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LIST OF ACRONYMS

Cap	Chapter
ERB	Electricity Regulatory Board
ERC	Energy Regulatory Commission
FY	Financial Year
GDP	Gross Domestic Product
GNI	Gross National Income
GWh	GigaWatt Hour
IPDs	Independent Power Distributors
IPPs	Independent Power Producers
KEBS	Kenya Bureau of Standards
KenGen	Kenya Electricity Generating Company
KIRDI	Kenya Industrial Research and Development Institute
Koe	Kilogrammes of Oil Equivalent
KPC	Kenya Pipeline Company
KPLC	Kenya Power and Lighting Company
KPRL	Kenya Petroleum Refineries Limited
KR	Kenya Railways
kV	KiloVolts
kWh	KiloWatt Hour
LCPDP	Least Cost Power Development Plan
LPG	Liquified Petroleum Gas
LRMC	Long Run Marginal Cost
MW	MegaWatt
MWe	Megawatt Electric
NEMA	National Environmental Management Authority
NGO	Non-Governmental Organization
NOCK	National Oil Corporation of Kenya
PBMR	Pebble Bed Modular Reactor
PIEA	Petroleum Institute of East Africa
R&D	Research and Development
REA	Rural Energy Agency
REP	Rural Electrification Programme
ToE	Tonnes of Oil Equivalent
VAT	Value Added Tax
W/M^2	Watts Per Meter Square

VISION

TO PROMOTE EQUITABLE ACCESS TO QUALITY ENERGY SERVICES AT LEAST COST WHILE PROTECTING THE ENVIRONMENT

EXECUTIVE SUMMARY

1. The aspiration of this Sessional Paper on Energy is to lay the policy framework upon which cost-effective, affordable and adequate quality energy services will be made available to the domestic economy on a sustainable basis over the period 2004-2023. This Sessional Paper recognizes that the success of socio-economic and environmental transformation strategies pursued by the Government at present and in the future is to a large extent, dependent on the performance of the energy sector as an economic infrastructure. This Sessional Paper therefore articulates the current and future policies to realise these growth strategies.

2. The challenges facing the energy sector today and as enumerated in this Sessional Paper include, inter alia, a weak power transmission and distribution infrastructure due to limited investments in power system upgrading. As a consequence, the economy has been experiencing high electric power system losses estimated at 20% of net generation, extreme voltage flunctuations and intermittent power outages at 11,000 per month, which cause material damage and losses in production. These power system weaknesses coupled with the high cost of power from independent power producers (IPPs) contribute to high cost of doing business in Kenya. Other power sub-sector challenges include low per capita power consumption at 121 kWh and low countrywide electricity access at 15.3% of the total population and 3.8% of the rural population.

3. The petroleum industry is, on the other hand, constrained by limited supply facilities for fuels including LPG, domestic production of motor fuels which do not meet international quality standards, inadequate distribution infrastructure in the remote parts of the country which contribute to high product prices, price leadership which inhibits competition, and insufficient legal and regulatory framework to guide sub-sector operations in consonance with international best practices for liberalized markets, thus exposing the public to health, environmental and safety hazards. In addition and as a result of the inadequacies in the legal and regulatory framework, the sub-sector has witnessed proliferation of substandard fuel dispensing facilities, and under dispensing of products including mixing of motor fuels with kerosene and dumping of export fuels for illicit financial gains at the expense of both the consumer and Government revenue.

4. On the policy front, salient highlights to address these short term challenges and meet the growing energy needs of the economy, include the following:

4.1 **Electricity sub-sector:**

- Enactment of an Energy Act to succeed the Electric Power Act No. 11 of 1997 and the Petroleum Act, Cap 116 to facilitate prudential regulation and enhance stakeholder interests including boosting of investor confidence. This Act will also bring under its purview, other energy sources and resources currently not covered in other legislations;
- Establishment of a single independent energy regulator under the Energy Act with adequate mandate to regulate all sector players;

- Establishment of a State owned Geothermal Development Company (GDC) to be in charge of geothermal resource assessments and sale of steam to future IPPs and KenGen for electricity generation. GDC will also sell low enthalpy to other users;
- Privatise KenGen over time starting with an initial public offering (IPO) of 30% of its equity through the Nairobi Stock Exchange;
- Creation of a Rural Electrification Authority to accelerate the pace of rural electrification in the country, a function currently undertaken by the Ministry of Energy;
- Unbundling of KPLC into two entities, one for transmission which will be a 100% state owned and the other for distribution which will be private sector owned;
- Promoting privately or community owned vertically integrated entities either operating renewable energy power plants or hybrid systems, to coexist with licensed electricity distributors;
- Allowing power generation companies to access bulk electricity consumers through the power transmission network;
- Creating a domestic power pool with a provision for wholesale and retail markets to create competition and thus reduce the cost of electricity;
- Privatisation or concessioning isolated power stations to reduce operating costs and thus free up resources for rural electrification expansion;
- Increase lifeline tariff applicable to domestic consumers of up to 50 kWh per month to at least recover the cost of electricity generation; and
- Transfer of the rural electrification assets within the interconnected electricity network to licensed electricity distributors at cost consistent with the law.

4.2 Petroleum sub-sector:

- Divestiture of Government interests in oil refining and marketing, and eventually in the Kenya Pipeline Company (KPC);
- Promoting investments in oil refining including supply and distribution of petroleum products throughout the country;
- Enhancing exploration for fossil fuels particularly hydrocarbons through sub-division of exploration acreage into smaller blocks and collection of additional geological data to attract more oil prospecting companies;
- Financing of strategic stocks by the Government and private sector, equivalent to 90 days demand in the medium to long term; and
- Strengthening regional and international cooperation to promote data and information exchange on oil exploration.

4.3 Renewable Energy:

To encourage the wider adoption and use of renewable energy technologies and thereby enhance their role in the country's energy supply matrix, Government will design incentive packages to promote private sector investments in renewable energy and other off-grid generation. Government will also provide requisite support for research and development in emerging technologies like cogeneration and wind energy generation. Cogeneration in the country's sugar belt will be promoted through an attractive bulk tariff regime that recognises the need to reduce oil based thermal generation to tap the current potential estimated at 300 MW of electricity.

CHAPTER ONE

1.0 INTRODUCTION

1.1 THE NEED FOR AN INTEGRATED NATIONAL ENERGY POLICY

1. The overall national development objectives of the Government of Kenya are accelerated economic growth and rising productivity of all sectors, equitable distribution of national income, alleviation of poverty through provision of basic needs, enhanced agricultural production, industrialisation, accelerated employment creation and improved rural-urban balance. The extent to which these objectives can be realised on a sustainable basis and in an environmentally sound manner is dependent on the degree and economic efficiency with which critical factors of production are made available and combined with each other to produce the desired results. The realisation of these objectives is only feasible if quality energy services are made available in a sustainable, cost effective and affordable manner to all sectors of the economy ranging from manufacturing, services, mining, and agriculture to households. The need for an integrated comprehensive national energy policy cannot therefore be gainsaid.

2. The first attempt to prepare a *Sessional Paper* on energy was made in 1987, to among other things, mitigate the adverse effects of oil importation on the domestic economy and balance of payments and the need to have a consistent policy on energy to ensure security of supply, efficient but affordable pricing and accelerated development of indigenous resources including the search for domestic fossil fuels, particularly the hydrocarbons.

3. New challenges associated with liberalisation of the economy in the 1990s, including worsening balance of payments, economic stagnation, rising population, rising poverty, electricity rationing and outages, dwindling official development assistance and the recently observed phenomenon of climate variability call for a new energy sector development strategy based on prudent integrated policies consistent with the broader Government policies on socio-economic development.

4. This energy *Sessional Paper* therefore sets out the national policies and strategies for Kenya's energy sector in the short to long-term.

1.2 THE ROLE OF ENERGY IN ECONOMIC DEVELOPMENT

1. The level and intensity of commercial energy use in a country is a key indicator of economic growth and development. It has been observed that countries with low per capita consumption of commercial energy register correspondingly low per capita gross domestic product (GDP). The converse is also true with countries enjoying higher per capita incomes usually recording relatively high levels of per capita energy consumption, even after taking into consideration efficient utilization to realize the same level of output.

2. Commercial energy consumption in Kenya has for the last three decades experienced a decline, due to weak and sluggish economic performance, as can be discerned from Table 1.1. This is in stark contrast with the growth in commercial energy consumption in countries, which have witnessed good economic performance such as Egypt and South Africa both of which are Kenya's trading partners in Eastern and Southern Africa. These two countries registered high growths in both energy consumption and Gross National Income (GNI). The fastest increments in both per capita incomes and commercial consumptions were registered by the South East Asian countries of Malaysia, South Korea and Singapore, a reflection of their booming economies.

Table 1.1: ***Per Capita GDP Relative to Per Capita Commercial Energy Consumption for Selected Countries.***

COUNTRY	PER CAPITA GROSS NATIONAL INCOME (US $/CAPITA)		COMPOUND GROWTH RATE%	PER CAPITA COMMERCIAL ENERGY CONSUMPTION (koe/capita)		COMPOUND GROWTH RATE%
	1971	**2000**		**1971**	**2000**	
Kenya	127	350	3.6	116	89.4	(0.9)
Egypt	211	1,490	7.0	213	726	4.3
South Africa	719	2,600	4.5	1,993	2,514	0.8
Zimbabwe	264	440	1.8	443	809	2.1
Malaysia	406	3,380	7.6	435	2,126	5.6
South Korea	298	9,010	12.5	507	4,119	7.5
Singapore	1,088	22,789	11.1	1,551	6,120	4.8
Sub-Saharan Africa	198	476	3.1	225	517	2.9
High Income Economies	3,066	27,608	7.9	4,407	5,694	0.9

Source: World Bank Development Indicators

3. Kenya's low and declining commercial energy consumption over the last three decades is attributable to a corresponding falling trend in economic performance. Between 1974 and 1979, GDP grew at a reasonable rate of 5.2% per annum on average, however, this growth plummeted in the subsequent years, averaging 4.1%, 2.5% and 1.3% per annum over the periods 1980-89, 1990-95 and 1996-2002, respectively. Among the factors that contributed to this declining economic performance were the cumulative effects of the oil shocks of the early 1970s and 1980s, pursuit of weak macro-economic and structural policies and occasional droughts particularly in 2000, which was the worst drought since the period 1947 to 1949.

4. In more specific terms, the low consumption of commercial energy is attributed to:

a) low level of industrialisation as the manufacturing sector only accounts for about 13 % of GDP;

b) high dependence on rain-fed agriculture as the prime mover of the economy which accounts for about 25% of GDP;

c) high cost of access to commercial energy, particularly electricity

d) low per capita incomes; and,

e) Limited investment in supply and distribution networks.

5. The economic policy challenge facing Government is to reverse this downward trend and put the domestic economy on a recovery path at a reasonable pace to redress rising poverty.

6. The principal taxation policy pursued by Government in the energy sector has hitherto been based on the need to create a sustainable balance between fiscal revenue generation and ensuring accessibility of energy by the low income segments of the population at reasonable prices. The Government also uses taxation as a prudent policy instrument to discourage wasteful consumption of energy and by extension to encourage its efficient utilization in a cost effective manner.

7. Given this policy regime, the energy sector has continued to play its role as a significant contributor to fiscal revenues through taxes, levies and duties imposed on various petroleum products, electrical energy and materials sourced by service providers for operations and maintenance including network expansion. The contribution of the energy sector to the overall tax revenue is about 20%, equivalent to 4% of GDP.

8. Currently the energy sector provides direct and indirect employment to an estimated 16,000 persons.

9. The cost of energy has significant impacts on economic activities particularly those that are energy intensive such as cement, steel and pulp and paper production. In a liberalized market such as Kenya's, energy prices are a significant determinant of competitiveness of local manufactures relative to imports. In this regard, high energy prices impact negatively on domestic wealth creation, balance of payments and employment creation since consumers opt for cheaper imports. In addition, high energy prices reduce our exports due to their high costs, assuming other factors of production are efficient.

10. While domestic petroleum fuels are priced on the basis of import parity to a large extent, electricity prices are currently based on the long run marginal cost of supply principle, which makes our tariffs much higher than those of our trading partners. Thus, the current high tariff regime is as a result of the tariffs adjustments effected in the 1990's to raise needed revenues for undertaking planned generation projects some of which had been delayed for lack of requisite funding. In the future, crowding of investments will therefore be avoided, while generation and transmission will continue to be undertaken on the basis of least cost development criteria, as has been the case hitherto to ensure cost effective tariffs. Despite the current high tariffs, the power sub-sector has continued to experience financial constraints due to high power systems losses, the devastating drought of 1999-2000, limited customer base and extremely low economic growth.

1.3 ENERGY POLICY OBJECTIVES

1. The broad objective of the energy policy is to ensure adequate, quality, cost effective and affordable supply of energy to meet development needs, while protecting and conserving the environment. The specific objectives are to:

    a) provide sustainable quality energy services for development;

    b) utilise energy as tool to accelerate economic empowerment for urban and rural development;

    c) improve access to affordable energy services;

    d) provide an enabling environment for the provision of energy services;

    e) enhance security of supply;

    f) promote development of indigenous energy resources; and,

    g) promote energy efficiency and conservation as well as prudent environmental, health and safety practices.

2. In order to meet these policy objectives and address the demand for energy as a critical input for development, the following key challenges have been identified:

    a) expanding and upgrading of energy infrastructure;

    b) promotion of energy efficiency and conservation;

    c) protecting the environment;

    d) mobilizing requisite financial resources for operation and expansion of energy services consistent with rising demand;

    e) ensuring security of supply through diversification of sources and mixes in a cost effective manner;

    f) increasing accessibility to all segments of the population;

    g) improving corporate governance and accountability;

    h) enhancing legal, regulatory and institutional frameworks to create both consumer and investor confidence; and,

i) enhancing and achieving economic competitiveness and efficiency in energy production, supply and delivery.

CHAPTER TWO

2.0 OVERVIEW OF THE ENERGY SECTOR

1. The commercial energy sector in Kenya is dominated by petroleum and electricity as the prime movers of the modern sector of the economy, while wood fuel provides energy needs of the traditional sector including rural communities and the urban poor. At the national level, woodfuel and other biomass account for about 68% of the total primary energy consumption, followed by petroleum at 22%, electricity at 9% and others at about less than 1%. Solar energy is also extensively used for drying.

2.1 ELECTRICITY

2.1.1 Sub-Sector Reforms

1. Electricity, by virtue of its versatility in application is crucial to Kenya's economic growth. Moreover, it is the most sought after energy service by the society and access to electricity is associated with rising or high quality of life. However, its consumption in Kenya is extremely low at 121kilowatt-hours (kWh) per capita and national access rate at about 15% is below the average 32% for developing economies.

2. Significant reforms and restructuring were effected in the power sub-sector by Government between 1994 and 2000, through rationalization of the operations of sub-sector players by placing all power generation assets under KenGen and transmission and distribution assets under KPLC, tariff adjustments to generate revenue for system operation and expansion, introduction of competition by liberalizing generation, thus broadening resource for generation system expansion and enactment of new electricity law in 1997 under which an independent power sub-sector regulator was established.

2.1.2 Institutional Arrangements

1. Government's activities in the power sub-sector are limited to formulation and articulation of policies through which it provides an enabling environment to all economic operators and other stakeholders, training of manpower, preparation of the country's 20 year rolling Least Cost Electric Power Development Plan (LCPDP) revised annually to take account of new information, implementation of the rural electrification programme and to a large extent mobilisation of financial resources for system expansion.

2. The Electricity Regulatory Board (ERB) is an autonomous, independent sub-sector regulator, established in 1998 under the Electric Power Act to, *inter alia*, set, review and adjust consumer tariffs, approve power purchase agreements, promote competition in the sub-sector where feasible, resolve consumer complaints and enforce environmental, health and, safety regulations.

3. KenGen, a 100% state owned company, and KPLC in which state interest stands at 51% of the equity are the principal players in the power sub-sector. KPLC has a virtual monopoly in power transmission and distribution. Furthermore, KPLC as the only licensed Public Electricity Supplier has energy purchase contracts with Independent Power Producers (IPPs) and KenGen. KenGen accounts for about 82.1% of the total installed capacity, the private sector for about 15.2%, imports for about 2.4% and the Government under the Rural Electrification Programme for less than 1%. The two parastatals: KenGen and KPLC, have the responsibility of raising funds needed for system expansion with and without state guarantees.

4. The involvement of the private sector in commercial power generation is a recent development since power generation was only liberalised in 1997. Four IPPs with a combined installed capacity of 187 MW are currently in operation. The role of the private sector is expected to grow over time in power generation, distribution and supply. However, the transmission network will remain a monopoly of the public sector providing power wheeling access to electric power producers, large retail consumers, other bulk power suppliers and distribution companies.

5. The electricity sub-sector faces a number of challenges, key among them include limited capacity for resource mobilisation, low access to electricity services, high consumer tariffs and environmental concerns. These challenges are discussed below.

2.1.3 Resource Mobilisation

1. The Government has in the past sought and obtained large amounts of development assistance from external sources, particularly from our development partners, on concessionary terms to implement power system expansion in consonance with rising demand for electricity. However, since the end of the cold war, this external source of funding has continued to dwindle thereby impacting adversely on our ability to implement planned development projects on a timely basis. The drop in funding was largely due to the emphasis by our development partners on the need to promote private sector involvement in the provision of commercial infrastructure. Furthermore, the liberalisation of power generation in 1997 has also not attracted significant private sector interest and despite the small number of bidders for the projects implemented or under implementation by the IPPs, serious delays had been encountered in concluding negotiations with successful IPPs. This had further worsened generation capacity shortfalls in 2000, leading to massive power rationing and attendant devastation of the economy from which it is as yet to recover. Given this situation, there is therefore a need to address issues of concern to the IPPs, where prudently possible but not at any cost.

2. Moreover, due to the inability to mobilise requisite funding for undertaking pre-feasibility and feasibility studies of our hydro potential and for geothermal resource assessment, the country risks being overly dependent on the expensive oil-fired generation to meet projected growth in demand for electricity. It is therefore critical to mobilise needed resources to undertake these assessments if both hydro and geothermal power projects are to play a significant role in economic merit order ranking in our electric power generation planning which emphases selection of projects based on least cost development criteria. The screening of power generation projects for economic merit

order ranking is dependent on the quality of information available and hence the need for undertaking these studies.

3. Despite the electricity tariff reforms and organizational restructuring, KPLC, which is the sole distributor of commercial electricity, has continued to manifest weak financial performance, which has impeded access to domestic and international money markets for the needed system reinforcement and expansion. Further more, such performance has largely influenced the demand for and degree of onerous payment security guarantees from lenders and IPPs, further aggravating the already weak financial situation of KPLC. There is therefore need to undertake further reforms to improve KPLC's performance and create an appropriate power market structure capable of attracting both domestic and foreign investments, at competitive costs.

2.1.4 Access to Affordable Electricity

1. It is common knowledge that a developing economy requires large quantities of affordable but quality electricity services to effect a prudent pace of social transformation and economic development. Access to electricity services by all sectors of the economy is therefore, crucial; particularly manufacturers and services to enable our products compete favourably on both the domestic and international markets, other factors being equal.

2. However, access to affordable electricity services has been constrained by a combination of low consumer incomes and high electricity tariffs. Furthermore, the rate of electrification currently at about 15% of the population has remained low due to the high costs of consumer connections and network expansion, particularly in rural areas and among the urban poor. In the rural areas where the access rate is about 4%, the scattered nature of human settlements further escalates the cost of supply as well as accessibility. A new policy strategy is therefore needed to redress these challenges.

2.1.5 End-User Tariffs

1. The crowding of power generation and transmission projects following the lifting of donor aid embargo to the energy sector in the second half of the 1990s has contributed to high consumer tariffs; as have operational inefficiencies of KPLC and the high generation tariffs charged by IPPs. High consumer tariffs have in turn affected affordability and hence accessibility of electricity by consumers, thus leading to marginalisation of low-income consumers including some small-scale commercial and industrial enterprises. As high electricity tariffs are a disincentive to social and economic development, there is need to critically develop strategies for reducing tariffs to spur growth.

2. Such strategies should include cost effective operation and maintenance of generation and distribution companies, implementation of projects based on least cost criteria, prudent corporate governance, review of the fiscal regime including indirect taxes levied on power generation, transmission, distribution and supply equipment, plant and machinery, spare parts and related accessories; and, implementation of generation and transmission projects on schedule to avoid undue demand for tariff increases to finance the projects.

2.1.6 Rural Electrification

1. The rural electrification programme was started in 1973 as part of the basic infrastructure to stimulate socio-economic growth, stem rural-urban migration through creation of social amenities and employment opportunities at close proximities to the rural population and thus uplift the quality of life in the rural areas. However, the rate of penetration has been slow with only 91,069 directly metered consumers having benefited from the programme by January 2004. The low penetration level is attributed to past mismanagement of financial resources, high cost of network extension, low consumer densities and the scattered nature of the human settlements in rural Kenya. In 2003, it costed more than KShs.1.2 million on average to construct a kilometre of an 11kV or a 33kV line. Thus, the average cost of supplying a rural consumer was KShs.180,000, which is about seven times the national per capita income in 2002. Rural electrification schemes also incur higher operating costs per unit sold than the KPLC system sales. For example, over the period 1997/98 to 2001/02 the average cost of selling one unit of electricity under the rural electrification programme was KShs.12..4 per kWh for the interconnected system as opposed to KShs.7.78 per kWh for KPLC, while for the isolated programme schemes the cost was KShs.32.0 per kWh.

2. Despite this high cost, very few of those who have been connected in rural market centres have made economic use of electricity. This has been attributed to poor entrepreneurship, high poverty incidence which nationally stands at about 56% of total population, lack of awareness on the potential for electricity to stimulate income generating activities and lack of innovative and appropriate financing schemes to promote commercial and industrial enterprises including irrigated agriculture and fisheries.

3. Because of high maintenance and operating losses relative to the tariff charged, 80% of the Rural Electrification Programmes revenue from sales and the 5% levy introduced in August, 1998 is used to finance net operating losses, thus leaving very little funds for system expansion. For this reason, the large numbers of projects submitted every year for funding are not implemented. There is therefore urgent need to address challenges of limited funding in order to increase the rate of rural electrification to a penetration target of at least 40% of the rural population by 2020 from the current 4%. There is also need to explore alternative innovative mechanisms for funding the Rural Electrification Programme and for operating and maintaining the system in order to release funds for electrification expansion through on and off-grid systems.

4. The current institutional arrangements for implementing rural electrification are unsatisfactory. There is no fully-fledged Government agency specifically dealing with rural electrification planning, resource mobilisation, system expansion and operation. Currently an inter-ministerial committee including KPLC, which also doubles up as the implementing contractor, is running the Rural Electrification Programme. Moreover, due to the lack of such an institution, rural electrification planning is not properly incorporated into integrated energy and development planning, despite explicit policy statements in the past economic *Sessional Papers* and *Development Plans* on the need for such integration. It is therefore critical to establish a Rural Electrification Agency, to be in charge of the programme

2.1.7 Environmental Concerns

1. The Construction and operation of electric power projects have direct impacts on the quality of the environment either by the emission of pollutants or by changing the ecological systems. The degree of pollution and other ecological impacts are dependent upon the nature of the technology in use as well as the size and the general location of the plant. Environmental, health and safety regulations require that mitigating measures be put in place to minimise the adverse impact of such projects. Therefore, comprehensive environmental impact assessments are conducted for all projects prior to their implementation to ascertain the level of potential environmental damage, the required mitigation measures as well as the associated costs.
2. Geothermal and hydroelectric power projects are known to have relatively less environmental impacts than fossil fired plants. However, not much attention has hitherto been given to the environmental impacts of the distribution grid expansion and therefore there is need to address the challenge while striking a sustainable balance between the environmental concerns posed by the distribution grid expansion on one hand and economic development, access and affordability on the other.

2.2 FOSSIL FUELS

2.2.1 Fossil Fuels in Kenya

1. Petroleum fuels are the most important source of commercial energy in Kenya, and are mainly used in the transport, commercial and industrial sectors. In 2002 the consumption of petroleum fuels in Kenya was 2.3 Million TOE, equivalent to per capita consumption of 74 kilogrammes, a figure which is low even by the standards of developing economies; and is attributable to stagnation in economic growth and over dependence on rain-fed agriculture.
2. Coal is exclusively used in the industrial sector, particularly in the cement industry for process heat. The level of consumption in 2002 was 99,000 TOE.

2.2.1 Institutional Arrangements

1. Direct Government involvement in the petroleum industry is in the oil refinery where it co-owns the Kenya Petroleum Refineries Ltd (KPRL) with three private companies (Shell, BP Petroleum and Caltex) on a 50-50 % equity basis and in oil storage facilities at Kipevu, capable of holding 1.5 million barrels. The storage facilities are available to all licensed importers at a fee. The Government through the Kenya Pipeline Company (KPC), in which it has 100% equity, owns a petroleum pipeline that runs from Mombasa to Nairobi and western Kenya with terminals in Nakuru, Eldoret and Kisumu. The Government is also the sole owner of the National Oil Corporation of Kenya (NOCK), which is involved in oil supply and distribution. NOCK also undertakes oil exploration on behalf of the Government. The Kenya Railways Corporation (KR), 100% state owned, is a key transporter of petroleum fuels, primarily LPG, heavy diesel and fuel oil from Mombasa to Nairobi and other up-country demand centres. It also transports kerosene, petrol and automotive gas oil, principally to areas not served by the petroleum pipeline.

2. Regulatory functions in the petroleum sector are shared amongst various players including the Ministry of Energy, Provincial Administration and Local Authorities. The Petroleum Institute of East Africa (PIEA) which is a voluntary membership institution patronised by the major oil companies plays a key role in capacity building and awareness creation

3. The private sector has an extensive network of distribution and marketing outlets in different parts of the country and accounts for about 99.4% of the total market sales of petroleum fuels. Seven oil companies, Shell, BP, Total, Mobil, Kenol, Kobil and Caltex account for about 85% of the total sales and the balance of 15% by NOCK and several small companies. Collectively, the oil companies have installed about 1000 filling and service stations countrywide. NOCK, on the other hand has seen its market share decline from about 2% in 2000 to about 0.6% in 2003 and has thus failed to live to the original Government objective of using the company to regulate petroleum market prices through competition, following the deregulation of the industry in 1994.

4. The liberalization of the petroleum industry in 1994 has resulted in the entry of new players some of who not only compromise safety, health and environmental standards but also deny Government of its fiscal revenue through dumping of export fuels and adulteration of motor fuels with lowly taxed kerosene. Motorists have also become victims through purchase of off-specification fuels and delivery of lower fuel quantities as a result of meter tempering. The challenge is therefore to evolve an effective legal and regulatory framework to guide the petroleum sector in accordance with international norms and practices for liberalised markets.

2.3 BIOMASS

1. Biomass energy resources are derived from forests formations such as closed forests, woodlands, bush lands, grasslands, farmlands, plantations and agricultural and industrial residues. These resources include woodfuel (firewood and charcoal) and agricultural residues. Biomass fuels are the most important source of primary energy in Kenya with woodfuel consumption accounting for over 68% of the total primary energy consumption.

2. About 2% of Kenya's land area is covered by forests which produce about 45% of the biomass energy resources including wood wastes. The balance is derived from farmlands in the form of woody biomass as well as crop and animal residues.

3. There have been two studies on biomass energy undertaken by the Ministry of Energy, one in 1980 and the other in 2000 respectively. These studies, despite being two decades apart reflected widening gap between supply and demand for woodfuel and recommended policy interventions to redress this challenge. There is, however, need to undertake more studies preferably at five year intervals in order to provide more relevant data for purposes of planning, policy formulation and analysis.

4. There exists a substantial potential for power generation using forestry and agro-industry residues including bagasse from the sugar industry for own consumption and supply to the grid.

5. The challenge is therefore to promote sustainable biomass harvesting through innovative and efficient exploitation and utilisation technologies while at the same time providing policy triggers to shift rural energy consumption to cleaner fuels like liquefied petroleum gas (LPG) and kerosene.

2.4 OTHER RENEWABLES

1. Kenya is endowed with significant amounts of other renewable energy sources which, *inter alia*, include solar, wind and small hydro power. Others include power alcohol, biogas and municipal waste energy. However, only solar, wind and small hydropower are currently harnessed for use in Kenya.

2.4.1 Solar Energy

1. Diverse application of solar energy include solar thermal for heating and drying and solar photovoltaic (PV) for lighting, water pumping, refrigeration and telecommunications. Solar PV is widely used for provision of electricity in off-grid rural and urban slum areas for low power application. It is estimated that up to 4 MW of PV power is currently installed in Kenya. On the other hand, solar thermal is used for drying and water heating. The Government recognizes the great potential of this source of energy and will encourage the development and utilization of appropriate technologies.
2. The challenge is to develop fiscal and regulatory frameworks to create an enabling environment to accelerate the development and utilization of the technology in the country.

2.4.2 Wind Energy

1. Wind energy has been used in Kenya primarily for water lifting since the beginning of th19th century but its use declined with the advent of oil fired internal combustion engines, which are flexible and more convenient to use. However, with the rising cost of oil, the exploitation of wind energy is becoming increasingly more attractive particularly in areas remote from the grid and oil supply outlets. To promote investment in wind energy generation, the Ministry of Energy has recently completed preparation of a broad National Wind Atlas. In addition, the Government is promoting the development of wind-diesel hybrid systems for electricity generation under rural electrification programme in areas remote from the national grid.
2. The challenge is therefore to attract substantial private sector investments in the fabrication of wind power systems and in wind energy generation with a view to significantly increasing the role of wind energy in the country's energy supply matrix.

2.4.3 Small Hydro

In addition to the identified economically significant hydroelectric capacity in sites with at least 30 MW potential, it is estimated that there exists at least 3,000 MW of hydroelectric power potential in the category of small, micro to pico hydro projects that are currently considered uneconomic to exploit. However, it is probable that pre-feasibility studies of these projects may establish economic viability for a host of applications including community based electricity production. Government will encourage development of such projects by communities and investors alike through mobilization resources for undertaking pre-feasibility studies, and feasibility studies for those commanding high economic merit order ranking. The challenge is therefore to undertake reconnaissance, pre-feasibility and feasibility studies on the resource potential in all river drainage basins.

2.4.4 Power Alcohol

1. Power alcohol was introduced in Kenya as a fuel blend for gasoline in 1983. However, due to its production related problems leading to unsustainable pricing, its use was discontinued in 1993. This blend which was used as a substitute for premium gasoline (93 Octane)) had a volume composition of 65% super petrol, 10% alcohol and 25% ordinary or regular petrol.
2. The Government will reintroduce power alcohol as a motor fuel in its long-term policy to enhance security of supply and redress the trade imbalance arising from petroleum imports based on a prudent economic pricing policy. The challenge is to redress the management and pricing problems which led to the loss of its competitiveness in the market place and the eventual withdrawal there from.

2.4.5 Bio diesel

1. Bio diesel is currently not in use in Kenya; however, the potential for its production from locally grown trees and crops exists. There is therefore need for research and development on the potential for the exploitation of this energy supply option, learning from the experiences of other countries that have succeeded in the implementation of this technology.
2. Given the shortage of arable land in Kenya, climate variability and high dependence on rain-fed agriculture, thus leading to inadequate food production chin, the challenge is to develop biotechnologies for production of crops suitable for production of bio-diesel in low and medium potential lands.

2.4.6 Biogas

1. Despite its potential benefits, the penetration rate of biogas technology is still very low. Research has shown that about 30% of the 800 biogas digesters introduced in the1980s have fallen into disuse. The main problems are poor management, high initial capital costs, high maintenance costs, limited water supply and weak technical support.
2. The challenge is to redress these constraints with a view to improving system management, and the level of awareness so as to enhance wider acceptance and adoption of the technology. The Government will provide technical support in form of research, development and demonstration.

2.4.7 Municipal and Industrial Waste Energy

1. With the appropriate management of municipal waste, it is possible to generate electricity using different technologies, the sale of which could generate a revenue stream sufficient to cover the costs of waste collection and treatment by local authorities. For the large cities in Kenya that continue to experience serious waste management problems, the use of waste for electricity generation is a unique solution to their revenue problems as well.
2. The challenge is to improve waste management, including sorting to identify waste suitable for electricity generation. Further, there is need to identify appropriate technologies with potential for electricity production using municipal waste as feedstock.

CHAPTER THREE

3.0 ENERGY DEMAND

3.1 Integrated Energy planning

1. There has been no systematic attempt to undertake an integrated and holistic energy planning for purposes of policy formulation or analysis in Kenya to date. Such planning, which should be based on prudent analytical principles, would consider the energy sources and the consuming sectors and project future energy demand and associated supply based on least-cost options. The scenarios would take into consideration the natural resources endowment taking cognizance of their economic potential and the possibilities for substitution between various energy sources as well as technological improvements in end-use devices. In an ideal situation, projections of demand for the respective energy sources would then be based on these scenarios, to the extent that inter-fuel substitution is economically and financially prudent.
2. There is therefore a need to reconsider the energy planning process with a view to making it integrated, internally consistent and analytically more sagacious in order to enhance the value and utility of the plans so developed.

3.2 Demand Projections for Electric Power and Energy

1. The demand for electricity sold through the KPLC system and isolated stations has over the period 1998/99- 2002/03 been mixed due to the combination of the effects of a severe drought, high capital cost for access and the prevailing economic recession. In the FY 1998/99 the overall demand for electricity stood at 4,637GWh, but declined to 4,081GWh at the peak of the drought in the FY 2000/01. This has since picked up slightly as KenGen and IPPs sold 4,750GWh to KPLC in FY2002/03 but its growth is still hampered by the slow economic recovery. The current peak demand stands at 821MW.
2. Demand for electricity in Kenya is projected to grow from 4,950GWh in the FY 2003/04 to 8,561GWh in the FY 2013/14, representing an annual average growth rate of 5.6%. This translates into about 1,421MW peak demand by 2013/14, from about 821MW in the FY 2003/04, corresponding to an effective generating capacity of about 1,645MW. As GDP growth is a key determinant, higher levels of economic growth will result in faster growth in the demand for electricity. The projected high growth in electricity demand is based on projected annual GDP growth of 2.3% in 2004, 3.4% in 2005 and 4.6% in 2007 and beyond.

3.3 Electricity Consumer Base

1. As at June 30th 2003 the number of customers connected to commercial electricity supply stood at 643,274. This figure includes 87,175 rural electrification consumers by 30th June 2003. Viewed another way, this figure represents an electrification rate of 15% of the total population out of which 4% is the rural population with direct access to electricity. This level of national penetration is very low relative to an average of 32% for developing countries. A few countries in sub-Saharan Africa have a penetration rate well above the global average for developing countries; South Africa 67%, Ghana 45% and Zambia 42%. Both Tunisia and Egypt have access rates above 90%.

2. The challenge is therefore to ensure growth in electricity supply to meet increasing demand, and to improve national electricity access to levels comparable with emerging African economies and other developing countries

3.4 Demand Projections for Petroleum fuels and Coal

1. Petroleum oil is imported in form of crude oil for domestic processing and as refined products. Petroleum accounts for 20% of the total primary energy consumed in the country, while coal contributes less than 1%.

2. During the period 1998/99 – 2002/03 petroleum imports averaged 2.5 million Metric Tons per annum accounting for 25.7% of the country's total annual import bill. Kenya's per capita consumption of commercial energy at 89 kilogrammes of oil equivalent (koe) for that period 1998-2002 is below the 1994 commercial energy average of 384 koe for low-income economies and a world average of 1,434 koe.

3. The overall demand is projected to rise by 2 % per annum on average to reach 2.93 million tonnes by FY 2009/10. However, with improved economic performance as a result of both macro and structural policies being pursued by the Government to stimulate recovery and growth, consumption of petroleum fuels could be expected to surpass this projected level of demand.

4. Coal is currently used only by Bamburi Portland Cement Company, where it complements heavy fuel oil for process heat. The consumption of coal has averaged 130,000 metric tonnes per annum over the last five years, with the highest consumption having been registered in 1997 at 152,000 metric tonnes and the lowest in 2000 at 110,000metric tons. Consumption recovered marginally in 2002 to 164,000MT. Coal consumption is not expected to change markedly, unless there is a significant drop in its price with a corresponding steep rise in the cost of fuel oil; or in the event of discovery of commercial deposits of coal in Kenya.

5. Coal utilization has remained low in Kenya despite international prices having been reasonable and fairly stable over the years relative to petroleum. Some of the major problems preventing wide application include inadequate import handling and storage facilities (currently imported coal comes in through Mbaraki terminal and is stored in the open) high conversion cost in industry changeover from fuel oil to dual fuel fired kilns and boilers; and, lack of fiscal incentives to encourage companies convert their liquid fuel fired systems to dual fuel.

Efforts to promote coal as an alternative source of commercial and industrial process since 1980s have been unsuccessful. The challenge is therefore to promote rational, efficient and cost effective utilisation of these imported fossil fuel resources while protecting the environment.

3.5 Demand Projections for Biomass Energy

1. Based on a comprehensive study undertaken in the year 2000, on supply and demand for energy, the estimated demand for woodfuel and other biomass in Kenya stood at 34.3 million metric tonnes, comprising 15.1 million metric tonnes of fuelwood and 16.5 million metric tonnes of wood for charcoal. Only 17% of the households consuming fuel wood buy it, while the rest obtain their fuelwood supplies from various sources including own farms and the rangeland
2. The study revealed that approximately 89% of rural households use firewood compared to 7% in the urban areas, with a corresponding per capita consumption of 741kg and 691kg in the rural and urban areas respectively. On the other hand, 82% of the households in urban areas and 34% in rural areas rely on charcoal to meet their energy needs. The per capita consumptions of charcoal in urban and rural areas were 152Kg and 156 kg respectively, depicting a national consumption of 2.4 million metric tonnes per annum. This level of consumption translates into a trade volume estimated at KSh. 17 5 billion, equivalent to approximately 43% of the total expenditure on petroleum imports. These consumption patterns are consistent with the findings of a similar energy survey undertaken by the Ministry of Energy in 1980.
3. There is a growing active market for fuel wood trading in the urban areas with all the wood consumed being bought while only a small percentage of fuel wood is commercially traded in the rural areas as most of it is collected freely from the farm and rangelands. This growth in fuel wood trade is a reflection of the rising opportunity cost of both land and fuel wood labour.
4. There is a dynamic market for charcoal throughout the country and its prices vary with eco-zone, demand, distance from source and season. It is actively traded in 4 litre tins or containers of similar measure at about KShs.30.00, which translates into about KShs.400.00 per 34 kg bag. However, a 34 kg bag of charcoal traded for KShs.300.00 in Nairobi in the year 2000.
5. In the absence of policy intervention, demand for biomass is expected to reach 53.4 million tonnes in the year 2020 from about 34.3 Million tonnes in 2000. However, with policy intervention, this is expected to decline to below 30.4 Million tonnes largely through introduction of more efficient end-use devices and promotion of LPG as a household fuel among the urban poor and the rural population

6. An estimated 34,280,490 metric tonnes of woody biomass and crop residues were consumed in the year 2000 as tabulated below.

Table 3.1: ***Consumption of Various Energy Types (Year 2000)***

Fuels Category	Firewood Tonnes/yr	Wood for Charcoal Tonnes/yr	Wood Wastes Tonnes/yr	Farm Residue Tonnes/yr
Rural Household	14,065,004	7,624,935	136,459	2,649,981
Urban Household	358,709	6,020,663	83,863	12,832
Cottage Industries	467,145	2,860,900	–	---
Total	**14,890,858**	**16,506,498**	**220,321**	**2,662,813**

Source Kamfor 2002

7. The continued high dependence on woodfuel and other forms of biomass as the dominant primary sources of energy largely to meet household energy needs has contributed to unsustainable harvesting of biomass with attendant negative impacts on the environment, which could be attributed to serious climate variability and associated unpredictability in rainfall patterns. In addition, continued consumption of biomass fuels contributes to poor health among users due to excessive smoke emissions in poorly ventilated houses.

8. Biomass energy will continue to be the primary source of energy for the rural population and urban poor for as long as it takes to transform the rural economy from subsistence to a highly productive monetised economy.

9. There exists woodfuel supply-demand imbalance, degraded eco-system and catchment areas, and lack of affordable energy alternatives to meet the needs of the rural areas and urban poor.

10. Lack of a favourable legal framework for charcoal production, distribution and marketing; awareness of tree growing as a commercially viable business enterprise; adequate data on biomass consumption and production; incentives for electricity cogeneration in sugar production; and harmonization of the policies and activities of the various ministries responsible for biomass energy issues

11. Other constraints to effective inter ministerial and other stakeholder policy interventions include:

    (i) The low profile and recognition given to biomass as a source of energy, despite its predominance in the energy matrix;

    (ii) Failure to exploit the opportunities for transforming agro industries, especially the sugar industry through the modern use of biomass energy;

    (iii) High incidence of poverty as a constraint to shifting from traditional biomass to modern energy; and,

    (iv) Inefficient production and use of biomass energy.

3.6 Demand Projections for Other Renewable Energy

1. No rigorous attempts have been made to project cost effective demand for the other renewable energy sources including solar, wind, biogas and municipal wastes. However, from the energy consumption based on installed capacities of the systems currently in use, rudimentary estimates of the current projected future demand for solar energy are provided in the subsequent paragraphs. The only exception is the demand for solar energy for crop drying.

2. Solar energy can be used for heating, drying and generating small quantities of electricity. Solar thermal is widely used for drying in the rural areas, for water heating in hotels and similar institutions. Solar photovoltaic, on the other hand is used for generating electricity by households in rural areas. Solar drying of coffee, cereals, vegetables, fish, hides and skins is a widespread technology whose potential needs to be explored with a view to improving products quality through introduction of commercially viable solar driers.

3. The 200,000 photovoltaic solar home systems in use mainly in areas remote from the electricity grid comprise an installed capacity of 4.3MW_e and generate 9GWh of electricity annually primarily for lighting and powering television sets. The demand for electricity generated from home based photovoltaic systems is projected to reach 22GWh annually in the FY 2019/20 from an installed capacity of 10MW_e This represents an annual growth rate of 20,000 units per year, as has been the case for the period 1999/2000 – 2002/03. It is estimated that with the projected growth in income generating activities in rural areas such as tea, dairy and coffee cooperatives, this number is likely to rise.

4. Solar water heating is competitive with both electricity and oil-fired systems and the number of units currently in use in Kenya provide an estimated 19,000 TOE annually, from the 50,000 units that were in use in FY 1999/2000. These systems were mainly used in institutions such as hotels, hospitals and learning institutions. The demand for solar for water heating is projected to grow to 400,000 units by 2019/20 equivalent to 150,000 TOE. This represents a growth rate of 10% per annum. The growth in demand is expected to come from households, public institutions and commercial establishments such as hotels

5. The percentage of solar energy harnessed for commercial and domestic applications is insignificant relative to the available potential. Among the constraints to accelerated market penetration are:

    a) lack of legal and regulatory framework and institutional support to promote widespread use of solar energy and protect consumer interests;

    b) high capital costs of the systems relative to consumer incomes. Despite gradual reduction of the indirect taxes by the Government over the years, the cost of solar home systems has remained beyond the reach of many potential consumers;

    c) erosion of consumer confidence because of inappropriate system standards, faulty installations, importation of sub-standard systems and poor after sales service ;

d) rising thefts of photovoltaic panels installed in rural homes, thus discouraging their purchase and by extension growth,

e) lack of awareness on the potential opportunities and economic benefits offered by solar technologies; and,

f) lack of appropriate credit and financing mechanisms to facilitate acquisition of solar technology by the rural population and urban poor.

CHAPTER FOUR

4.0 ENERGY SUPPLY

4.1 ELECTRICITY

4.1.1 Generation System

The generation system has an installed capacity of 1,239 MW, comprising 677 MW of domestic hydropower (55%), 125 MW Geothermal (10%), 407 MW oil-fired thermal (33%)and 30 MW of imported hydro from Uganda (2%). The corresponding effective capacity is 1111.2 MW under normal hydrology against a peak demand of 821 MW. However, under severe drought such as the 2000, the effective capacity of the hydropower plants would be reduced from 639 MW to 501 MW which when combined with existing thermal capacity would barely meet demand of 850 MW up to 2004/05. In addition, a 60 MW hydro power plant on River Sondu currently under construction is expected to come on stream by 2007.

4.1.2 Primary Energy Sources for Electricity Generation

A Hydropower

1. It is estimated that the undeveloped hydroelectric power potential, of economic significance is 1,558MW, out of which 1,310MW is for projects of 30MW or bigger. Average energy production from these potential projects is estimated to be at least 6,600GWh per annum. This hydropower potential is located in five geographical regions, representing Kenya's major drainage basins: Lake Victoria basin (434 MW), Rift Valley basin (264 MW), Athi River basin (109 MW), Tana River basin (604 MW) and Ewaso Ng'iro North River basin (146 MW).
2. Detailed resource assessments have only been done for a small number of hydroelectric power projects in all the five regions. There is therefore need to carry-out detailed feasibility studies in the absence of which it will be impossible for hydroelectric power projects to be included in the least-cost power development plan.
3. In the Lake Victoria drainage basin, the Sondu-Miriu 60MW project is currently under development and should be commissioned in the FY 2007/08. An additional 21MW of hydroelectric capacity downstream of Sondu-Miriu River has also been identified for exploitation following a full feasibility study but is being delayed on account of its high generation tariff at US Cents 7.2/kWh relative to other alternatives.

4. In the Tana River basin, full feasibility studies for two projects with a combined capacity of 200MW are complete. Similar studies have also been carried out for three projects on Ewaso Ng'iro South River in the Rift Valley drainage basin with a combined capacity of 220 MW. However, the estimated generation costs of these hydro sites at between US cents 9.7/kWh and US cents 11.8/kWh are not considered competitive compared to the alternatives. These projects are therefore not expected to be developed in the near future unless soft financing becomes available.

5. Small hydros are classified as hydropower schemes whose potential does not exceed 10MW_e of installed capacity. The total estimated potential of small, mini and micro hydro systems is about 3000 MW most of them situated within the country's five drainage basins: Lake Victoria basin, Rift Valley region, Athi River basin, Tana River basin and Ewaso Ng'iro North River basin. Small Hydropower plants with a combined capacity of approximately 14 MW_e supplying an average of 70GWh of electricity per annum under normal hydrology are operational. These plants were installed between 1925 and 1954 and since then there has not been any significant exploitation of this resource for electricity generation. Nevertheless, there is potential for small hydros particularly in areas where grid extension may not be economically viable.

6. Other applications of small hydros include grain milling, water pumping and agro-processing. These applications have largely fallen into disuse with the advent of oil fired systems.

7. The challenge is to reverse the decline in utilisation of this energy source by removing existing barriers and constraints which include:

    a) lack of awareness among rural communities of the economic potential offered by the technology;

    b) high cost of undertaking feasibility studies and resource development;

    c) inappropriate credit schemes and financing mechanisms;

    d) non-availability of small hydro systems and accessories on the local market;

    e) lack of domestic manufacturing capacity for hydro systems of all sizes;

    f) obsolete and inefficient technology in old hydro plants;

    g) destruction of rainfall catchment areas which has resulted in climate variability thus making investment in hydropower systems a risky venture;

    h) inadequate hydrological data; and,

    i) inadequate policy, legal and regulatory framework to support exploitation of this natural resource.

B Geothermal Energy

1. Geothermal resources in Kenya are located within the Rift Valley. Initial investigations indicate that Kenya's Rift Valley has a potential of more than 2,000 MW that can be exploited for generation of electricity using conventional methods for at least 20 years. These resource estimates are based on preliminary surface reconnaissance data as only Olkaria and Eburru fields have had significant investigations carried out which included exploratory drilling.

2. The actual potential for power generation may exceed this estimate, if binary generation systems are used concurrently with the conventional systems. Currently, only 125MW of the estimated geothermal potential has been developed, accounting for about 10% of the total installed generating capacity. KenGen owns 113 MW of this capacity and an IPP 12MW. The three plants are located in the Olkaria geothermal field. A potential site for Olkaria IV, 70 MW geothermal project has been identified and plans for full appraisal of the steam field are in progress through budgetary support by Government. This plant is scheduled for commissioning in 2009/10.

3. Between 1999 and 2003, no funds were provided for geothermal resource assessment and as a consequence time was lost in gathering critical data on geothermal field capacity for Olkaria IV fields. To address these financial resources constraints, Government is committed to providing some budgetary support. However, funds needed for steam field appraisal and production still pose serious challenges since the private sector is unprepared to commit resources in geothermal resources assessment. The overriding challenge therefore relates to the Government's ability to mobilise adequate resources in order to make geothermal energy development a feasible alternative to the high cost oil fired electricity generation.

C Nuclear Energy

1. A rule of thumb in planning electric power systems dictates that no single power plant should exceed 20% of a countrys' total installed capacity, in order to meet security of supply standards. Considering Kenya's situation and given this security of supply standard relative to the installed generating capacity, and taking into consideration an eight year lead time for construction and commissioning of a nuclear power plant, the largest nuclear power plant installation that would be appropriate for Kenya's power system in 2015 would be about 370MW. This plant size is in contrast with the current minimum economic size of 500MW for nuclear power plant estimated to cost US$1.5 billion to construct.

2. Assuming that a 370MW nuclear power facility was to be economic and that the current capital cost estimate of US$ 3000 per kW would be applicable and excluding interest during construction, it would cost at least US$1.3 billion to construct and commission. This is indeed a colossal sum of money, which Kenya can hardly afford in the near future. Moreover, it would cost about UScts8.4/kWh to generate electricity at 90% load factor which is higher than power generated from geothermal power plants

3. Moreover Kenya's preparedness for handling critical issues on environment, health and safety would require a lead-time of at least 10 years. Despite these economic and technical constraints, there is need to keep abreast of new developments with a view to taking advantage at opportune time. Of particular interest is the *Pebble Bed Modular Reactor* (PBMR) in units of 110 MW currently under development by the Republic of South Africa, estimated to cost US$1,200 per kW installed by 2006 when commercial production is expected to commence. At this cost, Kenya will seriously consider the economic merit order of nuclear power generation relative to other sources

4.1.2 Transmission System

1. The power transmission system is currently made up of 1,181 kilometres of 220kV lines and 2035 kilometres of 132kV lines. In addition, there are 580 kilometres of 66kV lines used for both power transmission and distribution. The installed capacity of generation substations in service is 1427 MVA.

2. Due to funding constraints, expansion and reinforcement of the network has not kept pace with the increase in demand for electricity, thus impacting negatively on supply reliability and system stability.

4.1.3 Distribution System

1. The current distribution network comprises 5,430 kilometres of 33kV lines and 13,879 kilometres of 11kV lines. The corresponding distribution transformer capacity in service is 6,267 MVA broken down into 3,721 substations and 2,546 transformers. Past poor corporate governance and imprudent allocation of financial resources have virtually devastated KPLC's distribution system to the extent that consumers are currently experiencing 11,000 power outages per month, not to mention the un-quantified massive damage to property and loss in economic production.

2. KPLC's weak financial resource base has resulted in the stagnation of investments in the distribution system reinforcement with the attendant increase in low voltage losses. As a consequence and coupled with rising electricity thefts the overall system losses have steadily risen from 15.6 % in FY 1994/95 to 21.5 % in 1999/00. This level of losses is both unacceptable and unsustainable. To address the distribution system weakness, the Government is assisting KPLC to mobilize requisite financial resources. KPLC is currently reinforcing its distribution system, and at the same time expeditiously putting in place appropriate measures to reduce electricity thefts. Marginal gains from these efforts are already being realised as system losses had reduced to 20% of net generation in 2002/03.

3. The overriding challenge is therefore to mobilize adequate financial resources to modernize the power transmission and distribution infrastructure in order to guarantee delivery of quality and cost-effective electricity supplies.

4.1.4 Regional Interconnection

1 The Kenyan power system is interconnected with the Ugandan system through a 132 kV double circuit from which 30MW of non-firm power is imported. Plans to interconnect with the Southern Africa Power Pool (SAPP) through Tanzania and Zambia are at an advanced stage. Other plans are also underway to interconnect Kenya with the Congo in the medium term. With these cross border transmission grid interconnections, Kenya will enhance power supply security particularly during periods of severe droughts, in addition to helping in making prudent decisions on generation capacity additions. The challenge is therefore to pool adequate financial resources from domestic, bilateral and multilateral sources to ensure timely implementation of these regional power interconnection projects.

4.2 FOSSIL FUELS

1. Kenya has no known commercial reserves of petroleum, coal and natural gas although exploration is in progress. All the requirements for these fuels are therefore imported. Petroleum oil is imported in form of crude oil for domestic processing and as refined products.

4.2.1 PETROLEUM

A Petroleum Exploration

1. Petroleum exploration began in the 1950s with the drilling of the first well in 1960, and by 1981 fourteen wells had been drilled in the sedimentary basins. Although some of these wells encountered oil and gas traces, none of them had any commercial deposits. However, the information obtained regarding the stratigraphy of these basins is critical in understanding the rock formation occurrence. These works were undertaken under a royalty based licensing system provided for under the *Mining Act, Cap 306.*
2. In 1982 the Petroleum Exploration and Production Act, Cap 308 was enacted to govern petroleum exploration and improve incentives to companies involved in exploration in Kenya. The period beginning in1983 saw significant exploration activities with five of the offered blocks taken up by oil companies, leading to the drilling of 12 wells by 1993. The period between1993 and 1999 registered low exploration activities mainly due to depressed international crude oil prices which made it unattractive for prospecting companies to venture into areas perceived to be marginal. Most of the exploration activities undertaken during this period largely consisted of collection and analysis of primary data by National Oil Corporation of Kenya (NOCK).

3. Since the year 2000, exploration activities have picked up markedly and three Production Sharing Contracts (PSCs) are currently in operation in the Lamu Basin. Four more PSCs were expected to be concluded between 2001 and 2002. Other ongoing activities in exploration include acreage promotion through sale of geological data to prospective oil companies, exhibitions at international geological seminars and conferences and advertisements in selected petroleum publications with wide international readership and on the Internet. Basin-to-basin studies are also being undertaken by NOCK and through limited consultancies in specialized areas. These activities are meant to minimise risks to potential oil prospecting companies by providing primary data on source rock formations in all sedimentary basins in the country.

4. Commercial discovery of hydrocarbon resources would have a profound impact on the domestic economy, particularly in addressing the trade imbalance, which the country has continued to experience over the last three decades. Currently, the *Petroleum Exploration and Production Act* requires a licensed petroleum exploration company to undertake minimum work programmes that include geophysical and geological surveys without specifying when this should be done. This has led to delays of 6-7 years in undertaking agreed drilling programmes from the dates of granting licenses. Furthermore, the rate of exploration has been very low, at an average of one well per year. The challenge therefore, is to reverse this trend by strengthening the legal framework and enhancing the enabling environment to mitigate perceived risks.

B Petroleum Supply and Distribution

1. Both the Government and private sector have made major investments in the downstream operations of the petroleum industry. The Government's interests are largely in refining, transportation and storage. It is also involved in the supply and distribution of petroleum fuels through the National Oil Corporation (NOCK) of which it is the sole owner, but its market share is less than 1%. The private sector has invested in petroleum refining jointly with Government, storage, supply, distribution and retail facilities. The private sector dominates the supply and distribution activities in the downstream petroleum industry.

2. Consistent with its economic policy reform agenda, the Government in 1994 decontrolled oil prices, which had been regulated since 1971, discontinued its involvement in crude oil importation, partially liberalised importation of refined petroleum products and fully deregulated oil transportation modes and their attendant tariffs. In addition, the Government fixed the minimum crude oil volume that had to be imported by oil companies at 1.6 million tonnes of LPG rich crude to ensure annual production of LPG did not fall below 28,000 tonnes, the average annual output by the oil refinery before deregulation.

3. Further, at the same time, the Government introduced suspended duty on motor gasolines and fuel oil at Ksh.500 per kilolitre to give the Kenya Petroleum Refineries (KPRL) time to restructure and become competitive. The duty was to be reduced to Kshs.250 per kilolitre in the second and abolished in the third year. Over the two years of the duty enforcement, the Government was to put up LPG import handling and storage facilities to ensure supply security in the event of inadequate production by the oil refineries due to competition. As at December 2003, the suspended duty had, however, not been abolished, but was instead adjusted to Kshs.450 per kilolitre as a result of the failure to make the needed investments in the oil refineries and the LPG facilities. Moreover, KPRL has virtually made no efforts to improve its competitiveness and continues to produce motor fuels which do not conform to international environmental standards.

4. The deregulation of the petroleum industry has introduced new economic players, most of whom have ignored environmental quality, health and safety regulations. In addition, the market entry of these economic operators has resulted in the increase of adulteration of motor fuels with kerosene and dumping export products for illicit commercial gains at the expense of fiscal revenue and unsuspecting motorists

5. The Challenge facing the downstream operations is for the key players to make the required investment decisions that meet minimum environmental, health and safety requirements. Lack of an effective legal and regulatory framework for the industry to enforce minimum operating standards is also challenge.

6. The Mombasa-Nairobi oil pipeline having done 26 years since its commissioning in the first quarter of 1978 needs to be renewed as the average economic lifespan of pipelines is 25 years. Investments are therefore needed to give it a new lease of life.

7. The KPRL which operate two simple crude oil hydro skimming units is unable to compete with imported refined products because of its high cost of production, inability to match supply to demand and production of large volumes of fuel oil. The refinery would therefore collapse if the current tariff and non-tariff protection were to be lifted.

8. The operations of the petroleum industry are regulated through licenses issued by various agencies under different Acts of Parliament With licensing being handled by a number of agencies, as provided for in these Acts, enforcement of regulations on industry standards and practices has posed a very serious challenge. Moreover, most of these Acts were written several decades ago and the fines and penalties stipulated therein are too low to serve as deterrents.

9. In addition, with petroleum prices deregulation, new governance issues relating to the industry not covered in these Acts have emerged, thus requiring harmonization of these Acts and in some cases introduction of new provisions consistent with developments in the industry. The following are the Acts impacting on the industry and some of which require revision and harmonisation to take account of the market dynamics;

a) ***Petroleum Act, Cap 116*** that regulates importation into the country, road transportation and storage of petroleum products;

b) ***Trade Licensing Act, Cap 497*** under which licences for importation, exportation distribution and retailing of petroleum products are granted;

c) ***The Standards Act, Cap 496*** that provides for establishment of minimum quality specifications for petroleum products used in the country;

d) ***Environmental Management and Co-ordination Act, 1999,*** which regulates the environmental aspect of the petroleum sector;

e) ***Local Government Act, Cap 265*** which provides authority for approval by Local Authorities of sites for construction and installation of fuel storage and dispensing facilities;

f) ***Physical Planning Act, Cap 286*** that provides for zoning of areas for storage, distribution and retailing of petroleum fuels; and,

g) ***Weights and Measures Ordinance, Cap 513*** under which storage tanks and dispensing equipment for sale of petroleum products are calibrated and regulated for accuracy.

10. With the increase in the number of oil trading companies, adulteration of motor fuels (i.e. gasoline or gas oil mixed with kerosene) for financial gains has been on the rise. This poses a problem to the consumer of the adulterated fuel in terms of vehicle breakdown and associated high cost of maintenance and also erodes Government's revenue as kerosene attracts lower duty and taxes than the other two products. The Kenya Bureau of Standards (KEBS) under the *Standards Act* is mandated to deal with problems of this nature. However, KEBS does not have adequate resources to address the menace. The Government, as a temporary measure has engaged a private inspection company to assist in the detection of adulterated fuel through a fuel marking mechanism for the purpose of prosecuting the culprits. The challenge is therefore to enforce the Petroleum Act, Customs *and Excise Act* and the *Standards Act* to ensure that the consumer gets quality fuel commensurate with value for money and the Government does not lose revenue. Government further intends to address this problem by creating an energy sector wide regulatory authority.

11. Diversion to the domestic market of duty free bunkering and export petroleum products increased sharply after the liberalization of the petroleum industry. This activity has continued to erode fiscal revenues and to distort statistics on domestic fuel consumption and balance of trade accounting through false customs declarations. A fuel-marking program has been introduced for bunkering and export products to stump out this problem by making such products easily detectable by enforcement agencies. In addition, export products are escorted to border points, a situation which increases administrative costs, thus diverting resources from other areas. Despite enforcement of these measures, the challenge remains elimination of this illicit trade.

12. Retail and wholesale dispensing sites that do not conform to any set standards sprung up with deregulation and have since continued to grow. Such fuel dispensing facilities are not only more vulnerable to accidents but also pose serious safety, health and environmental hazards associated with incidents of oil spills, fires and ground water contamination. Incidents of deliberate under-dispensing of fuel to consumers under the pretext of selling competitively priced fuel by interfering with dispensing pumps have been on the increase. The challenge is to ensure that all fuel-dispensing facilities meet the minimum prescribed standards for environmental, health and safety, and pumps are properly calibrated for accurate fuel dispensation.

13. Despite a significant increase in the number of retail outlets since price liberalization, supply of petroleum products in remote areas has not been adequate. This is associated with low consumption levels and long supply distances both of which make doing business in such areas uneconomical and therefore unattractive. Furthermore, the Government recognizes that there can be no meaningful development in such areas without adequate supplies of commercial energy. The challenge therefore is to ensure that such areas are adequately supplied with petroleum fuels at affordable prices.

14. Government recognizes that petroleum fuels are key prime movers of the modern sector of the economy and that without adequate, reliable and secure supply of competitively priced petroleum fuels, no meaningful level of economic growth can be realized. Cognizant of this reality, it is a legal requirement in the country for all oil-marketing companies to maintain at least twenty days of consumption as operating stocks. While it is accepted that this minimum stock level may be grossly inadequate in times of crisis, the Government recognizes that the economy may not be in a position to sustain higher stock levels, which are desirable due to the associated high cost of the working capital. The challenge is to have a long term solution to increasing fuel quantities of strategic importance to manageable levels.

4.2.2 COAL

A Coal Exploration

1. Kenya has no known commercial coal deposits and has been importing all her requirements. Exploratory drilling has been in progress in Mui Basin in Kitui and Mwingi districts and Taru basin in Kwale and Kilifi districts. Preliminary findings have been encouraging but a lot more work remains to be done.

2. To date there has been no private sector involvement in coal exploration and Government efforts in this respect have also been low. This situation has been caused by lack of interest by the private sector and inadequate financing for coal exploration work. It is recognized that any discovery of coal in the country will help alleviate the pressure on the balance of payments arising from importation of petroleum. The challenge is to mobilize sufficient resources to promote coal exploration.

4.3 BIOMASS

4.3.1 Woodfuel

1. Based on a comprehensive household energy supply and demand survey carried out in 2000 by the Ministry of Energy, it is estimated that Kenya has a sustainable wood fuel supply of 15 million metric tonnes, which leaves a deficit of 20 million metric tonnes, which was being met through stock depletion, and use of agricultural residues. Without policy intervention this deficit is expected to rise to 33 million metric tonnes by 2020.
2. The Government has promoted Agro forestry and social forestry programmes to increase the stock of woody biomass on farms to make up for the loss of forest trees as forestland is converted into agricultural and settlement land. This is a multidisciplinary effort involving the Ministries of Energy, Agriculture and Ministry of Environment and Natural Resources.
3. Current supply sources for fuelwood are on-farm production, which accounts for 84%, trust land 8% and gazetted forests 8%. This supply pattern shows a dramatic shift from the situation prevailing in the 1980s due to a high degree of success of the agro forestry campaign by the Government, self- help groups and Non Governmental Organisations (NGO's). In the 1980s, agro forestry sources accounted for 47% of the total supply while public lands (Trust land and gazetted forests) contributed 53%.

4.3.2 Co-Generation Using Bagasse

1. Co-generation using bagasse as a primary fuel is common practice in the domestic sugar industry in Kenya. The industry comprising seven sugar companies produces an average of 1.8 million tonnes of bagasse with fibre contents of about 18% by weight annually. Out of this quantity, about 56% is used in co-generation using an installed capacity of 25 MW and the balance disposed at cost. Mumias is the only sugar company among the seven factories that is self-sufficient in electricity production and has the capacity to export about 2 MW of surplus power to the national grid. Despite having adequate generating capacity to meet their respective demands and surplus for export, the other six companies are net importers of electricity from the grid. These companies are being restructured with a view to improving their financial performance and hopefully be in a position to be self reliant in electricity generation and export surplus capacity to the grid at competitive prices. In addition, and given that Kenya is a net importer of sugar there are plans to expand the existing factories to make the country self-sufficient and produce surplus for export, these new developments will provide opportunities for increased co-generation of electricity for export to the national grid and thus reduce reliance on oil fired electricity generation.

2. The potential for electricity generation from bagasse has been estimated at 300MW for the seven existing sugar companies at the current capacity. The exploitation of this capacity would improve the diversity of national power supply and save foreign exchange currently used to import fossil fuels for generation of power.

3. The Government is encouraging the sugar companies and other renewable energy producers to generate electricity for sale to the national grid. The Government will also assist such producers to secure favourable bulk electricity tariffs and supply related terms.

4.4 OTHER RENEWABLES

4.4.1 Solar Energy

1. Kenya receives good all year round solar insolation coupled with moderate to high temperatures estimated at 4-6 kWh/m²/day. This can be harnessed for water heating, cost effective crop drying and electricity generation for households and telecommunications facilities in isolated locations. It is currently used widely for various applications including crop, fish and wood drying, through direct exposure to the sun and this open approach affects product quality.

2. It is estimated that in 2003 a total of 140,000 square metres of solar heat collectors for domestic water heating were in use. Most of these are installed in hotels, hospitals and institutions of higher learning. At the household level where the potential for water heating is very high as it is competitive with electricity and charcoal, only a small number are in use.

3. Solar home systems are popular among the educated and relatively well to do rural households and other consumers who are far from the grid. It is estimated that 200,000 photovoltaic solar home systems most of which are rated at between 10 W_e and 20 W_e installed at an estimated cost of KSh. 1,000/W_e are currently in use in Kenya. Over the last three years, the number of home systems installed has grown at an average of 20,000 units per annum. This growth is attributable to aggressive marketing by the private sector with limited support from the Government in form of low taxes on panels. With enhanced state support, it is estimated that the rate of market penetration can be improved considerably. Given that there are at least four million households in rural Kenya alone, the potential for photovoltaic solar home systems is virtually untapped. It is therefore expected that with the diversification of rural electrification strategies, the number of installed photovoltaic solar home systems will grow substantially.

4.4.2 Wind Energy

1. Kenya has a proven wind energy potential of as high as 346 W/m² in some parts of Nairobi, Eastern, North Eastern and Coast provinces.

2. Currently, the installed capacity of wind turbines is 550 kW located at Ngong and in Marsabit. So far these systems have performed reliably generating an estimated 1.6GWh annually. Electricity generation from wind is expected to play an important role in rural electrification, as it is relatively much cheaper than oil fired generation in remote areas inaccessible to the grid in the

short to medium term The constraints facing wind dissemination of wind energy technology include:

a) high capital costs, which make it less attractive relative to diesel fired alternatives for applications such as small scale commercial farming;

b) lack of appropriate credit schemes and financing mechanisms;

c) lack of awareness about the economic opportunities offered by the technology;

d) inadequate data on wind regimes;

e) limited after sales service; and,

f) lack of system standards

4 The challenge is to redress these barriers through collection, analysis and compilation of a comprehensive data base to assist both developers and consumers of wind energy to develop the technical capacity to procure and adapt wind technology for use in different conditions.

4.4.3 Power Alcohol

1. A key reason for the discontinuation of using power alcohol as a motor fuel in Kenya was its relatively higher cost of production compared to petrol, which it was meant to complement. To bring the power alcohol-petrol blend (gasohol) to the same retail price level as super grade petrol, the Government had to reduce the customs tariff on the gasohol. Even with this subsidy, the production of gasohol was still not viable. The challenge is therefore to make the domestic production of power alcohol competitive with motor gasoline to facilitate its re-introduction as a motor fuel blend

2. Under then power alcohol production arrangement, the Agro Chemical and Food Company (ACFC) with Government assistance obtained molasses, the feed stock from state owned sugar factories, at prices which in most cases were below the prevailing market prices. This arrangement by implication provided additional subsidy to the power alcohol and was therefore unsustainable. Moreover, the producer prices of power alcohol did not leave any margin for oil companies for use of their retail network to sell gasohol.

4.4.4 Bio diesel

1. Kenya has no experience with the use of bio diesel, although the potential for its production from locally gown crops exists. However, in order to utilise bio diesel, a system for the production, distribution and use will need to be put in place from scratch. This calls for resources to be mobilised for research and development to facilitate its introduction as motor bled in the medium to long term.

2. Additional land resources will also need to be set aside for the production of energy crops from which the bio diesel will be produced. This calls for the formulation of strategies to optimise land use, as well as to harmonise land use policies with the energy policy.

CHAPTER FIVE

5.0 CROSS CUTTING ISSUES

5.1 INTEGRATED ENERGY PLANNING

1. There is need to integrate energy planning with the national economic, social and environmental policies as energy is a critical complementary factor input in the social economic progress of any economy. At the energy sector level, there are close linkages between the various forms of energy, which necessitate integrated energy planning. For example, increased usage of LPG would lead to a reduction in biomass consumption and attendant health risks; similarly, widespread use of windmills for water lifting either for domestic or agricultural use would have a corresponding reduction in the amount of electricity or petroleum needed to undertake these tasks. Given these inter-fuel linkages or substitution, integrated energy planning is essential in the development of energy supply and demand balances.
2. The main challenges facing integrated energy planning include development of reliable data bases for all energy forms, ensuring sustainable environmental conservation and linking integrated energy planning with human development and policy making processes.

5.2 LEGAL AND REGULATORY FRAMEWORKS

1. The existing legal and regulatory frameworks governing the petroleum and electricity sub-sectors are inadequate, and there is no specific law to regulate the management of biomass and other renewable energy sub-sectors. The challenge is therefore to review the existing laws to conform to the emerging issues in the petroleum and electricity sub-sectors and develop appropriate legal regimes for biomass and other renewable energies.

5.3 ENERGY PRICING

1. Pricing is a key policy instrument for promoting efficient allocation of resources and seeks to balance the economic value of goods and services against the cost of production and delivery to the consumer. As a key component of demand and supply management, the price should provide appropriate signals both to the consumer and the producers on which goods and services are desired by the market at any given time.
2. Under competitive conditions the market mechanism delivers this requirement, however where market players wield substantial market power, government intervention is required to mitigate the market failure. Where the government regulates prices, the pricing process is informed by principles of fairness and equity for the benefit of both producers and consumers. The objectives of energy pricing are closely related to the goals of energy planning and include economic pricing of energy services to ensure supply sustainability and eliminate wasteful consumption, promoting conservation and sustainable use of resources, providing a reasonable return on

investments to ensure the viability and autonomy of the energy sector, ensuring simplicity and transparency of the prices and pricing mechanism as well as a reasonable degree of price stability over time for regulated energy service providers and social recognition of every citizen's basic right to be supplied with the minimum energy needs and hence guaranteeing a minimum level of service to vulnerable segments of the society.

5.4 GENDER

1. In the traditional society, production and use of biomass fuels is the responsibility of women and children. Men only get involved when these activities get commercialised. Due to diminishing biomass energy supplies, women and children in some parts of the country are spending increasing amounts of time fetching firewood and other biomass fuels leaving little time for other productive activities for women; and limited study-time particularly for the girl child. The prevailing social structures including the land tenure system in some situations also inhibit access to biomass fuels by women. In addition, the use of low quality energy supplies and inefficient conversion devices poses health risks to women due to indoor air pollution. The challenges are therefore to mainstream gender issues in policy formulation and in energy planning, production and use, undertake public education and awareness creation on the cultural structures and practices hindering the access by women to biomass fuel resources, undertake public health education on appropriate use of biomass fuels and promote the use of fuel efficient biomass cook stoves.

5.5 RESEARCH AND DEVELOPMENT (R&D)

1. Research and Development plays a critical role in the development, conversion, transportation and use of energy. Energy-related R&D can be classified into three different categories, namely policy analysis and development, technology-oriented and demonstration activities.
2. Past efforts in R&D have focussed on policy analysis and development as well as demonstration activities, while limited attention has been given to technology-oriented research. The main challenges facing R&D on energy include developing a national energy research strategy, including defining specific roles of government, energy suppliers and private sector in R&D funding, increasing budgetary allocation for R&D, improving co-ordination and reporting mechanisms on energy research activities and results and facilitation of local participation in international and regional research activities, particularly in technology-oriented research.

5.6 ENERGY CONSERVATION AND EFFICIENCY

1. Energy conservation and efficiency refers to measures aimed at reducing energy consumption without sacrificing productivity or increasing costs. Energy conservation and efficiency measures have the potential to scale down capital investments needed to provide additional supplies and reduce overall resource use. It also has the potential of reducing cost of production at the end user level.

2. From the consumer's point of view, energy conservation and efficiency measures yield direct savings on the energy bill. From the national stand point, widespread adoption of such measures can significantly reduce the foreign exchange costs of oil imports and of deferred additional investment in power generation capacity. Ultimately, improved efficiency in the use of energy by all sectors of Kenya's economy would also have a positive effect on the competitiveness of Kenyan products because of the reduced energy input costs. The main challenges facing energy conservation and efficiency have been identified as high cost of introducing efficient and cost effective technologies, lack of awareness on opportunities offered, inadequate fiscal incentives, inappropriate and limited credit and financing mechanisms, lack of standards and codes of practice including regulatory mechanisms for their enforcement and inadequate capacity to promote and monitor penetration.

5.7 DISASTER PREPAREDNESS AND MITIGATION

1. The need to establish appropriate disaster preparedness and mitigation measures is motivated by the vulnerability to the complex and integrated network of energy infrastructure and its potential to affect a large number of people adversely in case of natural or man-made disasters. Natural disasters may be triggered by freak weather and climate changes, whereas man-made disasters may be due to sabotage, human error or technological failure. The material damage that occurs can also have adverse impacts on the environment. Government therefore recognises the need to establish appropriate disaster preparedness and mitigation mechanism within the energy sector.

2. The following hazards are a constant threat that must be taken into consideration in planning and management of the energy sector:

    a) climate and weather hazards including floods, droughts, all types of storms, weather and climate extremes;

    b) geophysical hazards including earthquakes, landslides, volcanic activity and mudflows;

    c) environmental hazards including erosion, desertification, wildfire and infestation;

    d) technological hazards including accidental chemical or industrial release, structural or infrastructural systems failure;

    e) human negligence hazards like fires and system stress, which lead to structural or infrastructural failure; and,

    f) vandalism and theft of energy installations.

3. The challenge is to establish a national capacity for predicting and where possible preventing disasters before they occur as well as mitigating disasters when they do occur.

5.8 ENVIRONMENT, HEALTH AND SAFETY

1. The impacts of energy production and consumption include atmospheric pollution, deforestation, climate change, soil erosion and siltation of hydropower reservoirs and river systems, among others. Atmospheric pollution and contamination of ground water resources and rivers impact on the health of all who consume the water directly or indirectly through the food chain. Government therefore recognizes the crucial need to protect the environment and sustain its carrying capacity while pursuing the development goals of the country.

2. The challenge is to achieve the socio-economic transformation and development goals through sustainable energy use in a cost-effective and environmentally benign manner. This entails assessment of energy projects for their environmental, health and safety impacts in order to facilitate the establishment of mitigating measures and monitoring plans in parallel with energy development and consumption; keeping all the electric power lines and other utility corridors free of human settlement and development; environmental rehabilitation on project completion or abandonment; and, continued implementation of sound environmental practices for all energy related activities including production and delivery systems.

5.9. HUMAN RESOURCE DEVELOPMENT AND CAPACITY BUILDING

1. Technological and policy issues in the energy sector are highly dynamic. There is therefore need to continuously train and upgrade human resource capacity to keep up with these dynamics. In Kenya's energy sector, specialized research and consultancy services have largely been internationally sourced due to inadequate domestic capacity to undertake such tasks. In addition, specialized training programmes on energy are not available in the country's institutions of higher learning; there is also a discernible gender imbalance in the management of the energy sector, which is dominated by men.

2. The challenges include the need to develop forward looking and dynamic capacity building programmes consistent with emerging needs in the energy sector to minimize external dependence, redressing the gender imbalance in the management of the energy sector and enhancing co-operation with industries, universities and other tertiary institutions of learning.

5.10 REGIONAL TRADE AND COOPERATION

1. Kenya has been actively trading with her neighbours in energy, particularly petroleum and electricity. Cognizant of the fact that international and regional energy trade will continually offer opportunities for reliable and cost effective energy supply to the country, Government will pursue a strategy that will ensure that the country exploits the inherent gains offered by international and regional energy markets. The challenge is therefore to develop and implement policies that promote efficiency pricing, security of supply and integration and linkage of the domestic energy sector to the international energy system.

CHAPTER SIX

6.0 ENERGY POLICIES AND STRATEGIES

6.1 ELECTRICITY

6.1.1 Hydropower

1. The high costs associated with undertaking pre-feasibility and feasibility studies of potential hydropower projects discourage private sector investors from showing interest in hydropower projects. To address these problems Government will set aside funds for carrying out resource reconnaissance survey, pre-feasibility and feasibility studies of already identified potential sites in the five drainage basins, and continue to seek external assistance to augment its resources Reports arising from pre-feasibility and feasibility studies will be made available to potential investors at nominal fees. However, all viable projects will be offered for development through international competitive bidding

2. Sites proving to be unattractive to the private sector on account of high capital outlays or by being economically margin when developed purely for electricity generation will be implemented by Government as multipurpose projects. Consideration will also be given to leasing out such projects for operation by the private sector through long-term concessions.

3. To facilitate investments, Government will ensure land availability and oversee resettlement activities, but investors will meet the cost of land acquisition, resettlement of displaced persons and environmental impact mitigation.

4. The private sector will be encouraged to develop potential sites to generate electricity for their own consumption and for export of surplus electrical power to the national grid. In recognition of any efforts expended, Government will provide letters of intent to serious investors to appropriately guarantee purchase of their electric power on more favourable terms than for investors in fossil fuel fired stations, including a better fiscal regime for hydropower developers. Such support will, however, largely depend on the economic benefits of the project including the competitiveness of the tariffs offered.

6.1.2 Geothermal

1. Government is cognisant of the fact that for accelerated development of the country's geothermal resources, joint efforts will be required from both the public and private sectors. However, it is recognised that the risks associated with initial geothermal exploration, drilling and the assessment of the resource are a significant disincentive to private sector investment and, as has been demonstrated through Kenya's short experience with private investments in this area, could lead to unsustainably high electricity tariffs

2. Government jointly with KenGen financed these pre-development activities prior to the liberalisation of power generation in 1996. KenGen has since then virtually withdrawn from funding these activities on account of being a potential competitor for development of appraised steam fields and largely due to lack of provision of adequate tariff to cover such activities. Government will therefore take full responsibility for such activities.

3. To facilitate undertaking these activities, Government will establish a special purpose Geothermal Development Company (GDC) to undertake geothermal resource assessment including exploration, appraisal and production drilling in prospective areas. In addition, the company will be responsible for development and management of proven steam fields and sell steam to KenGen and IPPs. Sources of funds for the company will include appropriations by Parliament, revenue from early generation through installation of appropriate steam turbine generators on wellheads during resource appraisal; revenue from steam sales to KenGen and other power generation companies selected through international competitive bidding, and loans from both domestic and external sources. For a start, GDC will take over the management of Olkaria I and II steam fields and sell steam to KenGen. In addition, GDC will undertake geothermal resource assessment, steam field appraisal and development of Olkaria IV, Domes and other potential areas.

6.1.3 Rural Electrification

1. The policy objectives are to expand access to electricity as a means to promote sustainable socio-economic development of rural communities. The goal is to accelerate the pace of rural electrification through grid extension and off-grid projects, taking into account economic cost effectiveness criteria, and emphasizing productive use of power for growth and employment creation. Government's goal is to provide electricity service connections to 20% of the rural population by 2010, increasing to at least 40% by 2020.

2. To achieve the above goals, Government will streamline the current institutional arrangements for implementation of the Rural Electrification Programme (REP). A special purpose agency, the Rural Electrification Authority (REA), will be established to manage the REP, including formulation of a rolling REP Master Plan which would present least-cost electrification options for target areas, taking into account location specific factors and also the potential productive use of electricity provided to eligible communities such as irrigation and off-farm income generating activities. Recognizing that grid extension may not be an economically viable and least-cost supply option for all rural communities in Kenya, the REP Master Plan will explore the development of small hydro and/or hybrid off-grid systems comprising renewable energy and oil-fired components. Where feasible, a one-off financial subsidy will be provided for their development by local communities or the private sector. Investors will be allowed to charge tariffs that will enable them have a fair return on their investments.

3. Government will through REA fund rural electrification activities on a cost-sharing basis with communities. The REA will be expected to administer the allocation of funds based on an equitable formula that reflects economic, financial and social development criteria. In addition, consideration will be given to supporting either community or private sector managed national grid interconnected rural electrification projects through a one-off financial subsidy. Under this policy intervention, such communities and the private sector will be allowed to charge a tariff reflecting the operating costs and a return on investments.

4. In an effort to encourage private schemes for rural electrification, Government will establish a conducive regulatory framework including cost reflective tariff structures for small power utilities. This policy will facilitate market entry by independent power distributors (IPDs) particularly in areas remote from the national grid.

5. The current isolated systems have been faced with serious financial resource constraints, which have greatly limited generation capacity and network expansion at a pace consistent with growth in demand. To redress this situation, Government will privatise or concession the isolated systems on the basis of tariff price cup and a committed programme for network expansion.

6.1.4 Transmission and Distribution

1. The power transmission system will be transformed into an open access system that would allow large electric power consumers to contract with generators of their choice. With the future interconnection of the Kenya grid with Tanzania and the Southern Africa Power Pool countries and strengthening of the link with Uganda, the policy of an open access transmission regime would enhance market and supply options for both generators and large consumers. As a first step towards realisation of this policy, KPLC will be restructured to create a state owned transmission company and a private sector majority owned distribution company. The transmission company will be subjected to performance obligations under a system of performance-based contract with Government, while the private sector led distribution company will have a performance based licence issued by the Regulator with strict performance targets.

6.1.5 Electricity Accessibility and Consumer Connections

1. Government recognizes that access to quality electricity services at affordable costs is critical to socio-economic development, particularly industrialization. Government also recognizes that supply of electricity to all needy cases requires financial resources that can hardly be mobilized from the power industry. It is therefore prudent to devise a flexible and financially sustainable strategy to provide electricity to consumers. In this respect, Government will assist where necessary the public electricity suppliers to mobilize financial resources for establishment of revolving funds, to finance financially viable extensions. As the amount needed at any one time may be beyond the financial capability of a utility, priority will be accorded to industrial consumers and small-scale service establishments with potential for fast employment creation and substantial income generation.

2. To ensure financial sustainability of this policy, the cost of electricity supply including associated financing charges will be recovered from such consumers on a monthly basis over a period not exceeding 24 months. In certain situations, consumers will however, be required to provide easily disposable collateral securities to the utilities to safeguard their investments.

6.2 FOSSIL FUELS

6.2.1 PETROLEUM

6.2.1.1 Hydrocarbons Exploration Policy

1. The objective of the Government is to enhance the enabling environment through which petroleum exploration and associated resources development activities can be undertaken in an environmentally sound manner. As part of its strategy to improve the enabling environment in order to advance the timing for undertaking drilling activities by the private sector, Government will carry out the minimum needed exploration works in areas designated for licensing. It is expected that this effort will minimize financial risks and therefore help to attract more oil prospecting companies.

2. Despite perceived marginality of Kenya as a potential of hydro carbons, the country has managed to attract a limited number of oil exploration companies due to the flexibility of the production-sharing model contract embedded in the Petroleum Exploration Act, where the sharing of cost oil, profit oil, surface fee, training levy including Government participation is negotiable. This production sharing contract model has served the country well and will therefore be continued and improved to take account of developments in other countries..

3. Recognizing that risk mitigation is a critical factor in improving the rate of oil exploration, the Government will undertake the following additional activities:

    i. collection and analysis of primary data so as to reduce the exploration risk by private explorers;

ii. making available additional funds to finance data collection and analysis. Sources of such funds will include levies on licensees for surface rights, training and royalties during the production period and the exchequer. External assistance will also be sought from Kenya's development partners to augment these funds;

iii. reducing the size of the exploration blocks in order to attract small exploration companies;

iv. enhancing the existing regional cooperation in data acquisition and exchange so as to reduce cost of exploration;

v. building internal capacity to undertake oil exploration to complement external efforts

vi. introducing services contracts to enhance exploration; and,

vii. ensuring that licensees comply with the licensing provisions including minimum works programme schedule.

6.2.1.2 Petroleum Supply and Distribution Policy

1. Government recognizes that regional imbalances in supply of petroleum fuels may equally promote disparities in the level and pace of socio-economic development. It is therefore Government policy to ensure provision of adequate supply and distribution of petroleum products in all parts of the country at least cost. Critical to the success of this policy is the availability of storage, distribution and fuel-dispensing facilities within close proximities, to guarantee access to fuel, while at the same time maintaining high quality standards of these facilities and products to protect consumer interests and the environment. Consistent with this policy, Government will pursue implementation of the following measures:

    i. development of retail network throughout the country and common user storage facilities where they do not exist;

    ii. investments in the oil pipeline system at a pace in consonance with demand;

    iii. construction of LPG import handling, storage and distribution facilities in the short term. Storage and filling facilities will also be constructed in Nairobi, Kisumu,Nakuru, Eldoret and Sagana and in other parts of the country in tandem with rising incomes and demand;

    iv. removal of non tariff barriers to market entry by abolishing requirements for minimum crude oil processing and contribution to pipeline line fill by 2006;

    v. provision of incentives to investors in new petroleum oil refining;

    vi. introduction of quality petroleum fuels consistent with international standards;

vii. introduction of a new energy legislation embracing both petroleum, electricity and other forms of energy to enhance incentives to the private sector and ensure prudential regulation of the energy sector;

viii. re-introduction of power alcohol as a motor fuel in its long-term policy to enhance security of supply and redress the trade imbalance arising from petroleum imports;

ix. review of the viability of production, marketing and use of bio-diesel in the long term;

x. ensuring that economic operators in the petroleum industry who adulterate motor fuels and divert exports for illicit financial gain will not be allowed to continue to hurt unsuspecting motorists and deny Government of its revenue. Such operators will not only be prosecuted but will also have their licences cancelled;

xi. ensuring strict conformity to minimum construction standards before licensing of dispensing sites and undertaking of frequent calibration of dispensing pumps;

xii. promoting wider use of both kerosene and LPG in households, as an alternative fuel to improve the quality of household energy and mitigate demand on woodfuel;

xiii. maintenance of strategic stocks equivalent to 90 days of national demand in the long term to guarantee security of supply under emergency, the cost of which will be shared equally between Government and the private sector; and

xiv. divestiture of state interests in oil refining and marketing, and eventually in the Kenya Pipeline Company.

6.2.2 COAL

6.2.2.1 Coal Exploration and Utilization Policy

1. The policy objective is to encourage greater coal utilisation using more efficient technologies which apart from being competitive also greatly reduce environmental pollution. Consistent with this objective, the Government will:

   i. encourage the adoption of clean and efficient coal technologies;

   ii. continue to provide budgetary resources for exploration for coal resources;

   iii. encourage private sector involvement in exploration;

   iv. promote wide coal utilization through fiscal incentives;

   v. establish an inventory of existing information and the highlights of preliminary results on local coal exploration which will be used in promotional campaigns in local and international conferences and exhibitions; and,

vi provide and publicise incentives, such as the drawing up of flexible agreements on exploration, development and sharing of profits between the state and private sector in the event of commercial discoveries.

6.3 BIOMASS

6.3.1 Woodfuel Policies

1. The policy objective is to ensure sufficient supplies to meet demand on a sustained basis while minimising the environmental impacts associated with biomass energy consumption. In this respect, Government will.

    i. formulate a national strategy for coordinating energy research;
    ii. increase support for R&D, including capacity building for technology transfer, support property rights and innovations;
    iii. integrate biomass energy issues including research on biomass energy effects on climate, health, etc, into the formal education system;
    iv. licence charcoal production to encourage its commercial production in a sustainable manner;
    v. promote private sector participation in biomass energy production, distribution and marketing;
    vi. increase the rate of adoption of efficient charcoal stoves from 47% currently to 80% by 2010 and to 100% by 2020 in urban areas; and to 40% by 2010 and 60% by 2020 respectively in rural areas;
    vii. increase the rate of adoption of efficient fuel wood (firewood) stoves from 4% currently to 30% by 2020,
    viii. promote inter-fuel substitution,
    ix. increase the efficiency of the improved charcoal stove from the current 30 -35% to 45-50% by 2020,
    x. promote introduction of efficient charcoal kilns in charcoal producing,
    xi promote of fast maturing trees for energy production;
    xii. promote establishment of commercial woodlots including peri-urban plantations; and,
    xiii. offer training opportunities for *Jua Kali* artisans at the village level for the manufacture installation and maintenance of renewable energy technologies including efficient cook stoves.

6.3.2 Cogeneration

1. Promote cogeneration to generate 300MW by the year 2015 in the sugar industry and other commercial establishments where opportunities exist; and,

2. Undertake appropriate studies on co-generation.

6.4 OTHER RENEWABLES

1. The Government recognizes that other renewable energy source including solar, wind, small hydros, biogas and municipal waste energy have potential for income and employment generation. In order to encourage private sector participation in harnessing these sources of energy, Government will:

    i. Continue to collect hydrological data and undertaking of pre-feasibility and feasibility studies on small hydro, including on wind regimes and solar insolation;

    ii. promote feasibility studies on the utilization of municipal waste as a source of energy;

    iii. formulate and enforce standards and codes of practice on renewable technologies to safeguard consumer interests;

    iv. package and disseminate information on renewable energy systems to create investor and consumer awareness on economic potential offered by these alternative sources of energy. This will include establishment of community based pilot projects where feasible to promote acceptance;

    v. amend the *Electric Power Act, 1997* to allow vertically integrated mini-grid systems for rural electrification using renewable energy technologies even in areas where licences have been issued to public electricity supplier;

    vi. promote research in, and development and demonstration of the manufacture of cost effective renewable energy technologies;

    vii. promote development of appropriate local capacity for manufacture, installation, maintenance and operation of basic renewable technologies such as bio digesters, solar water heating systems and hydro turbines;

    viii. promote development and widespread utilization for renewable energy technologies which are yet to reach commercialisation;

    ix. Promote growing of appropriate tree species for production of feedstock for manufacture of bio-diesel;

    x. allow duty free importation of renewable energy hardware to promote widespread usage;

    xi. provide tax incentives to producers of renewable energy technologies and related accessories to promote their widespread use;

    xii. provide fiscal incentives to financial institutions to provide credit facilities for periods of seven years to consumers and entrepreneurs;

xiii. support community based water lifting and pumping, using renewable energy technologies through cost sharing arrangements and fiscal incentives. The level of Government contribution will be determined by the degree of socio-economic impact on the community subject to a maximum capital contribution of 80% by the beneficiaries; and,

xiv. encourage private sector, NGOs and other self help groups to accelerate their efforts in tree planting, and environmental protection.

6.5 RURAL ENERGY

1. Government will encourage and promote private sector initiatives to enter clean biomass and other renewable technologies energy market. Further more, the Government will allocate resources to research into and promote mature alternative sources of energy and renewable energy technologies.

2. Government will continue to promote distribution of petroleum fuels including liquefied petroleum gas (LPG) as part of the energy infrastructure to stimulate both on and off-farm income generating activities, in addition to providing clean energy for rural household use.

6.6 CROSS CUTTING ISSUES

6.6.1 Legal and Regulatory Framework

1. The *Electric Power Act, 1997*, was legislated to replace CAP 314 in order to take new developments on board and to make it more responsive to private sector participation in the provision of electric service. Despite this positive policy development, it has, however, been found that the new Act is still inadequate in terms of providing incentives to the private sector and in accelerating electrification in the country. In addition, the Petroleum Act, Cap 116 has been found to be grossly inadequate in providing an effective regulatory framework for the petroleum industry in consonance with international benchmarks for liberalized markets, while there exists limited regulatory framework for renewable energy technologies. To redress this situation and resolve other regulatory challenges facing the entire energy sector, an umbrella Energy Act will be enacted into law in the short-run with specific provisions to:

   i. transform the Electricity Regulatory Board (ERB) into the Energy Regulatory Commission (ERC) with an elaborate regulatory mandate for the entire energy sector. To enhance regulatory autonomy, Government will remove ERC from the domain of the State Corporation's Act (SCA) and give it latitude to formulate and enforce secondary legislation;

   ii. enable electric power producers sell power in bulk to large retail consumers and power wholesalers through the transmission and distribution grids at economic wheeling charges which will be regulated by the ERC;

iii. enable electric power producers to access retail consumers in the event of the inability of public electricity suppliers to pay for electricity generated and dispatched under power purchase agreements ERC will determine when the affected electric power producers will access the retail consumers under such circumstances, unless otherwise determined by a tribunal proposed to be established under the proposed amendment;

iv. provide for the establishment of a new rural electrification agency as a state corporation to carry out rural electrification. The revenues of the agency will include proceeds of the rural electrification levy imposed by the Minister for Energy, State grants, loans from external sources as approved by Government and fines and fees imposed by ERC under the Electric Power Act on convicted consumers, electric power producers, public electricity suppliers and independent power producers;

v. provide for transfer of all rural electrification schemes to public electricity suppliers on such terms as will be determined by the Ministry of Energy in consultation with the ERC and Ministry of Finance;

vi. grant ERC authority to licence electric power producers, power wholesalers and distributors including contractors for wiring buildings and other installations requiring electricity supply upon conducting proficiency tests;

vii. make the ERC a one-stop office for facilitating permitting and licensing by different Governmental authorities;

viii. create an Appeals Tribunal to deal with complaints and grievances against ERC's decisions to replace the Minister who currently undertakes this function, including settlement of disputes relating to power thefts and non-payment of bills by consumers and public electricity suppliers,

ix. enable renewable energy systems not exceeding 3MW or if operating in hybrid mode in which the oil-fired component does not exceed 30% of the total capacity to operate in any area of the country without any license, irrespective of any other existing distribution license;

x. make it mandatory for a licensed public electricity supplier operating in an area where power generation is being undertaken by parties other than those with agreements or arrangements with such public electricity supplier to buy such power on terms approved by the ERC;

xi. provide for a long term dual or multiple licences for generating, distribution, combined generation and distribution, wholesale and retail of electrical energy, but with an obligation to extend network as appropriate; and,

xii. provide for establishment of a competitive market structure and power market pool in Kenya and within the region; and,

6.6.2 Mobilisation of Resources

1. Mobilisation of financial resources for power system expansion from own and external sources is a major challenge considering the large capital outlays required. Our own experience has shown that IPPs may require incentives to mitigate their perceived political and economic risks. Policies relating to risk management have already been addressed under the sections dealing with the fiscal, legal and regulatory policies. In addition, it is recognised that in the final analysis the responsibility for mobilising resources for the development of the sub-sector will squarely rest with Kenyans. It is in recognition of this responsibility that the fiscal incentives have been provided to domestic equity investors and creditors. Government will encourage Kenyans to take advantage of this generous fiscal regime to minimise country's dependence on external financing. Government will also continue to provide financial support for transmission capacity expansion, since the transmission grid is expected to remain in the public domain. Financial resource to support development of regional electric power inter-connector projects will be raised from a multiplicity of sources that will include taxes, levies, direct budgetary support and borrowing from multilateral and bilateral development partners.

2. Renewable energy technologies have been widely accepted in the country with the private sector playing the lead role in promoting their adoption. The main challenge therefore lies in achieving utilisation on a scale wide enough to create a significant impact. In this regard, Government will mobilise resources to ensure that renewable energy plays a more significant role especially in electrification of areas remote from the grid and which are considered economically unviable for grid extension.

6.6.3 Fiscal Policies

1. Electric power development by its very nature is capital intensive and the volume of funds needed to implement a power generation project can hardly be mobilised entirely from local sources. Furthermore, the response by the private sector in this area since liberalisation of the power generation segment in 1996 has been lukewarm. Our fiscal regime has not helped to improve this situation. In particular, the income tax regime has been cited by potential developers as wanting and should be made more attractive in order to get more competitive generation tariffs.

2. To address these constraints, Government will in the medium to long term review the fiscal regime applicable to the energy sector with a view to:

    i. granting

a) fifteen (15) year income tax holiday for hydroelectric projects whose installed capacity will not be less than 50 MW; 10 years for projects of between 20 MW and 49 MW, and 7 years for those below 20 MW but not less than 1 MW;

b) ten (10) year tax holiday for geothermal and fossil fuel power plants of at least 50 MW, 7 years for plants of between 30 MW and 49 MW and 5 years for plants between 29 MW and 10 MW;

c) ten year tax holiday for power plants using renewable energy including biomass;

d) tax holidays on dividend incomes from investments made on domestic energy sources for seven (7) years; and,

e) income tax exemption on interest incomes to domestic creditors including commercial banks and institutional investors extending loans, with repayment periods of at least seven (7) years, to companies engaged in power generation, transmission and distribution for the duration of their loans.,

ii. continuing the current fiscal policy of allowing procurement of plant, equipment and related accessories for generation and transmission projects free of duty and taxes during project implementation. Procurement of major spare parts for the power plants, transmission and distribution systems including high voltage conductors will also be exempted from duty and taxes;

iii. exempting public electricity suppliers from income tax subject to expanding the network at a cost equivalent to foregone income tax in the preceding year on annual basis. The ERC will monitor compliance and report back to the Minister for Finance on the amounts spent annually. In the event that such amounts are less than the foregone income taxes, the same will be liable for collection as income tax and treated as late payment attracting appropriate penalties under the Income Tax Act, Cap 470. This policy will be in place until the countrywide electricity access rate will be above 70%;

iv. Promoting biomass-based power generation projects; and,

v. Granting income tax holiday to investors in new oil refining facilities for a period of between 5 and 10 years depending on size of investment, in addition to allowing duty free imports for the construction of such refineries.

6.6.4 Integrated Energy Planning

1. The Government recognises the need for integrated energy planning particularly with regard to ascertaining approximate supply complimentarity and will therefore put in place mechanisms for coordinated energy planning in the country.

2. The Government will also facilitate the establishment, maintenance and update of databases on the energy sector as it is critical to decision making in determining least-cost energy supply options for various economic and social sectors, including domestic households.

3. Least Cost Power Development Plan Policy:

   i. The basis for power development planning has been a twenty-year Least Cost Power Development Plan (LCPDP). The preparation of the LCPDP has hitherto been a joint effort between KPLC and the Government; KenGen and ERB are currently involved in the effort as well. However, because of resource constraints, the LCPDP updates have hitherto tended to rely on inadequate information on economic costs for developing both geothermal and hydro projects.

   ii. The Government will take over the full responsibility for preparation of a detailed LCPDP every five years and updated annually to take account of new information and any promising technologies with the potential to generate power at competitive costs. Appropriate funding will be provided to accommodate this activity.

   iii. Where geothermal and hydro projects are marginally ranked below fossil fuel fired plants through economic merit order, they will be given preference on account of being domestic natural resources. However, this special preference will be discarded in the event of commercial discovery of hydrocarbons and/or coal in order to reduce the cost of electricity supply to consumers.

   iv. To ensure that the country will no longer experience power rationing of the scale experienced between September 1999 and December 2000, which was the worst ever in Kenya's history, Government will ensure timely implementation of candidate projects under the LCPDP.

   v. In the past, the LCPDP has tended to give preference to 20MW medium speed diesel modular development, thereby failing to take advantage of economies of scale offered by other technologies. While this approach is based on discounted net present value costs of incremental capacity additions to meet the projected electricity demand, Government will from time to time make alterations to this approach to take advantage of economies of scale or comparative costs in later years.

   vi. For the purpose of least cost ranking, the current policy of assigning an environmental tax of US$ 20 per ton of carbon dioxide or equivalent emitted by fossil fuel fired plants, as economic cost will continue to be enforced.

6.6.5 Energy Pricing

1. Where the market structure permits, energy prices will be determined by the market mechanism. However, where it is necessary to regulate prices because of the nature of the energy services such as electricity distribution which is by nature a virtue natural monopoly, Government will ensure efficiency pricing and a fair return on investments.

2. Petroleum pricing is tied directly to the global economy and hence has a direct and significant impact on the country's foreign exchange expenditures. Petroleum prices will therefore continue to be determined by the market.
3. Woodfuel (charcoal and firewood) prices will continue to be determined by the market, however, when licensing commences, the license fees will reflect the environmental costs associated with woodfuel harvesting to ensure sustainable exploitation of the country's woodfuel resources. New and renewable energy pricing will be determined by the market forces of demand and supply.
4. Electricity tariffs will reflect the cost of supply and also be efficient. In addition, consumer tariffs must also meet the social equity objective of affordability for the under privileged members of our population. The lifeline tariff that currently applies to the first 50 kWh will therefore be continued but consumers will be expected to pay a tariff that at least covers the cost of power generation, as is the practice in some countries. However, its administration will be streamlined to achieve better targeting thereby delivering the intended benefits to the needy and vulnerable members of the society.

6.6.6 Energy Efficiency and Conservation

1. The Government recognizes the need to remove barriers and constraints to adoption of energy efficiency and conservation technologies and will therefore put appropriate measures in place including:
    i. encouraging private sector participation in providing technical and financial support for energy conservation and efficiency;
    ii. enhancing the provision of energy audits and advisory services by the Ministry of Energy to institutions and companies including sensitisation of industries and financial institutions on benefits of energy efficiency;
    iii. establishment of energy and equipment testing laboratories for efficiency and accelerated equipment ageing testing;
    iv. promotion of cost effective industrial energy efficiency and conservation measures within economic sectors through exposure to competition;
    v. dissemination of energy efficiency and conservation information to consumers;
    vi. encouraging demand side management by industrial and commercial sectors, and where necessary provision of the necessary technical support by the Ministry of Energy and electric power utilities; and,
    vii. development of standards and codes of practice on cost effective energy use.

2. Transport Sector

i. The transport sector, which consumes about two-thirds of all petroleum fuels used in the country, offers opportunities for achieving savings on imported fuels through energy conservation and fuel substitution. Government will continue to pursue the following policies to enhance efficiency in motor fuels and to raise revenue.

a) **Taxation:** Since liberalization of the energy sector in October 1994, the only instrument available to Government in mitigating demand is taxation. This instrument has been used and will continue to be used to choke-off wasteful consumption of motor fuels, particularly petrol.

b) **Fuel Economy**: Government will develop and enforce standards for fuel efficiency of motor vehicle engines and also continue to enforce speed limits in order to achieve savings in petroleum fuels, in addition to reducing road accidents throughout the country.

c) **Awareness raising on opportunities to conserve fuel:** Measures will continue to be instituted aimed at raising awareness on the various methods of conserving fuel by adopting good driving and maintenance practices.

d) **Alternative form of transport:** Where appropriate, other transportation options will be encouraged such as mass transportation of passengers and cargo to encourage economies of scale and the attendant fuel efficiency

ii. Government will from time to time provide information on cost effective fuel efficiency standards and on energy conservation measures in the transport sector.

3. Industrial and Commercial Sector

i. Promotion of industrial growth, enhanced export earnings and increased domestic manufacturing are all major Government policy objectives. Industry and commerce including electricity generation consume about 25% of petroleum products in Kenya, second only to transport. The following policies will therefore be pursued:

a) provision where feasible of appropriate fiscal and other incentives to help exploit opportunities particularly as regarding motors, kilns, boilers and heat and energy transfer systems for energy conservation;

b) provision of technical assistance to industry to conserve energy through energy audits will be continued and strengthened;

c) assistance to industry in the establishment of energy management training programmes aimed at achieving greater levels of energy efficiency; and,

d) undertaking demonstration projects to show the benefits from investment in energy efficiency and conservation.

4. Large office buildings, Hotels, Schools and Hospitals

i. The main area for energy conservation lies with electricity use in office buildings, hot water systems in hotels, schools and hospitals. Properly designed buildings can offer reductions in energy use per unit area. Savings can also be made in retrofitting existing buildings. Government policy will therefore require new buildings to incorporate energy and conservation features and will encourage existing buildings to retrofit.

ii. Solar hot water systems can in most instances satisfy the demand for hot water even in very large buildings. It is also competitive with conventional electricity and oil-fired systems for domestic use and on a limited scale for commercial applications, where high heat requirements are low. Proper design can also reduce or eliminate the need for air conditioning systems. Therefore Government policy will be:

a) to enforce usage of solar water heating and natural ventilation in all new buildings where technically feasible.

b) to amend building by-laws under the Local Government Act, Cap.265 to:

- make it mandatory in urban areas to include hot water systems in building designs;
- provide for all new buildings to incorporate cost effective energy conservation measures; and,
- require local authorities to lead by example in the construction and modification of its buildings to incorporate energy conservation and efficiency.

5. Supply side energy conservation and efficiency

i. Government will continue to promote and encourage efficiency in extraction, conversion, transportation and distribution of energy in a cost effective manner. Critical areas of focus will continue to be oil refining, electricity generation and biomass extraction and conversion.

6.6.7. Environmental Policies

1. The Environment Management and Coordination Act, 1999 requires that all energy development projects be subjected to environmental Impact assessments and licences be granted prior to their implementation. In addition, periodic impact assessments are required to be made and licences cancelled for defaulters thus terminating the project. To ensure compliance with these requirements, Government will:

i. give legal authority to the ERC to be a one-stop office for permitting and licensing of generation, transmission and distribution. Under this arrangement the ERC will be responsible for facilitating issuance of permits and licences by the concerned authorities including National Environmental Management Authority (NEMA);

ii. ensure that all new fossil fuel fired plants meet stringent internationally accepted standards for gaseous and particulate emissions and require existing plants to retrofit to reduce environmental pollution to internationally acceptable standards; and,

iii. ensure environmental rehabilitation on project completion or abandonment

6.6.8 Disaster Preparedness and Mitigation

The concept of resilience, that is the ability at every relevant level to detect, prevent, and, if necessary, to handle disruptive challenges while minimising damage to humans, infrastructure and the environment, will be inculcated in the energy production and delivery systems. Consistent with this policy, measures will be undertaken by all the energy sector investments to incorporate disaster preparedness and mitigation strategies into energy policy and management planning and establish early warning systems in all energy production and delivery systems and networks.

1. Specific measure will, inter alia, include:

    i. creation of disaster management and response units;

    ii. putting in place a well-coordinated central command linked to all vulnerable areas of the sub-sector's systems and networks;

    iii. establishment of functional hazard monitoring systems for feedback purposes;

    iv. mainstreaming weather and climate data and information to the sector's core activities;

    v. provision of security to guard power and other energy installations; and,

    vi. undertaking deliberate and coordinated training and education programmes to develop capacity to understand the relationships between climate early warning products and services to usefully relate the same to disaster preparedness activities.

2. The general safety approach and design philosophy based on risk reduction and mitigation of adverse climate effects will remain the long-term basis for development and investment criteria in the energy sector. Using climate and weather information and data, the maximisation of safety factor for hydro dams, power stations, geothermal power stations and fuel oils depots will, inter alia, be taken on board in all future developments especially in areas considered of high risk and high hazard rating.

6.6.9 Research and Development (R&D)

The policy focus on R&D will be to develop a national energy research mechanism that defines the specific roles of Government, energy service providers and the private sector in R&D funding; identify budgetary requirements for R&D in the energy sector and facilitate mobilization of requisite

resources; and, improve co-ordination and reporting mechanisms on energy research activities and results.

6.6.10 Human Resource Development

1. To address the human resource development challenges in the energy sector, the policy focus will be on:

    i. development and implementation of a comprehensive capacity building programme for the energy sector on a continuous basis, particularly on the power sub-sector which has hitherto depended on foreign experts for feasibility studies and engineering supervision;

    ii. provision of adequate budgetary allocations to support capacity building in the energy sector with emphasis on facilitating local professionals to take up more prominent roles in the sector particularly in the realm of research and development and provision of consultancy services;

    iii. liaison with local training institutions to develop appropriate training curriculum targeting key areas in the energy sector;

    iv. promotion of closer collaboration and cooperation in capacity building especially information exchanges with regional Governments and international organizations; and,

    v. taking deliberate steps to integrate female gender in the policy formulation and management of the energy sector.

6.6.11 Regional Trade and Cooperation

1. As Kenya's endowment of commercially viable energy sources is limited and some of the countries in the Eastern, Central and Southern Africa regions have substantial energy resources, Government intends to pursue regional cooperation to take account of comparative costs of energy supply, particularly electricity. In this regard, Government will actively participate and promote bilateral cooperation with Kenya's neighbours and other countries in these regions with a view to:

    i. promoting and pursuing strategies that will minimize international energy trade barriers, attract investments and facilitate exchange of information and data; and,

    ii. actively participating in development of energy sector cooperation frameworks and protocols with regional Governments and international bodies.

CHAPTER SEVEN

7.0 AGENDA FOR ACTION: THE IMPLEMENTATION PLAN:

7.1 SHORT TERM 2004– 2007

7.1.1 Electricity

1. Timely implementation of planned power generation and transmission projects, namely: Sondu Miriu hydro plant (60 MW), optimization of Kiambere hydro plant to increase capacity by 20 MW, optimisation of Olkaria I and II steamfields to facilitate construction of the third 35 MW unit of Olkaria II, raising of Masinga Dam by 1.5 meters to provide additional storage equivalent to 90 GWh per annum, and rehabilitation of mini hydros to increase their life-spans and effective capacities;
2. Establish a Rural Electrification Authority under the State Corporations Act through an Executive Order to implement the rural electrification programme under the Ministry of Energy;
3. Implement a competitive power market structure for generation, supply and distribution of electricity to promote competition, enhance efficient utilisation of financial resources and create customer choice;
4. Establish a Geothermal Development Company to undertake geothermal resource assessment including steam-field appraisal and development for sale to KenGen and other power generation companies;
5. undertake pre-development studies for hydro power and other sources of energy;
6. Make available pre-feasibility study reports on geothermal, hydro, wind and other sources of energy;
7. Legislate a new Energy Act to, among other things, create a common energy sector regulator, the Energy Regulatory Commission;
8. Reinforce the transmission and distribution system to improve quality of electricity services and reduce system losses to about 15% with a view to putting KPLC on a sustainable path to financial recovery and reducing consumer tariffs;
9. Develop a prudent financially sustainable customer connection policy to accelerate consumer connections to at least 150,000 annually;
10. Enhance capacity building of energy regulatory commission for prudential and effective regulation and for the energy sector to reduce external dependence on consultancy services in engineering design and supervision of energy projects;
11. Concession or privatise the isolated power stations;

12. Transfer all the rural electrification assets to KPLC;
13. Assess bagasse based cogeneration potential and implement identified projects based on least cost criteria;
14. Increase rural electrification access rate to 10%; and,
15. Privatize KenGen through an initial public offering (IPO) of 30% of its equity through the Nairobi Stock Exchange.

7.1.2 Fossil Fuels

1. Review the Petroleum Act, Petroleum (Exploration and Production) Act, Mining Act and other related Acts;
2. Provide additional funds for oil and coal exploration;
3. Reduce the sizes of the exploration blocks to enhance prospecting interest;
4. Promote regional co-operation in data and information exchange;
5. Streamline the operations of KPC to optimise the pipeline transportation tariff;
6. Partially privatise KPC;
7. Pursue the streamlining of the operations of the Kenya Railways Corporation to make it more competitive;
8. Upgrade the truck loading facility in Nairobi;
9. KPC to increase the pipeline pumping capacity;
10. Review of the crude oil minimum processing and line fill conditions;
11. Harmonize national gasoline and gas oil standards with international standards on imports;
12. Establish a one-stop shop for petroleum licensing;
13. Privatize NOCK's downstream operations;
14. Build capacity within Government for combating petroleum products adulteration and dumping;
15. Enhance and enforce penalties for mixing motor fuels with Kerosene, dumping and under dispensing;
16. Determine the future of the Kenya Petroleum Refineries Ltd either by converting it into an import terminal or upgrading it;
17. Construct LPG import handling, storage, bottling and distribution facilities;
18. Enforce minimum construction standards for retail and wholesale dispensing sites;
19. Reduce taxes on LPG and related appliances;
20. Standardize LPG cylinders, valves and regulators for households and small scale business enterprises; and,

21. Increase the minimum operational stock requirement to 30 days consumption.

7.1.3 Biomass Energy

1 Draw appropriate plans for biomass energy development including biomass resource assessments and surveys,
2. Revitalize the existing Energy Centres to make them effective outreaches for promoting agro-forestry and other renewable energy technologies;
3. Undertake a study to identify the most appropriate charcoal kiln technologies;
4. Formulate strategies for attaining the target of 300MW of co-generation capacity-by-2015 and incorporate the same in the least cost power development plan;
5. Establish a pilot cogeneration investment programme; and
6 License charcoal trade to encourage sustainable production.

7.1.4 Other Renewable Energy

The short-term interest of the Government will be in capacity development in terms of human and physical resources to facilitate realisation of the energy sector policy objectives in a timely manner and will include the following measures:

1. Manpower rightsizing and critical mass development;
2. Short-term training of all levels of staff especially middle and top-level managers;
3. Development and revitalisation of the facilities in the Ministry of Energy centres to effectively serve as front line field extension, promotion and training facilities of the Ministry;
4. Undertaking critical analysis of the manpower and capability requirements for the renewable energy and other emerging technologies like fuel cell in order to develop capacity across the board in the renewable energy industry;
5. Increasing market penetration of renewable energy systems including photovoltaic and wind systems for rural electrification,
6. Developing standards, codes of practice and regulatory regimes for renewable energy technologies to safeguard consumer interests;
7. Revive the Ministry of Energy's Laboratory with a view to make it a centre of excellence for research, development and demonstration including provision of technical solutions to industry and related problems;

7.2 MEDIUM TERM 2004-2012

7.2.1 Electricity

1. Undertake further geothermal resource assessments to define additional resource base in support of new geothermal power plants;
2. Undertake pre-investment studies on hydro resources to define their technical and economic viability;
3. Implement regional power interconnection projects; and,
4. Provide adequate funding to increase rural electrification penetration to 20%.

7.2.2 Fossil Fuels

1. Introduce shorter durations in service contracts for oil exploration requiring companies to drill exploration wells;
2. Build local capacity in oil exploratory drilling;
3. Construct a common user truck loading facility in Mombasa;
4. Legislate minimum Kenyan standards for all petroleum products consistent with international standards;
5. Extend the oil pipeline to Kampala;
6. Encourage private sector investment in additional capacity for handling, storage and distribution of LPG; and,
7. Build local capacity in coal exploration skills.

7.2.3 Biomass Energy

1. Review and update biomass energy development plans;
2. Implement a program for dissemination of improved charcoal kilns;
3. Initiate programmes aimed at improved stove promotion and education ;
4. Commission a study to revisit the viability of power alcohol;
5. Launch medium term bagasse based cogeneration investment programme with a target of 150MW by 2010;
6. Establish biomass energy technology databases; and,
7. Expand improved stoves and charcoal kiln programmes, to reduce the fuelwood deficit to 5 million metric tonnes by the year 2012.

7.2.4 Other New and Renewable Energy

1. Undertaking full cycle technology transfer from initiation to local adaptation and acceptance of specified technologies;

2. Development of local expertise for energy consultancy services in renewable energy; and,
3. Provision of charcoal kilns by the Government in charcoal producing areas at a fee to cover transportation costs. Use of these kilns will be made mandatory for all charcoal producers.

7.3 LONG TERM 2004-2024

7.3.1 Electricity

1. Develop a regional power pool and a supporting domestic electricity industry structure;
2. Expand rural electrification penetration to 40%; and
3. Provide fiscal incentives to investors in power generation.

7.3.2 Fossil Fuels

1. KPC to install additional pumps for the Mombasa-Nairobi section of the oil pipeline;
2. Extend the oil pipeline to other neighbouring countries and other parts of the country where feasible;
3. Government to keep strategic stocks equivalent to 90 days of demand; and,
4. Put in place incentives to attract investments in a new refinery.

7.3.3 Biomass

1. Expand cogeneration investment programme to realise 300MW target by 2015;
2. Expand improved stoves and charcoal kiln programmes, to eliminate the fuelwood deficit;
3. Review and update biomass energy development plans;
4. Update biomass energy databases.

7.3.4 New and Renewable Energy

1. Develop local manufacturing capability for advanced renewable energy technologies (such as photovoltaic and wind power turbines for electricity generation) both for domestic and export markets; and,
2. Review of the fiscal regime for renewable energy technologies to promote their widespread utilisation.