the Half Die Depot are considered to be quite significant. Hence, the following recommendations are made with respect to the safe storage and distribution of petroleum products:

- a. Swift action should be taken on the relocation of the Half Die fuel depot, considering the hazards highlighted in the Study Reports provided by Shell Oil and ELF, especially the health, safety and environmental risks associated with the current location. It would appear the major bottleneck in deciding on the issue is the question of who should meet the various relocation costs. The Consultants are convinced that petroleum products, especially volatile fuels such as petrol, should not be stored in heavily populated areas. It is, therefore, strongly recommended that Government takes a decision, urgently, on the relocation issue to facilitate relocation of the depot to a more suitable and safer place, outside Banjul, thus forestall a major disaster that could occur resulting from spillage, accidents or other unfortunate incidents.
- b. A review study should be conducted, urgently, to examine various issues on the relocation exercise, including the following:
  - i. A review of the options presented in the Studies done by Shell and Elf, respectively
  - ii. An assessment of the relocation costs;
  - iii. Work out modalities for meeting the cost elements;
  - iv. Decide types of products to be stored;
  - v. Determine an ownership structure for the new depot/depots.
- c. Construction of the new depot to international standards;
- d. Increasing the storage capacity (to include HFO) of the new depot to reduce procurement costs, thereby reducing the domestic price of petroleum products;
- e. The Common Carrier concept should be applied to the main depot including the port unloading facilities, the sub-depots and the jet fuel depots at the Banjul International Airport;
- f. In order to support development of the eastern parts of the country and secure the Gambia's national reserves, at least two smaller depots should be built at strategic locations upstream of the River Gambia. These depots can be supplied either by barge or road tanker.

## **2.5. Supply/Storage of Heavy Fuel Oil (HFO)**

- a. A reliable, uninterrupted supply of HFO for power generation is of utmost importance for the electricity supply in The Gambia, and indeed a basic prerequisite for other business and community developments. Therefore, the HFO storage volume and number of tanks required need to be addressed in view of the anticipated future demand for HFO and other factors including ship parcel sizes and cost of inventories.
- b. It is also recommended that plans for a new HFO storage tank at the power plant be considered.
- c. It is strongly recommended that additional storage capacity for HFO be built. The new storage tanks could be situated either in Banjul, considering its low volatility, or at a new location, elsewhere. Unloading from ships should then be by a separate heat-traced and insulated pipeline.

- c. Alternatively, if it is decided to build a new jetty in connection with a new depot, the possibility of having a direct unloading pipeline from that jetty to the power plant should be explored.
- d. It is recommended that a HFO transfer optimisation study be carried out. Should the existing depot be moved out of Banjul to a location closer to the power plant, a pipeline may be more economical, depending on volumes and the distance between the two facilities.
- e. It is recommended that the new storage tanks be the property of the depot, and that NAWEC should pay a fee based on throughput for handling of the HFO.
- f. It is proposed that the new HFO storage tanks with associated facilities and pipeline(s) are included in the oil depot.

## **2.6. Improvement of Pricing Structure**

- a. Petroleum duty and sales tax revenue form a significant part of total fiscal revenues and international trade revenues for the country. The GOTG should therefore analyse and review the cost elements in the petroleum product pricing formula with a view to reducing costs of petroleum products in the immediate and medium-term. The establishment of a very transparent system is recommended, where the hydrocarbon products are purchased after a competitive bidding process. In this respect the principle of “common carrier” must be established.

## **2.7 Private Sector Participation**

- a. The private sector should be encouraged to participate more in the importation and marketing of petroleum products to foster competition and help lower the market prices of petroleum products, thus facilitate access to the various products.

## **2.8. Safety and Environmental Concerns**

- a. High standards of safety should be established in the importation and use of petroleum products. In addition, the impact on the environment should be carefully considered and clear and appropriate ground rules drawn up.

## **2.9. Establishment of a Small National Laboratory**

- a. There are, currently, no laboratory facilities in The Gambia for testing petroleum products. Samples of jet fuel for re-certification and other quality checks must be sent to the refinery in Dakar, Senegal, which takes a long time. In order to build expertise within the country and improve quality control on petroleum products, the establishment of a small national laboratory is recommended. A national laboratory will enable GOTG to perform spot checks on petroleum products to ensure that the quality of products marketed in The Gambia is up to standard.

- b. The Gambia, being a small nation with limited resources, would benefit from initiating actions relying on synergy effects from coordinated approaches for establishing a national laboratory, testing facility and research institute in cooperation with the Gambia Technical Training Institute, Gambia College and the University of The Gambia University.
- c. Environmental protection measures in The Gambia are in line with international standards, but there is room for improvement especially on enforcement aspects.

## **2.10. Options and Recommendations on Hydrocarbon Exploration and Exploitation**

- a. The Gambia imports all its petroleum product requirements. This is a major cost for the country, which means that a commercial discovery will significantly reduce the nation's import bill. However, it is important to be aware of the necessity for very good planning before starting any costly drilling operations, since it is known from statistics that 1 out of 4 exploration wells in such an environment fails to fulfil the objective of penetrating the targeted formation due to technical problems (*source: The World Bank Energy Reform and Infrastructure Project-ENG80/143/01/111/30 "Hydrocarbon Sector Study, The Gambia*).
- b. Exploration for oil and gas is high risk and costly. The main players are international companies willing to invest capital in projects all over the world. Normally, these companies have more opportunities than they have capital for, and therefore they give priority to project opportunities based on hydrocarbon potential including geological risk, fiscal and legal conditions as well as political stability in the countries.
- c. It is not advisable for The Gambia to spend huge amounts of capital in such risky areas as exploration activities. This should be left to the international oil companies. However, it will take time before the result of the first deep-water drilling is available. Hence, it is recommended for The Gambia to initiate new studies complementary to the work of the oil companies. These initiatives should include some seismic acquisition on open acreage in shallow water and onshore. The resulting data may reveal prospectivity making the acreage very attractive to the international oil industry, and the acreage may be offered to the international oil industry under conditions that are very favourable for The Gambia.
- d. There is the need for continuous support for hydrocarbon exploration and exploitation of oil and gas.
- e. More private sector participation should be encouraged in oil exploration and prospecting.

## **2.11. International Cooperation (Hydrocarbon Exploration)**

- a. Since Geology does not necessarily follow national boundaries, cooperation with neighbouring countries should be established, and cross-sections over boundary lines generated to adopt a cross-border approach for information collection and exchange.
- b. Mauritania, Senegal, The Gambia, Guinea-Bissau and Guinea Conakry (MSGBC) focus their attention on promotion of their hydrocarbon resources. To optimise petroleum

promotion in the region, more seismic acquisition across national boundaries is recommended, together with follow up studies.

- c. Licensing terms and petroleum laws should be harmonised between the countries, as in the mining sector. MSGBC must continue and be open for cooperation on the harmonisation of policies, strategies, regulations and fiscal regimes, for efficient implementation of programmes.
- d. The sub-regional oil and gas conference should be established as an annual or semi-annual conference.
- e. Collaboration with countries such as Norway and Canada is recommended. Such countries have excellent credentials and considerable expertise in modern oil technology. It is anticipated that these countries can assist in Human Resources Development for efficient management of sub-regional petroleum resources.

### **3. LIQUIFIED PETROLEUM GAS (LPG)**

#### **3.1. Regulatory Framework**

- a. The Consultant's overall conclusion is that the operational safety standards for LPG in The Gambia are lower than is acceptable.
- b. Moukhtara Holdings Company (MHC) is currently constructing major LPG landing and storage facilities at Bonto and, according to the Company, the facilities will be built and operated according to recognised international codes and standards. In order to monitor compliance, it is proposed that a regulatory framework administered by a government body set up to grant permits and supervise inspections of all LPG installations.
- c. Government should introduce legislation binding safe storage, transportation and use of LPG. The legislation should meet international environmental and safety standards. GOTG should decide which international codes and standards are best suited for The Gambia. These measures would help eliminate unsafe handling and encourage common use of facilities by private concerns, which are unable to fulfil the requirements

#### **3.2. Storage and Distribution**

- a. The Common Carrier concept should be applied to the new LPG terminal, including barges and a bottling station. This will require an agreement with Moukhtara Holding Company, which is currently developing this project.

#### **3.3. Access and Safety of Use**

- a. The use of LPG (a relatively clean fuel) has major advantages including lower emissions of greenhouse gases and greater efficiency than traditional energy resources. Greater access and safe use of LPG, as one alternative to fuel wood (forest-depleting) should be promoted through:



- i. Creation of incentives, initially, that far outweigh the price advantage of fuel wood, to enable people appreciate the value of using LPG;
- ii. Encouragement of more private sector participation;
- iii. Review of the pricing structure and introduction of some form of regulation to ensure that the benefits from the Government incentives are shared with consumers;
- iv. Prescription of safety standards for handling, transportation, storage and distribution;
- v. Awareness raising programmes to educate communities on the safe use of LPG;
- vi. Introduction of a start-up subsidy (donor-funded) to overcome one of the major drawbacks to the use of LPG - the relatively high cost of the prerequisite equipment (the cylinder, burner and stand). The subsidy can operate for a limited period of time, to encourage consumers to LPG with a view to adopting it for cooking.

### **3.4. Private Sector Participation**

- a. The local private sector initiative, by Moukhtara Holdings Company (MHC), currently underway at Bonto, Western Division - the construction of a jetty and storage facilities for receiving bulk imports of LPG - should be supported, as a contribution towards fulfilment of the objectives outlined for LPG. It is hoped that operation of the facility, when completed, would contribute, significantly, to a reduction in the retail price of LPG and also facilitate access by consumers.
- b. MHC should be encouraged to further develop their concept and to explore solutions with respect to ownership and operations that are in accordance with the “common carrier” concept.

## **4. ELECTRICITY SUB-SECTOR**

### **4.1. Institutional Restructuring/Development**

- a. The existing institutional structure for the electricity sub-sector is fragmented and should be reviewed with a view to fostering closer and more effective co-ordination of activities. On this score, there is considerable merit in implementing the reforms recommended in the Institutional, Legal and Regulatory Framework Study (by Stone and Webster Management Consultants, Inc.) and the World Bank Energy Reform and Infrastructure Project-“Hydrocarbon Sector Study”, The Gambia (by Aker Geo Petroleum Services, July 2001). Currently, the sub-sector is under the purview of different national institutions/agencies, and implementation of activities necessitates dealing with at least two Government institutions. It is, therefore, suggested that the recommendations of the two studies be adopted and implemented without delay.

- b. To facilitate better planning, effective management, resource allocation and divestiture, NAWEC should be unbundled into its Strategic Business Units (SBUs). A cost model for each SBU, reviewed against the industry's best practice, would reveal the levels of performance and targets at any point in time. The SBUs can be Electricity Generation, transmission and distribution, water production, water distribution, commercial services sewerage and management.
- c. It is also recommended that the projected power generation capacity for the country, for the medium- to long-term be pronounced and both local and international bids solicited for Build Operate and Transfer (BOT) arrangements for power generation, to meet the local demand.

#### **4.2. Human Resources Development**

- a. There is an urgent need to strengthen the human resource capacity of the sub-sector by building a critical mass of expertise in all areas through:
  - i. Development and funding of a comprehensive human resources development plan looking at the sub-sector's manpower requirements at all levels; and
  - ii. South-South Cooperation, using links established with SENELEC in SENEGAL, the Electricity Corporation of Ghana and ESKOM in South Africa, to provide hands-on experienced for existing staff, including Engineers, Technicians and Managers, to operate and maintain the electricity supply, and the transmission and distribution system, on a sustained basis.

#### **4.3. Power Generation, Transmission and Distribution (T&D) and Maintenance**

- a. The current electricity production capacity is insufficient to meet the demand of the urban and rural areas, and deserves urgent attention and effective future planning. The low generating capacity has, over the years, seriously limited the nation's investment potential and adversely affected productivity and efficiency in some productive sectors including tourism, agro-industries, manufacturing and the service industries.
- b. The capacity constraint in the existing T&D Network also seriously limits the extent to which power generated can be transmitted to consumers. In fact, without rehabilitating and expanding the T&D network, providing additional generators and generating power beyond the current capacity of 30 megawatts would be meaningless. Hence, while giving consideration to the procurement of new generating sets, to meet both existing and future demand, urgent attention should be given to rehabilitating and expanding the T&D Network, as appropriate. On this score, the elements defined by Electricite de France (EDF) in their study report on the Rehabilitation and Expansion of the Medium and Low Voltage Network (funded by Agence Francaise de Development - AFP) should address the current deficiencies in the T&D.
- c. NAWEC informed Sahel Invest Management International during discussions that, further to the EDF Study they (NAWEC) have now contracted a US\$15 million project to rehabilitate and extend the T&D network in the Greater Banjul Area. This initiative

should be pursued with utmost urgency to pave the way for further investments in additional generating capacity.

- d. The interconnection of electric power systems in OMVG Member-States with a transmission line of 225KV is a key project of the Organisation that will complement the US\$15million T&D Network rehabilitation. There is also the recent initiative to create the West African Power Pool. However, since the rehabilitation and expansion of the local T&D Network is a prerequisite for realising benefits from the two initiatives mentioned above, it should be undertaken very urgently.
- e. The rehabilitation activities on the T&D Network should be prioritised, according priority to those aspects that assure safety of personnel, given the hazardous environment in which maintenance and repair work is often undertaken.
- f. More energy-efficient generators and associated infrastructure should be planned for towards reducing power generation costs and increase electrification rate.
- g. Use of pre-payment (Cash Power) Meters should be made statutory to reduce losses from fraudulent connections and also minimise wasteful use of electric energy.
- h. Regular and effective maintenance of existing facilities and services (generating sets and the T& D network) is absolutely necessary to ensure utilisation of available potential to the fullest extent.

#### **4.4. Machinery Replacement**

Power supply in The Gambia, over the last 23 years, has been characterised by frequent blackouts resulting from various factors including ineffective planning of both maintenance and repair operations, and human resources development; and lack of a clear replacement policy for generators, transmission and distribution networks and associated equipment/systems. While proposals have already been made for addressing some of the constraints highlighted above, it is recommended that the following should form the basis for a machinery replacement policy:

- a. Immediate plans for replacement of NAWEC's aged generators (G1, G2 and G11), to pre-empt a steep drop in power supply capacity resulting from sudden breakdowns in one or more of these generating sets.
- b. Long-term planning for replacement of other generators, equipment and operating systems being acquired now or to be acquired sometime in the future.

#### **4.5. Hydro-electricity**

- a. In addition to the locally generated electricity (thermal), national interests in the hydro-electricity to be generated under the OMVG Energy Masterplan should be pursued for its lower cost and the potential to increase access rates to electricity by Gambian consumers. If fully exploited, the initiative can provide a total of up to 208 megawatts of electric power to the four countries (The Gambia, Guinea, Guinea Bissau and Senegal), in the

medium term. However, rehabilitation and expansion of the Gambia's existing T&D network is one of the pre-requisites for realising full benefits from the OMVG initiative.

#### **4.6. Rural Electrification**

- a. Recognising the noble objectives and socio-economic benefits of rural electrification, the current project, targeting 46 towns and villages, should be implemented as a matter of urgency, and funding possibilities explored for more projects, to increase the number of beneficiary-villages and accelerate the rural development and poverty reduction processes.
- b. The possibility of using Solar PV systems, as one of the options for providing electricity to remote villages not connected to the electricity grid, should be explored.

#### **4.7. Surveys/Studies/Research**

- a. An electricity demand survey should be commissioned, as soon as possible, to provide the basis for medium and long-term planning of electricity supplies. It is projected that, where distribution capacity is increased, embargoes lifted, electricity demand within Greater Banjul alone would rise dramatically to the extent that it would negate the current reserve capacity, hence the need for demand assessment.
- b. There should be a comprehensive study on transmission and distribution losses with a view to devising the most appropriate means of reducing the losses.
- c. Research should be conducted on more energy-efficient technologies for electricity generation, in the light of the rapidly growing demand, to prepare the ground for higher levels of inward investment in the country and reduced dependence on oil.
- d. More cost-effective options should be sought for disposal of sludge from the heavy fuels being used for electricity generation. One option could be to experiment on electricity generation with steam turbines, using the sludge as fuel, in which case the sludge would become a valuable resource.
- e. The tariff structure and pricing of electricity should be reviewed.

#### **4.8. Private Sector Participation**

- a. Legislation and regulatory procedures should be developed to include private sector participation in electric power generation, to encourage competition and delivery of electricity to consumers at the most cost-effective rates.
- b. The incorporation of Gampower one of the first IPPs in Africa and its eventual success is a key motivator for other IPPs to follow suit.

## **5. DOMESTIC (TRADITIONAL) ENERGY SUB-SECTOR**

### **5.1. Institutional Aspects**

- a. There should be a programme for strengthening institutions that play key roles in the traditional energy sub-sector, such as the Department of Forestry (DOF), and the Energy Division of the Department of State for Trade, Industry and Employment.
- b. Public sector institutions assigned regulatory functions should create an environment that would foster a participatory approach involving the private sector, NGOs and the grassroots in the harnessing of traditional energy resources and the promotion of proven technologies to address demand, bearing in mind the gender dimension.

### **5.2. Legislation**

- a. Government should consider approving the draft Forestry Bill to be discussed in the National Assembly to facilitate implementation of measures planned by DOF for harnessing forest resources.
- b. On the supply side, consideration should be given to conferring rights of forest resource exploitation to rural communities, subject to the provisions in existing legislation, while the promotion of agro-forestry should be a shared responsibility among all parties. For this reason, there should be legislative reform establishing property and exploitation rights in conjunction with the decentralisation of administrative responsibilities.

### **5.3. Conservation of Traditional Energy Resources**

- a. It is imperative that domestic energy sources be effectively managed to assure sustainability of supply. Use of fuel wood pre-dominates among rural communities and a very significant proportion of urban dwellers, due to its relatively low cost. Considering the adverse environmental impacts of exploiting fuel wood, the following recommendations (emanating from the Review of Policies in the Traditional Energy Sector - RPTES, 1994, but yet to be implemented) are relevant to address current threats to the Gambia's traditional energy resources:
  - i. Without revoking the ban on domestic production of charcoal, the importation of limited quantities, as a fuels source, should not be discouraged;
  - ii. Government should legalise the transfer of management responsibilities for forests to local populations, thus permitting the mass replication of the on-going Community Forest Management Demonstration Project;
  - iii. Harvesting of green trees for wood fuel should be permitted in zones that have been brought under community management (wood lots), under the provision of agreed management plans between the communities and Forestry Department, while more environment-friendly alternatives to fuel wood are sought;

- iv. It is recommended to carry out another biomass inventory, which will permit the analysis of change in land use since 1980, and the establishment of permanent sample plots to measure productivity on a regular basis;
  - v. To maintain a broad spectrum of consumer choice of fuels, every effort should be made by the private sector to reduce the cost of hydrocarbon fuels as substitutes, in particular by attempting to lower the cost of importing, storing and bottling of LPG, and further examining the prospects for kerosene as a cooking fuel;
  - vi. The Division of the Department of State responsible for energy should be adequately staffed and trained to take care of minimum requirements for coordination and liaison, and to effectively supervise the establishment of a central energy documentation centre.
- b. Plans should be made for rapid forest regeneration to address the current decline in forest cover, occurring as a result of serious competition for the meagre productive land resources, over-exploitation and the relatively high annual population growth rate of 3.2% in rural areas.
  - c. Measures should be instituted for curbing or minimising the forest-depleting effects of firewood harvesting and use, to assure sustainability of the resource. An intensive re-forestation programme should be embarked upon, including intensification of the on-going Community Forestry effort being implemented by the Department of Forestry.

#### **5.4. Research and Public Awareness**

- a. Further adaptive research should be conducted on the development of energy-efficient technologies for utilising traditional energy resources. A major effort should also be mounted to promote and increase access to these technologies by end-users.
- b. A comprehensive programme on awareness raising should be embarked on to educate rural communities on the benefits of forest management.
- c. Research into bio-fuels (alcohol/gelfuel and bio-diesel), plantations such as cashew and other energy crops should be undertaken in the quest for alternative fuels.

### **6. RENEWABLE ENERGY SUB-SECTOR**

#### **6.1. Legislation**

- a. Legislation should be formulated and passed according incentives and encouraging private sector participation in the further development, promotion, marketing and increased use of PV systems. Incentives should include tax-free concessions on all renewable energy devices and components, to facilitate widespread adoption.
- b. A capacity-building programme for the Gambia Renewable Energy Centre (GREC) and the private sector should be embarked upon to enable them maintain renewable energy devices, in the drive towards sustained use.

## **6.2. Research and Development / Networking**

- a. The Gambia should enter into co-operation agreements with other southern countries that have the know-how on the development of renewable energy technologies such as solar, wind and biomass energy, and the use of biomass digesters for decentralised electric power generation, by in-country institutions such as the Gambia Renewable Energy Centre (GREC), through sub-regional, regional or international collaboration.
- b. Agricultural potential should be harnessed by exploring more energy-efficient crop cultivation and irrigation systems to elevate farmers from subsistence level.
- c. Solar Photovoltaic (PV- direct conversion of sunlight into electricity) systems have proved viable in The Gambia, beyond doubt, for various applications including water lifting, broadcast reception and telecommunication, refrigeration of vaccines and other medicines in rural areas and for urban, community and domestic lighting.
- d. Modalities should be worked out for widespread use of PV technology; solar drying (of fish and other produce), cooking and water heating in The Gambia to, inter alia, help reduce fuel imports and Greenhouse Gas emissions into the atmosphere. Consideration should also be given to creating a mechanism for providing interest-free loans for the acquisition of PV devices (as practised in some countries), as one option for increasing the adoption rate.

## **7. ENERGY, THE ENVIRONMENT AND SUSTAINABLE DEVELOPMENT**

It is imperative that energy development be undertaken to facilitate sustainable development by ensuring minimum adverse effects on the environment. In particular, it should be oriented towards the following:

- 7.1. Facilitating access, by rural communities, to affordable energy, on a sustainable basis, for food production, cooking, water lifting and other chores, to enhance food security, assure poverty reduction and facilitate sustainable development.
- 7.2. Preserving national forest resources and the environment by progressively reducing wood fuel consumption.
- 7.3. Facilitating sustainable development in the country's development process, it is desirable to promote economic activities and technologies that are less energy consuming and less polluting, thus save energy at both enterprise and national levels, promote renewable energy and energy substitution, and create equilibrium between socio-economic benefits, quality of life and the environment.
- 7.4. Promoting energy efficiency and management and save energy by introducing legislation for:
  - 7.4.1. Demand side management, e.g., scrupulous management of energy use in buildings, industry, agriculture and use of appliances;
  - 7.4.2. Private sector involvement in energy provision;

- 7.4.3. Transport efficiency, i.e., selection and use of the most energy efficient and cost-effective means of transport for public/private transportation, taxis, cars, public transport, rail/river versus road development;
- 7.4.4. Subsidies: source, amount, timing and phasing
- 7.5. Energy and Poverty reduction
- 7.6. Creating conditions that would facilitate implementation of:
  - 7.6.1. Energy-efficient measures as tools for generating socio-economic benefits and mitigating greenhouse gas emissions in the environment;
  - 7.6.2. Pilot and capacity-building programmes on energy-related activities (including energy-efficiency) crucial to national development.