

**This document is an output from a project funded by the UK Department for International Development (DFID) for the benefit of developing countries. The views expressed are not necessarily those of the DFID.**

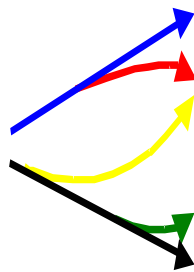
## **Annex 4.3 to Attachment 4 of the final report for R8037**

### **Country Contexts**



**itc**  
**ITDG**

***KITE***



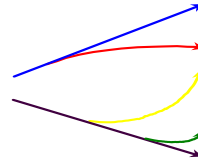
***CEEST***

***The  
Centre for  
Energy, Environment,  
Science and Technology***

***CONTENTS***

1. Ghana country Context prepared by KITE	Page 1
2. Tanzania Country Context	Page 39
3. Kenya country Context	Page 79

***KITE***



KUMASI INSTITUTE OF TECHNOLOGY AND  
ENVIRONMENT (KITE)

---

**GHANA CONTEXT REPORT**

**DRAFT REPORT**

*by*

**Sarah Naa Dedei Agbey  
Henry Mensah - Brown**

**October 2001**

## TABLE OF CONTENTS

<b>LIST OF ABBREVIATIONS.....</b>	<b>6</b>
1.1 POPULATION.....	8
<b>1.2 RURAL-URBAN SPLIT</b>	<b>9</b>
<b>1.3.2 SECTORAL CONTRIBUTION TO GROSS DOMESTIC PRODUCT</b>	<b>9</b>
<b>1.3.3 ECONOMIC SECTORS THAT HAVE ATTRACTED INWARD INVESTMENT</b>	<b>12</b>
1.4 THE ENERGY SECTOR.....	12
<b>1.4.1 USER GROUPS OF NATIONAL GRID ENERGY</b>	<b>12</b>
<b>1.4.2 SUPPLY OF ENERGY RESOURCES IN GHANA.</b>	<b>13</b>
Bio-Energy Resource .....	13
Solar Energy Resource .....	13
Hydro-energy Resource.....	14
Wind Energy Resource.....	14
1.5 DEVELOPMENT CHALLENGES .....	14
<b>1.5.3 POVERTY LEVELS AND INCOME DISTRIBUTION</b>	<b>16</b>
<b>1.6.1 TOTAL GHG EMISSIONS BY SOURCES</b>	<b>22</b>
<b>1.6.3..... METHANE EMISSIONS BY SOURCES</b>	<b>23</b>
<b>1.6.4..... NITROUS OXIDE EMISSIONS BY SOURCES</b>	<b>23</b>
<b>1.6.5 SECTORAL GHG INVENTORIES</b>	<b>23</b>
<b>1.7 DEVELOPMENT OBJECTIVES</b> .....	<b>25</b>
1.7.1 SUSTAINABLE DEVELOPMENT GOALS.....	25
1.7.2..... SUSTAINABLE DEVELOPMENT INDICATORS	26
<b>1.8.2.2 PROPAGATION OF FOREST-BASED PRODUCTS</b>	<b>29</b>
<b>1.8.2.3 FOREST INDUSTRY RATIONALIZATION</b>	<b>29</b>
<b>1.8.3 ENERGY</b>	<b>30</b>
RENEWABLE ENERGY TECHNOLOGIES (RETS).....	30
<b>1.8.3.1CONSOLIDATE AND IMPROVE EXISTING ENERGY SUPPLY SYSTEM</b>	<b>30</b>
<b>1.8.3.2..... INCREASE ACCESS TO HIGH QUALITY ENERGY SERVICES</b>	<b>31</b>
<b>1.8.3.3.....SECURE FUTURE ENERGY SUPPLIES</b>	<b>33</b>
<b>1.8.3.4..... STIMULATE ECONOMIC DEVELOPMENT</b>	<b>34</b>
<b>1.8.3.5MINIMIZE ENVIRONMENTAL IMPACTS OF ENERGY SUPPLY AND CONSUMPTION</b> .....	<b>34</b>

<b>1.8.3.6</b>	<b>STRENGTHEN INSTITUTIONAL AND HUMAN RESOURCE CAPACITY AND R &amp; D IN ENERGY DEVELOPMENT .....</b>	<b>35</b>
<b>1.8.3.7</b>	<b>.....SPECIAL CONCERNS</b>	<b>36</b>
	<b>.....</b>	<b>36</b>
	RENEWABLE ENERGY TECHNOLOGIES (RETs) .....	36
<b>1.8.4</b>	<b><i>TRANSPORT SECTOR</i></b>	<b>36</b>
<b>1.9</b>	<b><i>POVERTY ALLEVIATION AND CDM AGENDA</i></b>	<b>38</b>

## **1 LIST OF ABBREVIATIONS**

AIJ	-	Activities Implemented Jointly
CDM		-Clean Development Mechanism
CIDA	-	Canadian international Development Agency
COP	-	Conference of the Parties
CSIR	-	Council for Scientific and Industrial Research
DANIDA	-	Danish International Development Agency
DFID	-	Department for International Development, UK
EPA		-Environmental Protection Agency
ESMP	-	Energy Sector Management Programme
GDP	-	Gross Domestic Product
GEF	-	Global Environment Facility
GHG	-	Greenhouse Gas
GIPC	-	Ghana Investment Promotion Centre
GLSS	-	Ghana Living Standards Survey
GNP	-	Gross National Product
GOG		-Government of Ghana
GRATIS	-	Ghana Regional Appropriate Technology Industrial Service
GSS	-	Ghana Statistical Service
GTZ	-	Deutsche Gesellschaft für Technische Zusammenarbeit
IFAD		-International Fund for Agricultural Development
KITE	-	Kumasi Institute of Technology and Environment
MEST	-	Ministry of Environment, Science and Technology
MOF	-	Ministry of Finance
MOFA	-	Ministry of Food and Agriculture
MOME	-	Ministry of Mines and Energy
MOP		-Meeting of Parties
NCCC	-	National Climate Change Committee
NGO		-Non-governmental Organisation
NDPC	-	National Development Planning Commission
TCOP	-	Technical Committee on Poverty
UCCEE	-	UNEP Collaboration Center for Energy and Environment
UNCED	-	United Nations Conference on Environment and Development

- UNDP - United Nations Development Programme
- UNFCCC - United Nations Framework Convention on Climate Change
- USAID - United States Aid for International Development

## 1.0 Geography

Ghana is located in the West African Region. It is bordered in the east by Togo, west by Cote D'ivoire, north by Burkina Faso and in the south by the Atlantic Ocean. The total Land Area is 238, 540 km<sup>2</sup> with a fairly flat terrain along the coast and a rising terrain in the interior. There are four major ecological zones namely deciduous rainforest, Semi-deciduous rainforest, Savannah and the Coastal Savanna zones. The two main seasons are the rainy season and the dry season. The rich lands in terms of agriculture and minerals are located in the deciduous and semi-deciduous rainforest and most of the arable lands are in the Northern Region which also happen to be the poorest region in Ghana

### 1.1 Population

Ghana has a total population of 18.4million (2000 population Census report), and an average annual growth rate of 3.1%. The high rate of population growth has created a youthful population age structure with almost half the population (44%) under the age of 15 years.

The current total fertility rate (TFR) of 5.5 gives the country a high dependency ratio of 96 per cent, which compares unfavourably to the average in most industrialized countries taking into consideration the strain on National resources and services. The country had a population density of 32 persons per square kilometre in 1960, 36 persons per square kilometre in 1970, 52 persons per square kilometre in 1984, and then rose sharply to 81 persons per square kilometre in March 2000 (census report). The trend of the population is shown in Table 1.0

**Table 1.0: Ghana population trend from 1960 to 1995**

YEARS	POPULATION (MILLION)	POP. GROWTH RATE
1960	7.4	
1970		
1984		
1991	14.9	2.6
1992	15.2	2.6
1993	15.7	2.9
1994	16.2	3.1
1995	16.7	3.3
1997	18.0	3.1

Source: Population Census Report & Ghana Vision 2020



## 1.2 Rural-Urban Split

Ghana is predominantly rural with about 60% of its population living in the rural areas. The major cities are Accra, Tema, Kumasi, Takoradi and Tamale. The 1970 and 1984 population Censuses indicated that 28 percent and 31 percent of the Nation's population lived in the urban areas (Settlement with populations of 5,000 or more are statistically defined as urban areas while those less than 5,000 persons are classified as Rural in Ghana) while the remaining 72 percent and 69 percent respectively, lived in the rural areas. In 1993, 65% of the population lived in the rural areas. (Ghana Vision 2020).

The March 2000 Household survey conducted by the Statistical Service indicates an increase in the rate of urbanization. The survey found that 38 percent of the Nation's Population live in the urban areas and 62 percent live in the rural areas. Table 1.1 shows the Percentage Rural–Urban Split for three Census years.

**Table 1.1: Rural-Urban Split from 1970 to 2000**

1970		1984		2000	
URBAN	RURAL	URBAN	RURAL	URBAN	RURAL
28%	72%	31%	69%	38%	62%

*Source: Ghana Population Census Reports.*

## 1.3 ECONOMY

### 1.3.1 Economic Activities

About 82 per cent (Daily Graphic, 31st Oct 2000, pp 20) of adults are engaged in some form of gainful economic activity. The main economic activities are agriculture, industry, commerce and services with agriculture remaining the dominant sector by employing 55 per cent of the adult population. There are also 29 per cent of children aged between 7 and 14 years engaged in economic activities such as street selling, an indication of child labour in the country.

### 1.3.2 Sectoral contribution to Gross Domestic Product

The average annual Gross Domestic Product (GDP), growth was 1.1% between 1975 and 1984. The GDP at constant 1975 prices averaged around 5% per annum from 1983 to 1991 as a result of the Economic Recovery Programme (ERP) adopted during the period and fell to 3.9% in 1992.

Table shows the trend of Ghana's GDP from 1993 to 1999 at 1993 constant prices.

**Table 1.2: Ghana's GDP over 10 years period**

YEAR	GDP AT CONSTANT1993 PRICES (Cedi: billion)	REAL GDP GROWTH RATE
1993	3,882.5	
1994	3,999.1	3.0
1995	4,159.9	4.0
1996	4,351.2	4.6
1997	4,533.9	4.2
1998	4,741.1	4.6
1999	4,956.9	4.4

*Source: Ghana Statistical Service*

The GDP for 1999 was valued at ₵20,580.0 billion reflecting a nominal GDP growth of 18.9% over that of 1998. The real GDP grew by 4.4% to ₵4,956.9 billion in 1999 at constant 1993 prices. Despite the energy crisis in 1998, the real GDP grew by 4.6% in 1998. All sectors of the economy contributed positively to the growth in the GDP in 1998 and 1999.

The services sector however continued to be the fastest growing sector and in 1999 a growth rate of 5% was achieved compared to 6% in 1998. The sub-sector performing remarkably in the services sector is tourism with growth rates of 5% and 6.5% in 1998 and 1999 respectively. The performance of the services sector may be attributed mainly to increased output in the finance, insurance, real estate and business services and in the government services sub-sectors.

The agricultural sector continued to dominate the economy and contributed 40.2% of GDP (excluding indirect taxes) in 1999. The agricultural sector grew by 3.9% in 1999 compared to 5.1% in 1998. Cocoa production and marketing and forestry and logging constitute the main sources of growth in the agricultural sector.

Table 1.3 gives the contribution of the various sectors of the economy to the GDP at constant 1993 prices.

**Table 1.3: GDP for the various Economic Sectors  
(Million Cedis at Constant 1993 Prices)**

<b>SECTOR</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
<b>Agriculture</b>	<b>1,430.0</b>	<b>1,456.7</b>	<b>1,511.2</b>	<b>1,590.1</b>	<b>1,658.4</b>	<b>1,746.4</b>
Agriculture and Livestock	994.0	1,003.0	1,038.0	1,103.0	1,132.0	<b>1,168.9</b>
Cocoa Production and Marketing	108.1	0	4134.0	5138.0	7151.0	<b>168.3</b>
Forestry and Logging	107.7	121.3	7	6	5	<b>170.3</b>
Fishing	220.2	109.6	111.8	114.8	139.5	<b>238.9</b>
		222.8	226.3	233.2	234.7	
<b>Industry</b>	<b>971.1</b>	<b>994.5</b>	<b>1,035.3</b>	<b>1,084.4</b>	<b>1,153.3</b>	<b>1,182.3</b>
Mining and Quarrying	221.4	222.1				
Manufacturing	363.3	368.7	234.3	244.2	257.8	<b>268.1</b>
Electricity and Water	99.6	104.9	375.4	388.4	416.9	<b>429.4</b>
Construction	286.8	298.8	111.2	118.3	130.4	<b>117.4</b>
			314.4	333.5	348.2	<b>367.4</b>

<b>Services</b>	<b>1,065.8</b>	<b>1,118.6</b>	<b>1,170.8</b>	<b>1,220.3</b>	<b>1,300.2</b>	<b>1,377.7</b>
<b>Transport, storage and Communication</b>	<b>166.0</b>	<b>176.1</b>	<b>183.5</b>	<b>192.7</b>	<b>206.6</b>	<b>214.9</b>
<b>Wholesale and Retail Trade, Restaurants &amp; Hotels</b>	<b>224.7</b>	<b>237.1</b>	<b>252.5</b>	<b>273.4</b>	<b>299.4</b>	<b>314.4</b>
<b>Finance, Insurance, Real estate and Business Services</b>	<b>158.8</b>	<b>165.2</b>	<b>170.1</b>	<b>177.3</b>	<b>189.2</b>	<b>204.3</b>
<b>Government Services</b>	<b>409.5</b>	<b>430.4</b>	<b>451.9</b>	<b>462.6</b>	<b>482.4</b>	<b>516.2</b>
<b>Community, Social and Personal Services</b>	<b>70.8</b>	<b>72.9</b>	<b>74.8</b>	<b>75.6</b>	<b>81.1</b>	<b>84.3</b>
<b>Producers of Private non-profit Services</b>	<b>36.0</b>	<b>36.9</b>	<b>38.0</b>	<b>38.7</b>	<b>41.5</b>	<b>43.6</b>
	<b>3,466.9</b>	<b>3,569.8</b>	<b>3,717.3</b>	<b>3,894.8</b>	<b>4,111.9</b>	<b>4,306.4</b>
<b>Sub Total</b>	<b>415.6</b>	<b>429.3</b>	<b>442.7</b>	<b>456.4</b>	<b>422.0</b>	<b>434.7</b>
<b>Net Indirect Taxes</b>	<b>3,882.5</b>	<b>3,999.1</b>	<b>4,160.0</b>	<b>4,351.2</b>	<b>4,533.9</b>	<b>4,741.1</b>
<b>GDP in Purchaser's Values</b>						

*Source: Ghana Statistical Services*

### **1.3.3 Economic Sectors that have attracted Inward Investment**

The economic sector that has attracted a lot of investment from 1994 to 1999 is the service sector, thus making it the lead sector, although Agriculture employs the largest percentage of the population.

## **1.4 The energy sector**

### **1.4.1 User groups of national grid energy**

Estimates for access to electricity vary widely. One source estimates the percentage of the population in Ghana with access to electricity at about 50%.

Another source report the estimated percentage of total population with connections to electricity supply in Ghana as having grown from about 12% in 1989 to 36% in 1993 (Brew-Hammond, 1998). Only 15% of rural dwellers have access to grid electricity. (KITE 2000).

The energy mix currently is Hydro, Thermal and Solar (But basically on a pilot scale)

Hydro forms about 70% while Thermal forms 30%. At the household level, the major source of energy for cooking and lighting are Fuel wood, Charcoal and Kerosene.

#### **1.4.2 Supply of energy resources in Ghana.**

Ghana is endowed with biomass, solar, hydroelectric, wind and thermal energy sources.

##### ***Bio-Energy Resource***

Biomass resource is in the form of wood fuels in the forest areas. It has been estimated that wood fuels constitute about 75-80% of the country's average annual energy production in 1990 (MOME 1991). The situation is no different now. The future availability of wood fuels to meet the country's energy needs is uncertain. The uncertainty can be attributed to environmental and ecological damages caused by high rates of deforestation and desertification, shifting agricultural practices, which lead to degradation of soils.

Apart from wood fuel sources of energy, biogas as a source of energy is being explored in an effort to diversify and increase indigenous sources of energy so as to reduce over dependence on wood fuels. A typical model project is the "Appolonia" biogas project mentioned elsewhere in this report.

##### ***Solar Energy Resource***

By virtue of Ghana's location in the tropics the sun is directly overhead throughout the year and the country is naturally endowed with enormous amount of solar resources.

In the northern parts of the country – Northern, Upper West and Upper East regions daily solar radiations received range from 450 to 470 cal.cm<sup>2</sup>. Along the coastal regions, daily solar radiations range from 400 to 430 cal.cm<sup>2</sup> while in the forest areas – Ashanti, Brong Ahafo, Eastern and Western regions, because of the heavy forest covers that promote the formation of thick cloud cover the solar radiation averages as low as 380 cal.cm<sup>2</sup>.

In general, apart from isolated tiny demonstration of the operation of photovoltaic equipment in research stations and the university, photovoltaic electric generation is yet to be exploited fully as a viable energy resource in Ghana.

### *Hydro-energy Resource*

Presently, the Volta Basin is the only hydro-energy resource in Ghana. A study by the Volta River Authority (VRA) has identified 17 mini hydro sites on four river basins namely – Oti, White and Black Volta, Tano and Pra basins as economically viable.

### *Wind Energy Resource*

Studies by the Metrological services Department (MSD) indicate that mean wind speeds are highest in the coastal areas and are in the range 4 to 6 mph while the forest areas have wind speeds of 1 to 3 mph. In general, wind speeds are relatively low and thus make the exploitation of wind energy resource economically unattractive.

## **1.5 Development challenges**

Poverty is one of the major development challenges in Ghana and effort by Government to address this problem has led the people of Ghana to join the HIPC initiative. Poverty is a relative word and its characteristics vary from one country to another. Based on this respect there is the need to define Poverty in the Ghanaian perception.

### **1.5.1 Latest Indicators of Social Conditions in Ghana**

Development indicators show that Ghana is a poor country and generally characterised by poverty, low living standards and a poor quality of life for the vast majority of its people. Access to health care, safe water and sanitation is poor and in consequence, life expectancy is low – even though it has improved significantly since independence-and morbidity and infant/child mortality rates are high. Levels of education are generally low and nearly half the adult population is illiterate

The poor standard of living of most Ghanaians is both a function of low level of average incomes and a factor in its perpetuation. According to the World Bank classification, Ghana is ranked among the World's low income countries and, with an average income per head of around \$400 a year, average incomes are less than half those for developing countries as a whole.

These averages mask major disparities between different sections of the population. Females tend to be worse off than males and rural dwellers worse off than urban areas.

Ironically, rural females suffer the lowest living standards, even though they constitute the bulk of the labour engaged in the production and the distribution of the nation's food supplies.

Children in rural areas are especially vulnerable. Those who survive the high rates of infant and child mortality have much less chance of receiving even the most rudimentary education-especially the females; and because of contaminated drinking water, poor nutrition and lack of access to health care facilities, morbidity rates are high. In consequence their productivity as adults is low, thus reducing their chances of improving their standard of living.

### **1.5.2 Poverty**

According to the poverty profile for Ghana 1987-88 2, 35.9% of the total population are poor, defined as persons whose incomes are less than two-thirds of the national average. Poverty is overwhelmingly a rural phenomenon, with 80% of persons classified as poor residing in rural areas. Whereas 27% of non-Accra urban residents and 4% of Accra residents are poor, 43% of the 67% of Ghanaians who reside in the rural areas are poor. Poverty is more pronounced in rural areas as they contribute 80% to the national poverty.

There are also significant regional variations in the incidence of poverty. The incidence of poverty is highest in the savannah, Volta basin and Mid-coast zones. Hard-core poverty is also most pronounced in the Savannah and Mid-coast areas, as well as in the Mid-Forest zone, as shown in the Table 1.4 below.

**Table 1.4 POVERTY BY GEOGRAPHICAL ZONES**

<b>Zones</b>	<b>% of total population in Zone</b>	<b>% of population in poverty</b>	<b>% of population in hard-core poverty</b>
<b>Accra</b>	8.2	5.52	0.64
<b>Mid-Coast</b>	8.8	51.20	12.87
<b>West Coast</b>	9.9	16.19	1.33
<b>East Coast</b>	9.1	20.61	4.03
<b>East Forest</b>	10.6	19.89	3.11
<b>Mid-Forest</b>	9.1	47.28	11.39
<b>West Forest</b>	11.8	40.81	3.73
<b>Upper Forest</b>	9.0	39.84	3.71
<b>Volta basin</b>	11.6	52.33	8.77
<b>Savannah</b>	11.8	55.93	21.62
<b>Country-Wide</b>	100.0	35.93	7.39

Source: E. Oti-Boateng et al. "A Poverty Profile of Ghana 1987-88", World Bank SDA working Paper 5, 1990

Since poverty is a relative term and its definition varies from one place to the other the involvement of the perception of poverty-focused stakeholders is very significant. Characteristics of poverty derived from a focus group discussion in Ghana revealed poverty as follows;

### **1.5.3 Poverty Levels and Income Distribution**

The results of poverty trends have declined from 51.7 percent between 1991/1992 to 39.5 percent in 1998/1999 (GLSS 4). However, there are pronounced disparities in income distribution between rural and urban communities. Urban/rural disparities were also reflected in different degrees of access to social and economic services like health, water, markets, credit, electricity and education.

Concerning poverty, the Ghana Living Standard Survey (3) (GLSS 3), study revealed that about 31.5percent of the Ghanaian population in 1992 were defined as poor (Ghana Vision 2020: The first step). Of this, one third of the rural populations were classified as poor. However, since two thirds (about 68%) of the Ghanaian population lives in rural areas, the dwellers in the rural areas account for three quarters of the total poverty. Also, notwithstanding the fact that poverty is largely a rural phenomenon, the Ghana Living standard Survey-3, indicates



that urban poverty is increasing, involving 23% of the dwellers in Accra and 28% in the rest of the urban areas.

In Ghana, the incidence of poverty is marked by regional variations. The northern part of the country is poorer than the south. It was also noted that poverty is highest among agricultural food crop farmers and lowest among households where the principal earner is engaged in Formal Sector employment, either in the public or private Sector. The formal sector is however, only a small component of the economy, with a low capacity for labour absorption. The daily minimum wage was ¢2,900 (less than fifty cent) in October, it has however now been increased to ¢4,400 and the average per capita GNP at current prices is \$400. Table 1.5 shows the trend of the GNP, a five-year period.

**Table 1.5: Ghana per capita income for five-years (1991 –1995).**

<b>YEARS</b>	<b>PER CAPITA GNP AT CURRENT PRICES (US DOLLARS)+</b>
1991	436
1992	414
1993	430
1994	313
1995	362

*Source: Ghana Vision 2020*

#### **1.5.4 CHARACTERISTICS OF POVERTY IN GHANA**

##### **LOW PRODUCTION**

- Lack of access to land/assets
- Low productive inputs
- Low agricultural technology
- Lack of access to credit/capital
- Pricing and marketing constraints
- Climatic factors
- Low soil fertility
- Small farm sizes
- Lack of research and extension services
- Low productivity

##### **LOW INCOME**

- Lack of marketable skills/untrained labour

- Lack of employment opportunities
- Lack of small enterprise credit
- Lack of farm to market transport
- Low wages
- Lack of income-generating opportunities

### **LOW LEVEL OR LACK OF EDUCATION**

- Low primary enrolment rate
- Poor quality of education
- Inadequate resources
- Inability to pay school fees
- Inadequate classrooms
- Limited facilities
- Poor access (Distance factor)
- Absenteeism

### **POOR HEALTH**

- Food insecurity
- Poor nutrition
- Lack of access to potable water
- Poor access to health facilities (distance factor)
- Inadequate health services
- Insanitary conditions

### **WATER**

- Poor water quality
- Water-borne diseases
- Inadequate supply
- Long distances to fetch water
- Inability to pay for potable water

### **UNPLANNED UNCONTROLLED HUMAN SETTLEMENT**

- Isolated settlements
- High residential densities
- Inadequate transportation network
- Unaffordable housing rents

Lack of access to affordable housing finance

## **ENVIRONMENTAL DEGRADATION**

- Farming in environmentally sensitive areas
- Soil erosion
- Soil nutrient depletion
- Overgrazed/depleted ranges
- Fuel wood shortage
- Deforestation
- Bushfires
- Poor environmental sanitation
- Environmental sanitation problems

### **1.5.5 Expenditure on food**

Food is major item of expenditure for all Ghanaians and its share in total household expenditure has increased. Food has a weighting of 49.2% in the consumer price index, which is based on the household expenditure survey conducted in 1977. In 1987, the Poverty Profile recorded cash expenditure on food of 42.6% of total expenditure. Total expenditure on food averaged 66.6% of which just over one –third is the estimated value of food produced and consumed by the household. Outlay on food by the poor is only slightly higher at 69.1% of total expenditure or nearly half the value of food consumption.

### **1.5.6 Sources of Income**

Over half 55.6% of the incomes of all Ghanaians is derived from agriculture, followed by income from other forms of self-employment which contributes 28.2%. Income from employment provides only 7.3% of household incomes. For the poor the comparable figures are 65.1 from agriculture, 22.8% from other forms of self-employment and only 4.4% from employment. In addition to these low incomes, the age/economic dependency ratio are very high.0

### **1.5.7 Health**

There has been little change in the country's morbidity pattern over the years and endemic diseases such as malaria, water-borne diseases and upper respiratory tract infections are still widespread. These diseases are usually prevalent in areas where there is widespread poverty, poor environmental conditions are and low standards of personal hygiene. There have however been some improvements, notably the eradication of onchocerciasis (river blindness) in areas in the northern parts of Ghana.

In general, slow improvement in the health of the population has resulted in a decline in mortality rates and infant and child mortality

Overall life expectancy at birth had risen to about 55years in 1990(3) compared with 49years recorded in 1970 and 53years in 1985. As in most countries, the life expectancy for men lower than for women, being estimated at 53.2years compared with 56.8years for women

Despite the general increase in life expectancy, infant (0 – 12 months) and child (1-4 years) rates are still high at 87 and 84 per 1000 respectively (UNICEF, 1991 and GDHS, 1988 respectively). Deaths of children aged five years and below accounted for 32% of all deaths reported in the Ministry of Health institutions in 1991 and 30% in 1992.

High infant and child mortality death rates are linked to demographic and socio-economic factors such as high fertility, short intervals between births, malnutrition and communicable diseases hence the disparities between regions i.e rural and urban areas.

Access to health services still remains low. The modern health institutions provide services to about 60% of the population. Although the health system reaches almost all the urban population (92%), it covers only 45% of the rural population, which constitutes 67% of the country's total population.

### **1.5.8 Nutrition**

Available evidence indicates that malnutrition; especially among young children and pregnant women is a serious problem in Ghana. The most common types of nutritional disorders occurring in Ghana are protein-energy malnutrition, anaemia, vitamin A deficiency and goitre. These are manifested in low height/weight in relation to age (stunted); low weight for height (wasted); or clinically classifiable by appearance as in the case of goitre, marasmus and kwashiorkor (severely malnourished)

The GDHS shows that in 1988 about 31% of children were stunted and 8% wasted. In general however, malnutrition like other health problems is predominantly a rural phenomenon and especially acute in the northern savannah zone. In addition, seasonal trends in food intake also influence malnutrition. For example, surveys have found that majority of rural pre-school children in Upper East Region are malnourished during pre-harvest, early post harvest and late post harvest periods

### **1.5.9 Education**

The importance of education in the process of economic and social development cannot be overstated. Experience in developing countries, which have achieved

rapid rates of economic growth shows, that invariably this was preceded by the achievement of high rates of functional literacy. In Ghana, government spending concentrates on primary and secondary education. Expenditure on tertiary education is less than one per cent (0.8%) of total enrolment at all levels. Basic education receives just half the expenditure, even though it accounts for over 90% of enrolment, excluding those in non-formal education. The effects of this bias in favour of tertiary education can be seen in the low level of literacy.

The adult literacy rate in Ghana is estimated at 53%. This is comparable to other developing countries and above the average for sub-Saharan Africa of 45%, but well below the level needed for accelerated development. Inequalities in education can also be found among sexes and different regions (rural and urban areas) in Ghana.

### **1.5.10 Housing**

The housing stock of houses in the country has hardly increased whilst the population has continued to grow, putting considerable pressure on the availability and affordability of housing. In 1987, the total housing stock was over 1.2 million units for a population of 12.3 million, implying a national average of 10.1 persons per housing unit. The occupancy rate in Accra as at that time was 12.1 persons per house and it was amongst the highest in the country.

The shortage of housing is largely due to financial constraints. The performance of the housing finance system has not been adequate, as the system caters mainly for the minority in the upper income groups and provides little assistance to the medium and lower income groups.

### **1.5.11 Water**

Disparities between urban and rural areas are particularly marked in the case of water supply. Most urban dwellers-93%- have access to safe water but only 40% of the rural population. In 1988, only 56% of the overall population had access to safe water compared to 1997 where 65% of the population has access to safe water.

The quality of water available to rural household is unsatisfactory as most communities rely on streams as their source of water supply. As a result of long distances from water source in rural areas and the limited number of public standpipes in urban slums, most households are unable to meet the recommended per capita daily water consumption vital for good hygiene. This has contributed to the occurrence of water – borne diseases.

Although water supplies are better in urban than rural areas, they are still inadequate. The Ghana Water and Sewerage Company, has not been able to expand the supply system to meet the growing urban population, resulting in intermittent closure of water supply as well as poor quality water to certain parts of urban areas.

The supply of water to both rural and urban areas is mainly constrained by lack of adequate resources, both human and financial, rather than any basic shortage of water.

## **1.6 INVENTORY OF GREENHOUSE GASES**

In Ghana, the results of the initial National greenhouse gas inventories on emissions indicate that the significant National sources of CO<sub>2</sub> are petroleum fuel combustion in transportation, residential and commercial activities.

Non –CO<sub>2</sub> emissions sources are biomass burned for energy and the burning of savannah in agriculture.

### **1.6.1 TOTAL GHG EMISSIONS BY SOURCES**

The total CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions by sources for the base year 1994 are 3,330, 414.6 and 3.07 Gg respectively. CO<sub>2</sub> emissions thus constitute 89% of the total GHG emissions by sources while CH<sub>4</sub> and N<sub>2</sub>O contribute 11.1% and 0.1% respectively in absolute terms.

However, considering the global warming potentials of CH<sub>4</sub> (24.5) and N<sub>2</sub>O (320), the percentage share of CO<sub>2</sub> equivalent emissions changes very significantly to CO<sub>2</sub> (23%), CH<sub>4</sub> (70%) and N<sub>2</sub>O (7%)

### **1.6.2 CO<sub>2</sub> EMISSIONS BY SOURCES AND REMOVAL BY SINKS**

The significant sources of CO<sub>2</sub> emissions are fuel combustion in the energy sector and industrial processes. The other sources are biomass burned for energy and burning of savannah agricultural land use. The significant sources are energy (49%) and agriculture (42%), constituting 91% of the total CO<sub>2</sub> equivalent emissions. For instance, of the 3330 Ghg emissions by source categories in 1994, fuel combustion contributes 92% (3048Gg), while industrial processes account for 8% (282Gg) as shown in the appendix. However, the net emissions from these sources are considered zero because CO<sub>2</sub> is absorbed during the re-growth period.

For example, the total CO<sub>2</sub> equivalent emissions by all GHGs (i.e. CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O) for the base year is 1,4465Gg CO<sub>2</sub> equivalent and the corresponding total net CO<sub>2</sub> removals by sinks is –19,878Gg CO<sub>2</sub>. Thus, the carbon sinks in the forested and the reforested lands offset the total CO<sub>2</sub> equivalent emissions giving total net CO<sub>2</sub> equivalent removals by sinks as –5411Gg CO<sub>2</sub> equivalent in 1994. The total CO<sub>2</sub> equivalent removals by sinks over the period, however, decreased

drastically from –20,418Gg (1990) to –4,082Gg (1996) representing about 80% reduction during the inventory period. The sharp decline was due to the increase in the total CO<sub>2</sub> equivalent emissions (CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O increased by 6.6%, 14.7% and 12% respectively) and the decreases in total CO<sub>2</sub> removals by sinks which decreased by over 40% during the same period as a result of high rate of deforestation and correspondingly low reforestation.

### **1.6.3 METHANE EMISSIONS BY SOURCES**

Methane is predominantly emitted from biomass burned for energy and agricultural activities namely rice cultivation prescribed burning of savannah. Both sectors accounted for 91% of the total CH<sub>4</sub> emissions in 1994. The contribution from solid waste disposal sites was very low because they were largely unmanaged shallow sites with very low methane emission potentials.

### **1.6.4 NITROUS OXIDE EMISSIONS BY SOURCES**

Nitrous Oxide is also emitted in much smaller amounts than CO<sub>2</sub> and CH<sub>4</sub>. The total emissions for 1994 amounted to 3.1 Gg as compared to CO<sub>2</sub> (3,048Gg) and CH<sub>4</sub> (155.8). Regardless of the low emission levels N<sub>2</sub>O like methane has much higher GWP of 320 and contributed to 6.8% of the total CO<sub>2</sub> equivalent emissions for 1994. The main sources of N<sub>2</sub>O emissions are burning of savannah in the agriculture sector and biomass burned for energy. N<sub>2</sub>O emissions from human waste are presently not significant because of the small population size and also the present low level of protein consumption per capita.

### **1.6.5 SECTORAL GHG INVENTORIES**

This report identifies the significant sub-sources and sinks categories of the respective economic sectors.

#### **1.6.5.1 Energy Sector**

The emissions from the sector grew by 6.6% during the period 1990-1996. The sector contributed about 57,122Gg to the total CO<sub>2</sub> equivalent emissions in 1994. The share of fuel combustion was 3,048Gg from the sector, while biomass burned for energy accounted for 4,073Gg. The Country's per capita CO<sub>2</sub> emission from commercial energy was relatively low for the inventory period. This was due to the fact that only 20% of the National energy consumption was as a result of fuel combustion, which leads to CO<sub>2</sub> emissions. Thus 80% of the National energy consumption (10% hydropower, and 70% biomass energy) do not contribute to the net CO<sub>2</sub> emissions from the sector. Non –CO<sub>2</sub> emissions from fuel combustion have not been estimated.

#### **1.6.5.2 Industrial Sector**

The contribution of the sector to the total CO<sub>2</sub> equivalent in 1994 was 2%. The significant CO<sub>2</sub> source categories are in the aluminium smelting, Limestone use, and iron and steel scrap melting plants. The CO<sub>2</sub> emissions from the sub-sectors in 1994 are (248.3Gg), Limestone use (28.0Gg) iron and steel (3.18Gg). Thus aluminium and limestone use contributed over 98% of total sectoral CO<sub>2</sub> emissions. Cement is currently produced from clinker processing and therefore does not contribute to CO<sub>2</sub> emissions. The emissions from the aluminium sector decreased from 1994 due to reduction in hydropower production, which supplies power to the aluminium plant. This was also due to low water levels arising from low precipitation in the Volta catchment's, which suggests the vulnerability of the water resources to climate variations.

### **1.6.5.3 Agriculture Sector**

The non-CO<sub>2</sub> emissions from the sector for 1994 are CH<sub>4</sub> (220.6Gg) and N<sub>2</sub>O (2.01Gg). The total CO<sub>2</sub> equivalent emissions thus amounted to 6,049Gg, which is quite close to energy sector emissions of 7,122Gg. The significant source categories in the sector were burning of savannah and enteric fermentation. The CO<sub>2</sub> emissions from burning of savannah and agricultural residue were considered zero since there is re-absorption during re-growth. Burning of savannah in the agriculture sector contributed to 68% whilst enteric fermentation accounted for 28.4% of CH<sub>4</sub> emissions in 1994. About 95% of the total N<sub>2</sub>O emission in 1994 in this sector was due to savannah burning.

### **1.6.5.4 Land Use Change and Forestry**

In 1994 the estimated CO<sub>2</sub> emissions by forest and grassland conversion amounted to 5738Gg while the total CO<sub>2</sub> removals by the country's sinks was estimated at -25,618Gg. This gives the net CO<sub>2</sub> removals by sinks in the land use change and forestry sector as -19,878Gg for 1994. The sector is therefore very important in providing the country's sinks for CO<sub>2</sub> sequestration. The total non-CO<sub>2</sub> equivalent emissions of CH<sub>4</sub> and N<sub>2</sub>O from on-site burning of forest were low, estimated at 467Gg, Co<sub>2</sub> equivalent representing only 3% of the total emissions.

The CO<sub>2</sub> removals by the country's sink however reduced drastically from -40275Gg. (1973) to as low as -5411Gg (1994) within two decades. The sharp decline is attributed to the following National circumstances.

- Seasonal biomass clearings annually for farming, grazing lands, mining and settlement.
- Charcoal and fuel wood use has been increasing over the years (approximately 2.4 times of wood harvested for timber in 1973)
- Restoration of deforested lands was minimal.
- High population growth led to shortening of fallow periods.



- Stocking levels of timber in the forest area has fallen

#### **1.6.5.5 Waste Sector**

The methane emissions from the various sub-categories were low due to absence of waste management practices. The methane emissions from Solid Waste Disposal Sites (SWDS), based on the recommended IPCC methane correction factor of 0.40 for shallow unmanaged SWDS (<5-m depth), ranged from 4.8Gg in 1990 to 7.5Gg in 1996. The increase may be the result of increased population and increase in the volume of solid waste disposal to SWDSs

The total estimated methane emissions from domestic and industrial wastewater handling source categories increased slowly from 17.35Gg in 1990 to 22.35Gg in 1996. This increase was attributed to increased urban population using septic tank sewage treatment that approximates to anaerobic system.

The estimated nitrous oxide (N<sub>2</sub>O) emissions from human sewage increased from 0.12Gg/yr in 1990 to 0.15Gg/yr in 1996 as a result of increased population. The relatively low N<sub>2</sub>O is accounted for by the low protein intake per person per year, estimated at approximately 10% of WHO level of 25.55kg/person/year.

### **1.7 DEVELOPMENT OBJECTIVES**

#### ***1.7.1 SUSTAINABLE DEVELOPMENT GOALS.***

Effort to fight against the menace poverty and the current environmental problem is clearly stated under the Sustainable development indicators and the sectoral goals of Ghana.

Sustainable development can be defined as “positive socio-economic change that does not undermine the ecological and social systems upon which communities and societies are dependent” [Rees, 1989]. Any sustainable development agenda must be concerned with intergenerational equity – that is, with ensuring that future generations have the same capacity to develop as the present generation. A development path is sustainable only if it ensures that the stock of overall capital assets remains constant or increases over-time. These assets include manufactured capital (such as machines and roads), human capital (knowledge and skills), social capital (relationships and institutions), and environmental capital (forests and coral reefs) [World Bank, 2000].

Sustainable development has many objectives. Its overarching aim is to lift the living standards of people, that is, raise per capita income. Embodied in this broad aim are specific goals of sustainable

Development, which include the following [World Bank, 2000]:

- ♦ Reducing poverty;
- ♦ Expanding access to health services;
- ♦ Increasing educational levels;
- ♦ Helping to ensure a clean environment;
- ♦ Giving everyone the opportunity to participate in public life; and,
- ♦ Promoting intergenerational equity.

In Ghana, Sustainable development in the broad sense means improving the standard of living of the populace with the use of environmentally friendly technologies.

The growth strategies employed are therefore designed to be sustainable in terms of both human and physical resources and to avoid the adoption of policies that jeopardise long – term growth. The major goals as outlined in the Vision 2020 are as follows;

- Accelerating growth with macro-economic stability;
- Ensuring balanced development to ensure growth with equity;
- Reducing poverty;
- Enhancing the role of the private sector as the engine of growth;
- Creating an indigenous business and commercial community;
- Building a strong and broad human resource base;
- Developing and modernizing infrastructure facilities;
- Creating a self-reliant and resilient society; and
- Developing quality governance.

These goals are supposed to be achieved sustainably, and the indicators stated in the Vision 2020 for assessing these are as follows

### ***1.7.2 Sustainable development indicators***

National sustainable development indicators (SDI) of projects are to include, among others, factors that would contribute to the attainment of the national development objective to transform the country from the current status of severely indebted, exporter of non-fuel primary products, and low income to at least a lower middle income, moderately indebted, and diversified exporter by the year 2020. The following are the indicators;

- (a) Effective integration of environmental considerations into projects so as to ensure minimization of environmental impacts and thus break the vicious cycle of environmental cost that erode socio-economic gains.
- (b) Poverty reduction
- (c) Increased employment generation and average incomes to raise the current GNP of about US\$400 to a minimum of US\$1700 by 2020.
- (d) Improvement of general health, welfare and well being of the majority of the population
- (e) Positive contribution to GDP growth rate targeted at 8.3% to sustain the high rate of population growth of about 3.0% per annum.
- (f) Contribution to real industry growth rate and raise the current GDP share of 14% to 36% of which manufacturing is 25%.
- (g) Increase literacy level and the proportion of the population with secondary, technical, and tertiary education.
- (h) Contribution to improving the balance of trade position of the country through competitive import substitution and foreign exchange savings, as well as export oriented and foreign exchange earning potential.

## **1.8 SECTORAL GOALS**

The various sectors in the economy in other to help improve the economy have set themselves the following goals;

### **1.8.1 AGRICULTURE**

The overall objectives of the programmes for agriculture development are:

- Achieving a rate of growth in sectoral (crops, livestock, cocoa and export crops, fisheries and forestry) of 4% per annum;
- Increasing the productivity, incomes and employment of workers in agriculture and agro industries in a sustainable and a friendly environment;
- Ensuring an adequate supply of nutritious food for all Ghanaians;
- Raising producer prices as a percentage of prices paid by end-users;
- Fostering relatively balanced regional development through the promotion of regional agricultural growth based on comparative advantage and resource endowment;

- Strengthening intra sectoral linkages as well as linkages between agriculture and other sectors, particularly, industrial processing;
- Strengthening linkages between farming communities and major market centres through the provision of basic infrastructure like marketing information and intelligence, roads;
- Improving land and water conservation.

Some specific activities identified to achieve these objectives are as follows;

- (a) Improve storage, marketing and transport facilities.
- (b) Improve access to schools and medical facilities.
- (c) Expand water and electricity suppliers in crop producing areas.
- (d) Improve linkages with industry and other relevant sector of the economy.
- (e) Improve farmers' access to inputs and credit
- (f) Develop small-scale community-based valley bottom irrigation schemes
- (g) Intensify research on adaptation and local manufacture of agricultural machinery appropriate to smallholdings
- (h) Train farmers in the use of animal traction
- (i) Promote production and distribution of high quality seeds for all principal crops.
- (j) Gradually reduce export taxes on cocoa with a view to their eventual elimination when this is fiscally feasible.

## **1.8.2 FORESTRY**

Forestry is an important source of export and domestic earnings. At the same time, forests protect our soil and water resources, moderate adverse climatic conditions and provide habitat for wildlife. With recent dramatic rise in the exploitation of forest resources mainly through logging and saw milling interests, a Medium –term forest development plan has been prepared.

The plan aims at providing “a sustainable basis for the utilisation and development of forest and wildlife resources, for the modernisation of the timber industry and for the conservation of the environment, thereby maximizing the rate of social and economic development of the country and securing optimum welfare and adequate means of livelihood for all Ghanaians” The specific objectives for attaining the goals of the forestry sector have been translated into five basic development programmes namely:

- Sustainable forest and savannah management
- Propagation of forest-based products
- Forest industry rationalisation
- Wildlife and biodiversity conservation.

### **1.8.2.1 Sustainable forest and savannah management**

The objectives of this programme are to improve management of existing high forest and sustainable levels of timber harvesting, increase public awareness of and the involvement of individuals and communities in the protection and management of forest resources, controlling destructive forest land-use practices (bushfires and unplanned exploitation) and developing and applying sustainable management systems in savannah woodlands. The programme activities to achieve the above objectives are;

- *Sustainable forest management*
- *Increased public awareness and involvement*
- *Technical skills for increased control of destructive land-use practices*

### **1.8.2.2 Propagation of Forest-based Products**

The objectives of this programme are to expand the nation's forest cover for increased yields of domestic and industrial products and also to develop and manage sustainable fuel wood and non-timber products. The programme activities to achieve the above objectives are as follows;

- *Increased forest and tree cover* through enrichment and restocking of degraded forest areas and concessions establish plantations on suitable conversion areas and support community forestry and agro forestry needs.
- *Involvement of local communities in the development of fuel wood and non-timber products*
- *Encourage and assist, indigenous commercial charcoal burners to establish their own woodlot for charcoal burning*
- *Educate local communities on long –term benefits of planting trees for fuel wood*

### **1.8.2.3 Forest industry Rationalization**

The developments objectives of the forest industry rationalisation programme are to assist undertake structural reform to facilitate an effective balance between the timber resource base and the industrial capacity and to improve and modernise milling and increase value-added marketing.

Specific activities set to achieve these objectives are the following;

- *Structural reforms to balance the timber resource base with industrial capacity*
- *Increased mill recovery and value-added processing*
- *Develop processing capacity for plantation and non-timber products.*

### **1.8.2.4 Wildlife and biodiversity Conservation**

Specific activities set to achieve this are;

- *Establishing a viable system of ecologically representative protected areas;*

- *Developing specific tourism attraction areas and promoting eco-tourism;*
- *Increasing marketing opportunities for increased income generation from wildlife products;*
- *Promoting public awareness of conservation and biodiversity benefit*

### **1.8.3 ENERGY**

The objectives developed to address the issues and constraints faced by the energy sector are as follows;

- Reduce the country's vulnerability to short-term disruptions in energy sources and supply;
- Securing future power supply through thermal complementation of a hydro-based electricity generation system;
- Restoring improved productivity and efficiency in the procurement, transformation, distribution and use of all energy resources; and
- Consolidating and further accelerating the development and use of the country's indigenous energy sources, especially wood fuels, hydropower, petroleum and solar energy.

Within the context of the stated vision and also to respond to the developmental priorities of the current Government, the following seven (7) policies are intended to provide the framework for the development and implementation of energy sector programmes and projects in the country.

The policies are as follows;

- to consolidate and improve existing energy supply system
- increase access to high quality energy services
- secure future energy supplies
- stimulate economic development
- 
- minimize environmental impacts of energy supply and consumption
- strengthen institutional and human resource capacity and r & d in energy development
- renewable energy technologies (rets)

#### **1.8.3.1 Consolidate and improve existing energy supply system**

To meet this short-term policy, the Ministry of Energy will pursue the following actions:

- Secure private sector investment in partnership with the public sector for re-capitalization of the energy supply system. The

Ministry of Energy will work to conclude negotiations for the financing and completion of the second phase of Takoradi Power Plant (Takoradi 2) to bring the total capacity to 330MW.

- Expedite the on-going retrofit programme of the Akosombo hydro power plant.
- Reinforce and expand the high voltage electricity transmission system.
- Reinforce, expand and modernise the electricity distribution network.
- Ensure efficiency in the management of the existing energy supply system through the restructuring of the utilities and unbundling of electricity supply system and the deregulation of the petroleum sector. The restructuring of the GNPC, ECG and the creation of the power transmission company will be completed.
- Ensure cost-recovery in energy supply through efficient pricing of all energy services. The utility companies (VRA, ECG and TOR) all face very precarious financial position, which could lead to the complete breakdown of energy services delivery in the country. It is the intention of the Ministry of Energy to reverse this situation in order to ensure un-interrupted supply of energy to meet the requirement of the economy.
- Create adequate strategic stocks for petroleum products to take care of unexpected shocks.

### **1.8.3.2 Increase access to high quality energy services**

In order to meet this objective the following actions would be pursued:

- The Ministry of Energy will continue to expand Government support for rural electrification from both grid extension and decentralized sources such as solar PV and mini-hydro.

- The on-going SHEP 3, which is intended to provide electricity to over 621 remaining towns and rural communities, will be completed. In addition, the Ministry has initiated a SHEP 4, which will commence in 2002 and is intended to extend electricity to about 2,000 rural communities. Unlike previously, the Ministry, in line with the objectives of creating jobs will initiate a vigorous programme support for productive uses of electricity in the rural areas.
- There are some remote rural communities that cannot be connected to the grid in the next 5 to 10 years. Under the rural electrification programme, the Ministry of Energy in partnership with the utility companies and the private sector will initiate a programme to provide these communities with Solar PV systems.

Under this programme Solar PV power will be used to provide lights for rural schools, power computers and television, and also provide potable water. The Ministry of Education has identified a number of distressed schools in the country, which will benefit from this programme.

This programme when successfully implemented will go a long way to improve access to quality education in the rural areas and specifically in the distressed schools.

Under the same programme, the Ministry of Energy will provide solar PV-based power to all remote health posts and health centres, which do not have access to electric power and rely on kerosene for lighting and other energy needs. These PV systems will be used for lighting, vaccine refrigeration and provision of potable water. This programme will improve health care in the rural areas.

- Expand the supply and reach of Liquefied Petroleum Gas (LPG) to substitute wood fuel use in homes and small businesses. The Ministry of Energy will ensure the timely completion of the



secondary conversion unit at the Tema Oil Refinery (TOR) to increase the production of LPG from the current 26,636 tonnes to 117,142 tonnes.

### **1.8.3.3 Secure future energy supplies**

This policy is intended to ensure that Ghana is assured of sufficient energy supplies in the future. To meet this policy objective, the following actions would be pursued:

- Diversify Ghana's energy supply sources by promoting the exploitation of alternative energy supply sources.
- The Ministry of Energy will pursue the development of the West African Gas Pipeline to make available to Ghana the huge reserves of natural gas in Nigeria.
- The Ministry of Energy will ensure that the necessary protocols for the implementation of the West African Gas Pipeline project are completed and the project implemented.
- The Ministry of Energy will promote the use of indigenous renewable energy such as wind energy, solar energy, small hydro as well as biomass energy.
- Promote end-use energy efficiency and conservation.
- INTENSIFY HYDROCARBON EXPLORATION IN GHANA UNDER A MORE PRIVATE SECTOR FRIENDLY POLICY ENVIRONMENT AND WITH A MORE FOCUSED GNPC. GNPC WILL THEREFORE BE RESTRUCTURED TO CONCENTRATE ON ITS CORE BUSINESS OF FINDING HYDROCARBONS.
- The requisite legal and regulatory mechanisms will be put in place to facilitate the participation of Independent Power Producers (IPPs).

#### **1.8.3.4 Stimulate economic development**

This policy is intended to provide an impetus for the energy sector to become a major contributor to the economic growth and prosperity of the country. The following actions would be pursued in order to achieve this objective:

- Export of energy: This is to be achieved through the sale of Ghanaian energy services to neighbouring country markets. By this, the Ministry of Energy will pursue a strategy to expand electricity supply capacity in the country in order to become a net-exporter in the West African Power Pool. The Ministry of Energy also intends to expand petroleum product supply to neighbouring countries by expanding the Tema Oil Refinery and, in the medium term, commission the building of a new and modern refinery.
- Enhance productive uses of electricity in rural areas: This activity will be pursued under the Rural Electrification Programme and is intended to ensure that electricity supplied to the rural communities is used to support agriculture and the establishment of small-scale businesses in the rural communities.
- Enhance Government revenue generation: The Ministry of Energy will ensure that the energy sector will continue to provide a basis for the enhancement of Government revenue through efficient taxes and levies on energy supply and consumption.
- Employment generation: This will be achieved through the expansion and operation of indigenous energy supply services such as electricity generation and refining of crude oil.

#### **1.8.3.5 Minimize environmental impacts of energy supply and consumption**

To achieve this objective, the Ministry of Energy intends to:

- Promote the gradual increase of more environmentally friendly energy supply sources such as renewable energy (solar, wind and small hydro) in the energy mix of the country.
- Promote a shift from oil to gas wherever gas is a viable substitute.
- Support and actively participate in international efforts and cooperation with international organizations that seek to ensure sustainable delivery of energy to mitigate climate change. The Ministry of Energy endorses the United Nations Joint Implementation (JI) and Clean Development Mechanism (CDM).

#### **1.8.3.6 Strengthen institutional and human resource capacity and R & D in energy development**

To satisfy this policy objective, the Ministry of Energy will pursue the following actions:

- Support institutional reforms in the energy sector in line with the provisions of Energy Commission (EC) Act 541 and Public Utility Regulatory Commission (PURC) Act 538.
- Strengthen existing regulatory agencies (Public Utility Regulatory Commission (PURC) and Energy Commission (EC)) to enhance the regulatory environment in the energy sector.
- Support the training of Ghanaians in all fields of energy development and management.
- Re-direct the use of the “Energy Fund” for the support of energy R & D activities.
- Support the transformation of Ghanaian energy research institutions into Centres of Excellence in Africa for energy research and development.
- Strengthen the Energy Commission to compile and maintain a comprehensive energy information database for the country.

### 1.8.3.7 Special Concerns

#### *Renewable Energy Technologies (RETs)*

The Ministry of Energy recognises the growing importance of renewable energy in meeting the policy objectives of securing future energy supplies especially for strategic applications in addition to minimising the environmental impacts of energy supply. The Ministry of Energy is also aware of the numerous barriers facing the utilization of the technology.

To accelerate the development and utilisation of renewable energy sources the Ministry of Energy will pursue the following policy actions:

- Create a level playing field for renewable energy by removing all fiscal and market barriers.
- Encourage utility companies to adopt renewable energy in their supply mix.
- Institute a “RET-Friendly” pricing framework in competitive applications such as in grid-connected supply.
- Provide Government funding support for non-grid connected renewable energy technologies for economic activities (such as agriculture) and social services (such as schools, health centers, provision of potable drinking water).
- Support technological development and cost reduction through pilot demonstration projects and local manufacture of RETs.

### 1.8.4 TRANSPORT SECTOR

The major goal of the transport sector is to provide quality services to the people of Ghana. The activities identified for achieving this are as follows;

- *Provide motorised and non-motorised facilities for the convenience of all Ghanaians.*

- *Promote the use of mass transit facilities such as buses to reduce traffic congestion; Consolidate and expand the arterial roads network to provide the capacity necessary for improved traffic flow and road safety*
- *Operating of railway as a commercially viable enterprise without government subsidy*
- *Reconnect all rail lines in Tema to support the Free Trade Zone (FTZ) programme.*
- *Introduce Sub-Urban trains within Accra-Tema Metropolis*

### **1.8.5 POLICY FOCUS AND GUIDELINES FOR POVERTY REDUCTION.**

Several policies and initiatives have been taken towards poverty reduction in Ghana. The key ones are as follows:

- Program of Actions to mitigate the Social Cost of Adjustment (PAMSCAD). 1986
- The Child Cannot Wait. 1992
- National Action Programme for Poverty Reduction. 1995
- Extended Poverty Study 1988-1992. 1995
- National Plan of Action: HABITAT II. 1995
- Free Compulsory Universal Basic Education (fCUBE). 1996
- Medium-Term Health Strategy (MTHS). 1995
- Revised Population Policy and Population Action Plans. 1994

Ghana Vision 2020 also has specific policy statements pertaining to poverty reduction, under the section containing Policies for the Preparation of Development Plans.

The purpose of this section in the Vision 2020 is to provide a National policy focus to guide sectoral ministries/agencies and other actors

- to prepare action plans, programmes and projects for poverty reduction; and
- to review action plans and programmes in place in order to strengthen and redirect them in accordance with the policy focus.

Action plans/programmes for poverty embraces many aspects of National Development policy. The key elements include the following **priority development themes**

Economic growth, employment and access to productive assets

Access to basic social services and safety nets

Food security and nutrition

Population

Governance and decentralization

Needs of women

Institutional and coordination arrangements  
Poverty indicators and monitoring


### **1.9 Poverty Alleviation and CDM Agenda**

Poverty reduction is one of the key sustainable development indicators among others identified in the National Development Plan (1996 – 2020) - Ghana Vision 2020. A very high premium is placed on poverty alleviation/reduction that every development effort or program has to incorporate a poverty alleviation component so as to obtain government approval and backing. In this respect, there is an implicit understanding among all stakeholders, promoters and partners in CDM program and projects that poverty reduction/alleviation is of paramount importance in the developmental effort.

The involvement/inclusion of poverty-focused stakeholders in the domestic CDM framework-setting is by representation of the National Development Planning Commission (NDPC) on the Committee on Clean Development Mechanism which among others examines the roles Government will be required to play in the implementation of CDM.

The National Poverty Reduction Program is a program directly under the supervision of NDPC and is charged with the responsibility of poverty reduction in the 25 year development plan (1996 – 2020) namely Ghana Vision 2020. The views and interests of the Poverty Reduction Program vis-à-vis CDM agenda are articulated by the NDPC on the Committee on CDM.

***CEEST***

 *The  
Centre for  
Energy, Environment,  
Science and Technology*

**THE CENTRE FOR ENERGY, ENVIRONMENT, SCIENCE AND TECHNOLOGY**

---

**TANZANIA CONTEXT REPORT**

**by**

**Hubert E. Meena,  
Stephen M. Mwakifwamba, and  
Stanford Mwakasonda**

**October 2001**





# TABLE OF CONTENTS

<b>TABLE OF CONTENTS.....</b>	<b>.....</b>
<b>1.0.....</b>	<b>INTRODUCTION</b>
1.1	43
1.2	43
<b>1.2.1</b>	<b>44</b>
<b>1.2.2</b>	<b>45</b>
<b>1.2.3</b>	<b>46</b>
1.3	46
<b>1.3.1</b>	<b>46</b>
<b>1.3.2</b>	<b>47</b>
<b>1.3.3</b>	<b>48</b>
1.4	50
1.5	51
<b>1.5.1</b>	<b>51</b>
<b>1.5.2</b>	<b>52</b>
<b>1.5.3</b>	<b>53</b>
<b>1.5.4</b>	<b>54</b>
<b>1.5.5</b>	<b>54</b>
<b>1.5.6</b>	<b>55</b>
<b>1.5.7</b>	<b>55</b>
<b>2.....</b>	<b>ENERGY PROFILE</b>
<b>.....</b>	<b>56</b>
2.1	56
2.2	58
<b>2.2.1</b>	<b>58</b>
<b>2.2.2</b>	<b>59</b>
<b>2.2.3</b>	<b>60</b>
<b>2.2.4</b>	<b>61</b>
<b>2.2.5</b>	<b>61</b>
<b>3.....</b>	<b>CLIMATE CHANGE CHALLENGE: TANZANIA ACTIVITIES</b>
<b>.....</b>	<b>61</b>
3.1	61
<b>3.1.1</b>	<b>63</b>
<b>3.1.2</b>	<b>64</b>
<b>3.1.3</b>	<b>67</b>
3.2	68
<b>4.....</b>	<b>AWARENESS ON CLEAN DEVELOPMENT MECHANISM (CDM)</b>
<b>.....</b>	<b>68</b>

4.1	AWARENESS CREATION WORKSHOP .....	68
4.2	GENERAL OBJECTIVES OF THE WORKSHOP.....	69
4.2	SPECIFIC OBJECTIVES OF THE WORKSHOP.....	70
4.3	RELEVANCE OF AWARENESS CREATION ON CDM .....	70
<b>5.CEEST INVOLVEMENT IN ENVIRONMENTAL INITIATIVES AS PART OF CAPACITY BUILDING.....</b>		<b>71</b>
5.1	STRENGTHS AND ACTIVITIES UNDERTAKEN.....	72
5.1.1	<i>ENVIRONMENTAL IMPACT ASSESSMENTS</i>	<i>72</i>
5.1.2	<i>ENVIRONMENTAL CONSULTANCY</i>	<i>73</i>
5.1.3	<i>NATURAL RESOURCE MANAGEMENT</i>	<i>74</i>
5.1.4	<i>ENERGY STUDIES</i>	<i>74</i>
5.1.5	<i>CLIMATE CHANGE STUDIES</i>	<i>75</i>

## 1.0 INTRODUCTION

### 1.1 *Physiography*

Tanzania is located on the east coast of Africa between parallels 1<sup>0</sup>S and 12<sup>0</sup>S and meridians 30<sup>0</sup>E and 40<sup>0</sup>E. It extends from Lake Tanganyika in the west to the Indian Ocean in the east, Lake Victoria in the north to Lake Nyasa and River Ruvuma in the south. It borders Kenya and Uganda in the north, Rwanda and Burundi in the north-west, Zaire to the west, Zambia to the south-west and Malawi and Mozambique to the south.

Mainland Tanzania has an area of about 939,702 square Kilometres and the islands of Zanzibar, in the Indian Ocean, occupy an area of 2,643 square kilometres. The mean annual rainfall varies from 400 milimetres to 250 milimetre and over, although both extremes occur in restricted areas. The average duration of the dry season is 5 to 6 months.

The country can be roughly divided into four main climatic/topological zones:

- (a) *The lowland coastal zone* - This zone can be sub-divided into three subzones, the wet subzone, between 0 to 500 metres of elevation, with 1,800 milimetre of annual rainfall on average; elevation ranging from 500 metres to 1000 metres with annual rainfall between 1000 and 1,800 milimetres and the drier zone, about 1,000 metres in altitude with less than 1,000 milimetres of rainfall per annum.
- (b) *The highlands zone* - This comprises of the north eastern highlands which include the Usambara mountains and Mt. Kilimanjaro and Mt. Meru; and the southern highlands which include the Livingstone Ranges, Mt. Rungwe and Mt. Mbeya. As catchment areas, these are generally areas of high precipitation.
- (c) *The plateau zone* - around Lake Victoria and much of western Tanzania is occupied by what are generally referred to as Miombo woodlands. These are, in the main, dry areas with a rainfall of up to 1,000 milimetre on average.
- (d) *The semi-desert zone* - in central Tanzania around Dodoma has rainfall of less than 600 milimetres per annum.

Mainland Tanzania is intersected by the Rift Valley, with both the western and eastern wings, cutting across the country. This is geophysically active area.

### 1.2 *Social economic Profile*

Over the last five years, the Gross Domestic Product (GDP) in constant prices has been growing at an average of 4 percent per annum with population growing at 2.8 percent a year. Agriculture is by far the single most important sector in the economy, growing at about 3 percent per annum, accounting for 49.6 percent of the GDP, and employing 80 percent of the active population work force and 75 percent of foreign exchange earnings. Agriculture is the main source of food supply and raw materials for the national industries with manufacturing contributing about 8.1 percent of the real GDP; mining and

quarrying contributes about 1.3 percent of the real GDP. The transport sector accounts for about 6 percent of the real GDP and 16 percent of the gross capital formation.

### 1.2.1 Social economic indicators

Households in Tanzania get their incomes mainly from self-employment on farm and non-farm activities, wage employment and rental services. The relative importance of the various sources of income indicate that 54 percent of rural households get their incomes from agricultural activities, 20 percent from non-agricultural self-employment activities and 8 percent from wage employment and 18 percent from other sources. About 28 percent of urban households get their incomes from agricultural activities, another 28 percent from self-employment in non-agricultural activities, 18 percent from wage employment, 2 percent from rent income, and 26 percent from other sources.

**A 1 Table 1.4: Tanzania, National Circumstances**

CRITERIA	1990	1994	1996	1998
Population (Million people)	24	26.7	28.2	30
Relevant areas ('000 square kilometres)	945	945	945	945
Inland water area ('000 square kilometres)	61.5	61.5	61.5	61.5
GDP (1994 US\$) at current price	2,880	4,170.6	5,952.7	7,710.7
GDP per capita (US\$)	120	156.1	210.6	256.8
Estimated share of the informal sector to GDP (%) <sup>1</sup>	32	32	32	32
Share of industry in GDP (percentage)	8.0	8.1	8.0	8.4
Share of services in GDP (percentage) <sup>2</sup>	34.6	36.4	36.1	36.0
Share of agriculture in GDP (percentage)	47.8	49.6	50.6	49.1
Share of mining and Quarrying in GDP (percentage)	0.6	1.3	1.5	2.0
Share of construction in GDP (percentage)	3.2	4.6	3.9	4.3
Land area used for agricultural purposes (sq. kilometres)	5.2	5.2	5.2	5.2
Urban population as percentage of total population <sup>3</sup>	18	18	18	18
Grazing land (million hectares)	35	35	35	35
Other land (million hectares)	4.4	4.4	4.4	4.4
Livestock population (Million)*				
Cattle	13.046	13.461	15.957	16.602
Goats	8.529	9.72	10.36	11.3
Poultry	27.0	27.0	27	27
(Annual average)				
Forest area and woodlands (square kilometres)	44.0	44.0	44.0	44.0
Population in absolute poverty (percentage) <sup>4</sup>	48	48	48	48
Life expectancy at birth (years)	49	49	52	52
Literacy rate (percentage) <sup>5</sup>	84	84	84	84

**Notes:**

<sup>1</sup> Based on the Tanzania informal sector survey of 1991

<sup>2</sup> Includes electricity and water, trade, hotels and restaurants, financial and business services, public administration and other services, less financial services indirectly measured

<sup>3</sup> Based on National Population Census

<sup>4</sup> based on Household Budget Survey of 1991/92

<sup>5</sup> based on Basic Statistics in Education

\* Ministry of Agriculture and Food  
Economic Surveys (1999)

Life expectancy at birth is about 49 years for the year 1994. Infant mortality rate is about 88 per 1000 while the maternal mortality rate is about 529 per 100,000 and under age five mortality rates are about 137 per 1,000. Total and severe malnutrition had declined from 50 percent in the 1980s to 30 percent in the late 1990s while severe malnutrition had declined from 6 percent to 2 percent during the same period. In terms of coverage, only 72 percent of the population lived within 5 kilometres from the nearest health facility. About 50 percent of 22 million rural population and 68 percent out of 4 million urban populations have access to improved water supply. Sanitation services are available to about 79 percent of the rural population and 85 percent of the urban population.

The literacy rate is about 84 percent. Gross enrolment in primary education is about 80 percent while that of secondary education is about 15 percent. Gender-wise, enrolment at the primary school level is around 50 percent for girls and 50 percent for boys while at the secondary school level, the percentage of girls is slightly lower.

### **1.2.2 Demographic Profile**

In 1994, Tanzania had an estimated population of 26 million people. The population is estimated to be growing at the average rate of 2.8 percent per annum. The fertility rate is about 6.2 children per woman. About 46 percent of the population is under 15 years. Population in the age group of 15-64 years (the productive age) accounts for 50.23 percent of the total while the aged, 65 years and above account for 4.53 percent. Females account for 51.5 percent while males account for the remaining 48.5 percent of the total population. Females in the productive age (15-64 years) account for 51.3 percent of the population. The average population density is about 26 persons per square kilometre. About 25 percent of the total population lives in urban areas.

The majority of people in Tanzania still live in the rural areas (about 80 percent of the total population). As noted above, the availability of arable land and its quality is of considerable importance in explaining the internal distribution of the population.

However, an analysis of previous censuses show that the urban population is increasing very rapidly. This population increased by 1,653,000 i.e. by more than 200 percent between 1967 and 1978 while during the following ten years the urban population increased by 2,473,000, a more than 100 per cent increase.

The City of Dar es Salaam continues to have the largest proportion of the urban population with a 29.8 percent share. All other regions contributed less than 10 percent to the total urban population. Dar es Salaam region has the largest proportion of urban population (about 90 percent). Other regions which have high proportion of urban population include Zanzibar (31.8 percent), and Morogoro (21 percent). The rest of the regions have less than 20 percent of the population living in towns.

### **1.2.3 Population Growth and Sustainability**

Tanzania adopted the National Population Policy (NPP) in 1992. The policy recognises that there is no simple cause and effect relationship between population growth and economic growth, and that population growth may not be the primary obstacle to development. Nevertheless the NPP realised that population growth aggravates the difficult economic situation and renders remedial measures more difficult. At the macro level rapid population growth tends to increase outlays on private and public consumption, drawing resources away from savings for productive investment. The NPP recognises also the impact of population growth on natural resources and the environment.

The NPP spells out as its principal objective, to reinforce national development through developing available resources in order to improve the quality of life of the people; with special emphasis laid on regulating population growth rate, enhancing population quality, and improving the health and welfare of women and children. The NPP is intended to provide guidelines that would strengthen the process of integrating and thus providing means at all times of monitoring and evaluating national development plans more accurately in order to promote sustainable relationship between population, resources and environment. The issues addressed include population growth and health; population growth and nutrition; the impact of population growth on natural resources and environment; population growth and employment; gender, and the problems of children, the youth, people with disability and the elderly.

Institutional building, advocacy and population education in form of information, education and communication (IEC) are the main NPP implementation strategies.

## **1.3 Poverty Situation**

### **1.3.1 Population and Poverty**

Tanzania does not yet have a national definition or indicators of poverty. This by no means indicates that poverty is not a major national issue. Combating poverty is the critical element in the country's development endeavour. In order to develop poverty indicators the Government has launched a study on poverty statistics and indicators for Tanzania and is in the process of adopting a national poverty eradication policy in order to enhance the impact of national development plans and programmes through focusing on the poor population.

*Table 1.3: Estimated Per Capita Income Annual Changes for the Period 1988-1995*

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Per Capita Income Annual Change (%)	2.2	3.2	1.2	1.2	0.2	0.8	1.7	0.7	1.2	2
Estimated Population Growth rate (%)	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8

The country still use conventional measures as indicators of national poverty. Such indicators include per capita income, and its changes; a measure which relates population and gross domestic product (GDP) growth. However, this measure does not help in giving the proportion of the population which could be considered economically poor. Other indicators of national poverty include the rate of employment, dependence on external assistance in financing development, etc.

Employment opportunities as an important avenue of earning income among the population is very weak in Tanzania. The employment opportunities have been limited in the recent past due to three main factors, namely, slow growth of the economy, freezing of new recruitment in the Government civil service and other public service. As a result dependence on the informal sector for the provision of employment opportunities has significantly grown in the recent past. On initial analysis of the City of Dar es Salaam informal sectors survey undertaken in 1995 indicates that this sector provides employment opportunities for about 65 percent of the City's labour force.

### **1.3.2 National Poverty Definitions and Tackling Initiatives**

Since independence in 1961, the Government of Tanzania has been preoccupied with three development problems: ignorance, diseases and poverty. National efforts to tackle these problems were initially channelled through centrally directed, medium-term and long-term development plan, and resulted in a significant improvement in per capita income and access to education, health and other social services until 1970s. Thereafter, these gains could not be sustained because of various domestic and external shocks, and policy weaknesses.

Today, after more than 30 years since declaring the war, against poverty, Tanzania is still ranked as one of the poorest countries in the world. For instance, per capita income of a Tanzanian is USD 156.1 per year for the year 1994. The extent of poverty among Tanzanians is still high. It is estimated that 48 percent of Tanzanians live under the poverty line, while 36% live in very poor conditions. Average earnings do not meet requirements for basic minimum needs. To many, a single meal in a day is commonplace. Malnutrition and underweight of infants are endemic among Tanzanians. About 7.2 percent of infants have severe malnutrition. Only 70 percent of school age

going children is able to get registered in primary school. Those who get registered are faced with inadequate facilities at school. Some are forced to sit on the floor during classes. Most Tanzanians are still affected with preventable diseases like malaria, diarrhoea, cholera, anaemia, etc, which have been eradicated in other parts of the World. Maternal child and infant mortality rates are still high. In every 1,000 births, 96 infants die compared to only 7 for developed countries. A lot of time is spent by women in villages fetching water and firewood. Around 24 percent of all Tanzanians have to walk for more than 30 minutes to reach the nearest water source. In some cases the quality of the water fetched is not guaranteed.

It is evident that many places in the rural areas do not have dependable means of transport, resulting in failure by farmers to send their produce to markets and consumers in urban areas. While some parts of Tanzania would be experiencing food shortage, the same would be in excess supply in another part of the country because of lack of reliable communication. Despite all those problems, the Government resolves to eradicate poverty still remains. Because of that Tanzania joined the International Community in 1995 at the Copenhagen Social Summit in resolving to eradicate poverty globally.

### **1.3.3 International and National Initiatives in Combating Poverty**

Poverty is a complex multidimensional problem with both national and international origins. The eradication of poverty and hunger, greater equity in income distribution and human resources development therefore remain the major challenges everywhere.

As Agenda 21 proposes that to combat poverty good population policies, good healthcare and education policies must be in place and the rights of women and the role of young people must be known to enable all people to achieve sustainable livelihoods in Tanzania, steps towards implementing the above have been going on and some more are being started.

Tanzania government had shown intentions of combating poverty since independence when the government declared war against three closely related enemies namely, poverty ignorance and hunger. To achieve this various strategies were launched including state interventions to reduce economic and social inequalities in resource distribution and control. Furthermore, mass mobilization using slogans like "Freedom and Work" (Uhuru na Kazi) were lunched to extol the virtues of work as a basis for development and self dignity and also as a strategy to enhance employment opportunities.

To increase rural incomes and ensure food security the masses were mobilized using slogans such as "Politics is Agriculture" (Siasa ni Kilimo). The movement aimed at improving small holder agriculture through better farm management practices and use of improved technologies, the efforts resulted in real improvement in agricultural productivity and an increase in real incomes for farmers.



Within the social sector the government introduced the policy of "Life is Health" (Mtu ni Afya) aimed at increasing mass awareness of the importance of health care and galvanize Community efforts towards the provision of health care services. Through community and government efforts, rural health centres, district and regional hospitals were constructed and training institutions for health workers were established. The overall outcome of these efforts was a marked improvement in the provision of health services.

In education the policy of Universal Primary Education (UPE) was introduced to promote primary education, and Adult Education programmes to promote functional literacy in the adult population. The product of these initiatives was the rapid increase in education infrastructure and of primary and secondary school graduates. The country was able to achieve a literacy rate of 90% in the 1980s.

Other government efforts in the eradication of poverty were directed at the provision of good quality housing. The policy of "Modern Houses" (Nyumba Bora za Kisasa) aimed at promoting adequate and decent housing for all. Emphasis was placed on improvement of existing homes with a view to increasing ventilation and better domestic waste management.

Besides the government, Non-Governmental and Religious Organizations have played an important role in eradicating poverty. These have been particularly active in the provision of schools both primary and tertiary and health care facilities. With respect to health care for example, about 49% (1993) of the hospitals in the country have been constructed and are managed by voluntary organizations. The contribution of the voluntary organizations in the education sector is equally significant.

Donor agencies have also been active partners with the government in the eradication of poverty. Donors through financial and technical assistance have been active in the various sectors. These include the provision of social services i.e. water, education, and health services, in infrastructure, agriculture, industry, environmental protection and policy support programme.

The previous efforts though very good they had some shortcomings mainly because there was no policy to provide the direction and guidance to stakeholders who could initiate, implement and evaluate their programmes and to enable them to put poverty eradication programmes and plans as part of their daily activities.

Realizing this, the Government now is putting in place a policy on Poverty Eradication whose overall goals, objectives policies and strategies are geared towards:-

- (i) creating an enabling environment for effective poverty eradication efforts;
- (ii) empowering the poor to participate in poverty eradication programmes;
- (iii) ensuring full participation of women in poverty eradication initiatives;
- (iv) providing coordination mechanisms for the implementation of poverty; eradication initiatives; and

- (v) promoting equality of opportunity for men and women to lead a decent and productive life.

#### ***1.4 The Macro-economic Policy Framework***

Since the mid-1980s, Tanzania's economy has undergone fundamental transformation through wide-ranging political and economic reforms and policy actions. The role of the government has been redefined to be that of policy formulation and guidance, law and order, regulatory and public sector support functions, while the private sector has been assigned to undertake production, processing, commercial and marketing functions. The policy thrust of the transformation process is on macroeconomic stability, public sector efficiency, putting in an enabling environment to facilitate the effective participation of all actors in development, and evolving a long-term perspective for the dynamic development of the economy.

The current medium-term planning and budgetary framework underscores the following policy objectives:

- ◆ Achieving a real rate of economic growth well in excess of the expected population growth in order to attain real improvement in the living standards.
- ◆ Reducing the rate of inflation to below 10 percent.
- ◆ Reducing external dependence by creating self-sustained internal and external balances.
- ◆ Substantially reducing the role of the public sector in direct involvement in the productive sector and letting the private sector assume the leading role.
- ◆ Improving the efficiency of public expenditure by properly utilizing the scarce resources in the priority sectors.
- ◆ Undertaking investment in the infrastructure for rehabilitation and development.
- ◆ Undertaking investment in the sectors dealing with human development particularly the health, education, water and environment sectors.

The long-term development perspective plan is embodied in Tanzania's Development Vision 2025, underpinned by following policy objectives:

- ◆ Ensuring economic prosperity and improving the living standards of the people.
- ◆ Ensuring economic justice and equity through productive employment and enterprise.
- ◆ Promoting and achieving self-reliance, self-sustaining economy and a nation that can effectively cope with changing market and technological conditions.
- ◆ Encouraging the transfer of appropriate technologies and human resource development, including the enlargement and development of local scientific and technological capacities.
- ◆ Transforming Tanzania from a rural based agricultural economy to a more diversified and industrialized one.
- ◆ Promoting, achieving and maintaining national equity and cohesion.

- ◆ Optimally utilizing the nation's natural and other resources and balancing an accelerated economic growth with the more efficient management of the environment and the use of the country's natural resources in ways which will ensure sustainability.

## **1.5 Sectoral Policies**

### **1.5.1 Agriculture**

In the medium and long- term perspective, agriculture will continue to play a central role in Tanzania's economy. Key areas of the economy in which the contribution of agriculture is decisive are the country's Gross Domestic Product (GDP), export earnings and employment in which the sector accounts for 75 percent and 80 percent respectively. Crucial components of the agricultural sector are food crops, livestock, and traditional export crops whose contribution currently stands at respectively 55 percent, 30 percent and 8 percent of the total agricultural GDP.

The main policy objectives highlighted in the Agricultural and Livestock Policy, 1997 are the following:

- ◆ Assuring basic food security for the nation, and to improve national standards of nutrition by increasing output, quality and availability of food commodities.
- ◆ Improving the standards of living in the rural areas through increased income generation from agricultural and livestock and livestock production, processing and marketing.
- ◆ Increasing foreign exchange earnings for the nation by encouraging the production and increased exportation of cash crops, livestock products, other agricultural surpluses, including food crops, by-products and residues.
- ◆ Producing and supplying raw materials for local industries.
- ◆ Developing and introducing new technologies, which increase the productivity of labour and land.
- ◆ Promoting integrated and sustainable use and the management of natural resources such as land, soil, soil, water and vegetation in order to conserve the environment.
- ◆ Developing the human resource in order to increase the productivity of labour and to improve ability, awareness and morale.
- ◆ Providing support services to the agricultural sector, which cannot be provided efficiently by the private sector.
- ◆ Specifically promoting the access of women and youth to land, credit, education and information.
- ◆ The main and ultimate challenge for Tanzania is to improve the well-being of its people whose principal occupation and way of life is based on agriculture and to meet the needs of other sectors.

The Government is using the following policy instruments in achieving the objectives in this sector:

- ◆ Agricultural research, extension and training;

- ◆ The monitoring and evaluation of agricultural development and the identification of new opportunities (products), technologies, markets and the promotion of new production processes.
- ◆ The collection and dissemination of market information in order to integrate the domestic markets and make foreign markets accessible.
- ◆ The facilitation of the provision of a good infrastructure, especially transport and storage.
- ◆ The control of quality, hygienic and sanitary standard.
- ◆ The control of vermin, epidemic pests and diseases.
- ◆ The provision of an adequate legal and regulatory framework.
- ◆ Natural resource management.
- ◆ The promotion of institutional structures in the sector.
- ◆ Taxes and subsidies.

Aware of the critical dependence of agriculture on the environmental resources such as land, water, forest and air, the government underscores the imperative need to design agricultural policies that fit in the overall environmental policy which provides guidance for the proper and balanced use of natural resources and defines the sectoral responsibilities in environmental management.

### **1.5.2 Industry**

The government is addressing the main challenge of building a strong, diversified and resilient industrial sector, which can produce efficiently for the needs of the people and supply competitively to the world market. The main objectives of the National Industry Policy are to increase industrial output and the share of industry in the overall economy through increased efficiency and increased capacity utilization in existing industries, and the development of new industries in the key sub-sectors. It is envisaged that through appropriate macro-economic policy environment and management private sector participation will be increased and the direct involvement of the government in productive activities will be reduced.

The specific objectives of industrial sector development are the following:

- ◆ Increasing the use of domestically available materials.
- ◆ Expanding employment opportunities.
- ◆ Increasing and diversifying the sources of export earnings.
- ◆ Ensuring the best use of resources towards potentially efficient enterprise.
- ◆ Protecting the environment from industrial pollution.
- ◆ Enhancing research and the development of technology.

In order to achieve those objectives, the following policy measures and strategies are pursued:

- ◆ The promotions of small-scale and medium scale industries for the purposes of increasing industrial output, employment generation, sector linkages and rural industrial development.
- ◆ The creation of an enabling environment for private sector participation in investment and production.
- ◆ The strengthening of human resource development and technical capabilities to ensure competent engineering, technical and management skills.
- ◆ The promoting of clean technologies and environmentally friendly technologies.

### **1.5.3 Energy**

The overall policy objective of energy development in Tanzania is to provide an input into the development process of the economy through the establishment of an efficient energy production, procurement, transportation, distribution and end-use system in an environmentally sound manner and with due regard to gender issues. Thus, the principal specific objectives of the national energy policy are:

- ◆ To satisfy the energy demand of all sectors of the economy, not only to the productive sectors (i.e., agriculture, industry and mining) but also to the whole country.
- ◆ To develop indigenous sources of energy (natural gas, coal, solar, wind, geothermal, hydropower and biomass fuels) to substitute for imported petroleum products.
- ◆ To ensure that the existing and expanded supply of energy is environmentally sustainable.

The following policies and strategies are pursued to address the challenges facing the energy sector in the economy:

- ◆ Improvement of the availability, reliability and security of energy supply through the rehabilitation of the existing energy systems and the expansion of the power generation and distribution capacity.
- ◆ The development of indigenous sources through the further exploration, exploitation, capacity building by training, research and development of technologies, and strengthening of energy information systems.
- ◆ Improvement of efficiency in energy chains relating to tariffs, management, maintenance and training.
- ◆ The promotion and dissemination of affordable technologies through the demonstration of efficient technologies, and encouraging the participation of the private sector, Non Governmental Organizations (NGOs) and Community Based Organizations (CBOs).
- ◆ The promotion of energy development that is environmentally sustainable including environmental impact assessment of projects, afforestation and reforestation programmes, and instituting appropriate legal and regulatory frameworks.
- ◆ The promotion of rural electrification and decentralized energy systems.

#### **1.5.4 Transport**

The transport sector accounts for about 6 percent of the real GDP and 16 percent of the gross capital formation. It provides vital spatial and sectoral links in the economy and facilitates trade with other land-locked countries in the region. The main challenge is to provide a wide and efficient transport system that covers the entire country and is connected to other countries in the region. The development of the transport system should ensure coordination between and complement the different modes of transport (i.e., road, air, rail and water transport).

The main objective of the transport policy is to provide efficient and effective domestic and international transport services. Other objectives include maximizing both foreign and local revenue generation in the transport sector, and minimizing transport-related environmental hazards. In order to realize these objectives, the government is pursuing the following policies and strategies:

- ◆ Limiting the role of the government to policy formulation, monitoring and evaluation and thereby according greater autonomy to parastatals and the private sector.
- ◆ Streamlining and strengthening the institutional framework and developing the sector's capacity to plan and enhance inter-modal co-ordination.
- ◆ Improving rural and urban travel and transport in order to improve the welfare of the population.
- ◆ Encouraging investments by the private sector.
- ◆ Encouraging regional cooperation and investment.
- ◆ Encouraging domestic and foreign investments to promote the adoption of new and emerging technologies.

#### **1.5.5 Land**

Since Tanzania attained political independence in 1961 there has been the need to have a comprehensive land policy that would govern land tenure, land use, management and administration. The new National Land Policy was enacted in 1998. The main objectives of the policy are the following:

- ◆ Promoting an equitable distribution and access to land by all citizens;
- ◆ Ensuring that existing rights in land, especially customary rights of small holders, are recognized, clarified and secured in law;
- ◆ Setting ceilings on land ownership which will later be translated into statutory ceilings to prevent or avoid land concentration;
- ◆ Ensuring that land is put to its most productive use for the promotion of rapid social and economic development of the economy;
- ◆ Modifying and streamlining the existing land management systems and improving the efficiency of land delivery systems;
- ◆ Streamlining the institutional arrangements in land administration and land dispute adjudication and also making them more transparent;

- ◆ Promoting sound land information management;
- ◆ Protecting land resources from degradation for sustainable development.

### **1.5.6 Forestry**

The importance of forestry in Tanzania is manifested by the facts that: forest and woodland cover about half of the total land area; about 90 percent of all energy used by Tanzanians is derived from fuelwood; forestry provides protection for watersheds for various purposes; forestry provides timber; and forestry provides employment opportunities. The main challenge is to enhance the utilization of the potentials of forests while at the same time managing them to ensure sustainability.

The main objectives of the Forest Policy are the following:

- ◆ Enhanced forest-based national development and poverty alleviation through the sustainable supply of forest products and services.
- ◆ Increased employment and foreign earnings through sustainable forest based industrial development and trade; conservation of biodiversity, forest ecosystems, water catchments and soil fertility.
- ◆ Enhanced national capacity to manage and develop the forestry sector in collaboration with other sectors and the international community.

### **1.5.7 National Environmental Policy**

The main challenge of development is to promote a quality of life that is socially desirable, economically viable and environmentally sustainable. Sustainable development requires the integration of environmental consideration into economic development policies and programmes. The National Environmental Policy, promulgated in December 1997, provides the framework for mainstreaming environmental considerations in decision-making processes in Tanzania. It provides guidelines on plans and priority actions, monitoring and evaluation. It further provides for sectoral and cross-sectoral policy analysis in order to achieve compatibility among the sectors and interest groups and exploit synergies among them.

The overall objectives of the National Environmental Policy are the following:

- ◆ Ensuring sustainability, security and the equitable use of resources for meeting the basic needs of the present and future generations without degrading the environment or risking health or safety.
- ◆ Preventing and controlling the degradation of land, water, vegetation, and air which constitute our life support systems
- ◆ Conserving and enhancing our natural and man-made heritage, including the biological diversity of the unique ecosystems of Tanzania.

- ◆ Improving the condition and productivity of degraded areas including rural and urban settlements so that Tanzanians may live in safe, hygienic, productive and aesthetically pleasing surroundings.
- ◆ Raising public awareness and understanding of the essential linkages between the environment and development, and promoting individual and community participation in environmental action.
- ◆ Promoting international cooperation on the environmental agenda, and expanding our participation and contribution to the relevant bilateral, sub-regional, regional, and global organizations and programmes, including the implementation of Treaties.

In Tanzania, although some measures have been undertaken which influence the reduction in GHG, many of the initiatives were targeted at achieving other development goals, such as energy efficiency and distribution, and revenue collection. Various sectoral initiatives have implicitly addressed environmental aspects, notably reduction in GHG emission. For instance, the energy sector has benefited from various projects aimed at exploiting renewable energy sources by using energy conservation and efficiency enhancing technologies, such as improved firewood stoves, the use of solar energy for rural electrification, electrical production using biomass.

The transportation sector is estimated to consume around 50 percent of fossil fuels used in Tanzania. The current improvements in road construction are indirectly part of the mitigation options in the transport sector. A lot needs to be done to improve traffic flows to improve vehicle maintenance, and other measures, which lead to an efficient transport system, which simultaneously leads to a reduction in rate of increase of GHG emissions.

In this section, a review has been made of the essential features of the national economic development and other sectoral policies. These policies and the measures adopted to implement broad development objectives have not been formulated with climate change in mind. These policies and measures, however, do also address climate change, an indication that socio-economic and sustainable development need not be pursued at the expense of the environment.

## **2 ENERGY PROFILE**

### ***2.1 Status of the Tanzania Energy Sector***

The availability of energy is a prerequisite for the proper functioning and development of all other sectors of the economy, since the energy demand is driven by the requirements of the entire economy. The main challenge is to develop reliable, economically accessible and appropriately priced energy supplies to facilitate the development of other activities in the economy while ensuring environmental sustainability.

The energy sector covers non-commercial primary energy sources (mainly wood-fuels) and commercial energy (petroleum, natural gas, hydroelectricity, coal and geothermal



energy). Tanzania's energy demand and end-use structure reflects the low level of development.

Woodfuel in the form of fuelwood, charcoal and agricultural wastes, remains the predominant source of energy for the economy. The total forested area of Tanzania is 37.3 million hectares, mainly savannah and intermediate woodland. About 13 million hectares of these are reserved forests. Village woodlots account for a mere 200,000 hectares. Forest areas are being harvested at a rate faster than the regeneration rate. It is estimated that Tanzania loses about 300,000 to 400,000 ha of forests per year through various causes.

The country has considerable biomass resources in the form of forest and agricultural residues. Possibilities exist for the economic conversion of these resources into electricity and energy for industrial and domestic purposes. However, limited forest and agricultural residues are being used for electricity and mechanical power generation as well as fuel wood substitute in various parts of the country. Currently, they account for at least 10 percent of the nation's energy requirements.

Coal and natural gas are the other commercial fuels with a high potential. Coal reserves are estimated at about 1,200 million tones, of which 304 million tones may be considered proven. A field of 29.02 billion cubic metres of proven, probable and possible recoverable high quality natural gas has been discovered at Songosongo and Mnazi Bay. The Songosongo gas field contains about 30 billion m<sup>3</sup> meters while the Mnazi bay field is estimated to contain 13 billion m<sup>3</sup> of gas.

Hydroelectric energy is the single most important indigenous source of commercial energy with a potential of 4.7 Gigawatts (GW) of installed capacity and about 3.2GW of firm capacity. Only 15 percent of the potential installed capacity has been developed. Solar, wind and geothermal energy are virtually untapped resources. The mean solar energy density is of the order of 4.5 kW per square metre per day, an indication of its potential for use as an energy source. Low speed windmills also have a potential in the country. Uranium, which is one of the sources of nuclear energy, is known to exist in Tanzania.

Wood-fuels such as fuelwood, charcoal and agricultural residues account for 92 percent of primary consumption while commercial fuels such as electricity and petroleum account for 0.8 percent and 7.2 percent of primary consumption respectively. It is estimated that in Tanzania's final energy consumption was 15.0 million tones of oil equivalent (TOE). The per capita energy consumption is of the order of 0.65 TOE. In 1986, Tanzania consumed almost 1 million tones of petroleum products. The transport sector accounts for nearly 51 percent of the petroleum used while industry accounts for 26 percent, and households for 10 percent of the consumption.

Tanzania is still a relatively small consumer of electricity despite of the existing enormous potential sources. The per capita consumption is 46 kilowatt-hour (kWh). Those who have access to electricity constitute a mere 10 percent of the entire population of which only 1 percent of rural population has access to electricity.

**Table 1.4: Energy Sources and Development**

Resource	Quantity	Installed Capacity (2000)
Forest and Woodlands	37.3 Million hectares	
Other Biomass	16.0 million tons available per year	
Coal	1.2 billion tons estimated, 304 millions tons proven reserves	160,000 runs of mined coal per year
Natural Gas	43 billions m <sup>3</sup>	
Hydroelectric	4.7 GW potential 3.2 GW firm capacity	
Solar	215 W/m <sup>2</sup>	

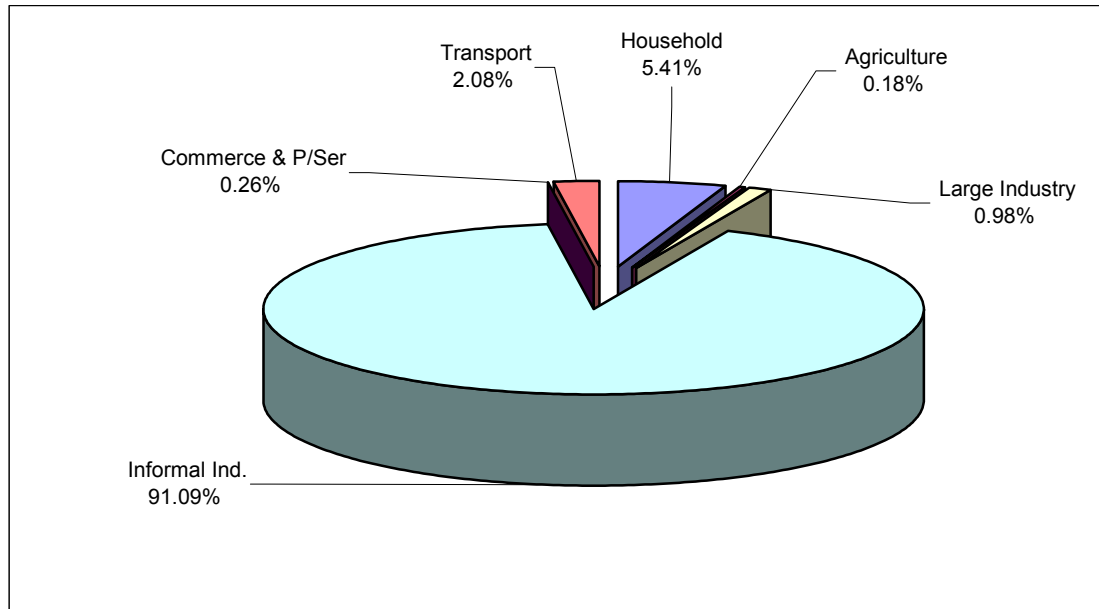


Figure 1.1 Energy Balance:(Million Tonnes OIL EQ)

## 2.2 Energy Sector Programmes for Sustainable Development

### 2.2.1 Electricity

- Present national installed capacity is 804 MW (including the recent Kihansi of 180 MW and IPTL 100MW). In the near future the Songosongo Gas to electricity plant will add 150 MW.
- the share of electricity to total energy balance is about 1%
- the per capita electricity consumption is about 60kwh/annum
- the average growth rate of electricity demand is between 11-13% per annum
- less than 10% of the population has access to electricity
- the installed transmission and distribution lines total 10,661 km of which 1,620 km are 220KV, 1,041km are 132KV and 8,000km are 33 and 11KV
- the average tariff is 0.09USD/kwh
- of the power generated is from the public utility and the remaining is from IPP

- of the electricity is hydro based
- and at present 30 District Headquarters are not yet electrified.

### ***Short description of the power generation system***

The power system in Tanzania consists of an interconnected transmission grid system and several dispersed isolated systems. The interconnected systems consists of large hydroelectric and thermal generating facilities that provide power to major cities and towns.

The name plate hydro generating capacity rating is 399 MW or about 66% of the total available installed capacity in the interconnected system. The major hydropower plants are Kidatu (204 MW), Mtera (80 MW), Pangani Falls (66 MW), and Hale (21 MW).

The thermal generating capacity in the grid system consists of about 44 diesel and gas turbine unit located in seven power stations countrywide. The diesel generating capacity has nameplate rating of approximately 119 MW. However only about 50 % of these are in serviceable condition. The balance is in very bad condition due to old age, obsolescence and lack of spare parts. The gas turbine installed capacity is 110 MW of which 35 MW.

The isolated systems are supplied by diesel generating facilities with an installed capacity of about 29 MW. Most of these units are old and in urgent need of rehabilitation and even replacement. The isolated systems are widely dispersed and supply 5 regional headquarters, several districts headquarters and other areas that are not connected to the national grid system.

***Table 5: Power Generation***

	Installed Capacity (MW)	% of Total		Installed Capacity (MW)	% of Total
<b>Grid System</b>					
Hydroelectric	399.22	62.19	Thermal	202.30	31.51
<b>Isolated System</b>					
Hydroelectric	5.21	0.81	Thermal	29.23	4.55

### **2.2.2 Coal**

Tanzania has coal reserve of about 1,864 million tonnes has a proven reserve of 304 million tonnes. However the coal mines are facing financial and management problems.

The main intended consumers of coal are:

- Kiwira coal power station with an installed capacity of 6 MW with annual coal demand of 22,000 tonnes.
- Southern Paper Mills Company with an annual coal demand of 42,000 tonnes.
- Mbeya Cement Factory with an annual coal demand of 30,000 tonnes.
- tea and tobacco curing with an annual coal demand of 5,000 tonnes.

- Extended coal utilization programmes (coal for cooking) in institutions & households and coal use in other agro-industries.

### **2.2.3 Charcoal production**

- Charcoal is the main source of domestic energy to urban areas.
- Production of charcoal takes place in rural areas where it is mostly undertaken by individual farmers in particular during the dry season (May-October) to supplement income from crop and animal production.
- Simple earthmound or pit kilns are widely used. Earthmound kilns are most popular; pit kilns are less common and they are found only in those areas where soil is sandy and easy to dig.
- The average volume of stack woodfuel for earthmound kilns is 5m<sup>3</sup> stacked, producing 10 bags of charcoal per charge. For pit kilns an average of 3m<sup>3</sup> stack of wood is normally used to produce 5 bags of charcoal.
- Traditional charcoal production kilns yield an average recovery of 19% charcoal on an oven-dry wood input basis or 15% charcoal on an air-dry wood basis at 20% moisture content.
- Improved traditional kilns (casamance) have a charcoal recovery of 27% for air-dry wood.
- With proper kiln management and wood seasoning, an average charcoal recovery of 25% could be obtained from earthmound kilns.
- Improved metal and brick kilns have over 28% charcoal recovery but requires high initial capital investment.
- Adoption of improved kilns would increase income of charcoal producers and minimize wasteful use of wood for charcoal production and consequently enhancing environmental protection.

### ***Cook Stoves***

#### *Improved charcoal stoves:*

- have been recommended for urban areas
- their sustainable production has been achieved
- quality control is still a problem
- their production has business opportunities

Improved firewood stoves though they have been recommended for rural people no serious efforts have been made so far.

### ***Biomass for industrial development***

Biomass generating industries are:

- the sugar industries by co-generation
- the Tan Watt company (which produces wattle) by thermal power
- the sisal industries by biogasification etc.

Firewood is still being used for:

- Tea drying
- tobacco
- salt production
- baking
- brewing
- pottery & brick burning
- fish smoking etc.

#### **2.2.4 Solar energy**

- Is seen to further rural electrification
- Is seen as a source of solar thermal energy for solar water heaters, crop driers, etc.
- Has dissemination bottlenecks especially for Solar cookers due to social-cultural aspects
- The initial investments cost of solar systems is rather high
- There is a need for government/private partnership which is still very weak in Tanzania
- Solar summit initiatives for creation of energy fund and incentives eg. import duty exemption is needed.

#### **2.2.5 Wind energy**

- can be used for water pumping
- can be used for electricity generation
- There is a need for enhanced public/private partnership

### **3 CLIMATE CHANGE CHALLENGE: TANZANIA ACTIVITIES**

#### ***3.1 Sources and Sinks of Greenhouse Gases***

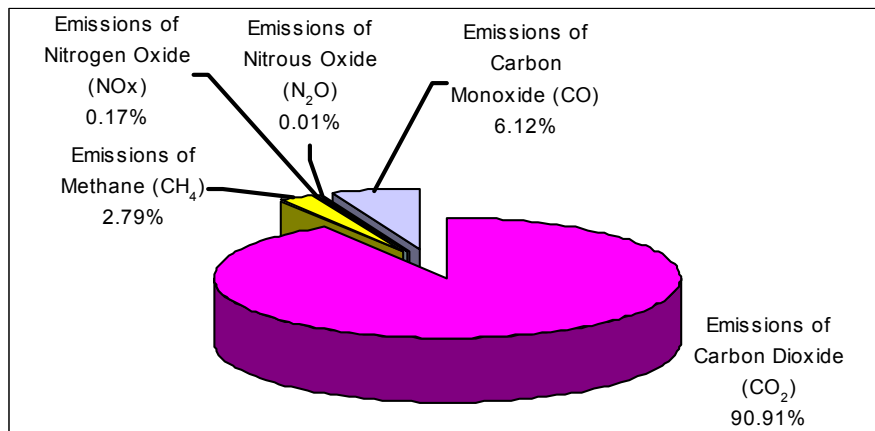
An inventory of greenhouse gas emissions and removals in Tanzania was developed in 1993 to 1994 based on United Nations Environment Programme (UNEP)/Organization for Economic Cooperation and Development (OECD)/Intergovernmental Panel on

Climate Change (IPCC) guidelines of 1991. The inventory was based on data obtained from 1988 to 1990.

Activity data was based on data survey and statistical information, where available. Where records were not available default data compiled by International Energy Agency (IEA), OECD, Food and Agricultural Organization (FAO) and the IPCC was used. Default emission factors in IPCC guidelines have been applied except for the estimation of methane emissions from municipal waste water treatment. Direct greenhouse gases Carbon dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>) and Nitrous oxide (N<sub>2</sub>O) as well as indirect greenhouse gases Nitrogen oxides (NO<sub>x</sub>) and Carbon monoxide (CO) has been covered.

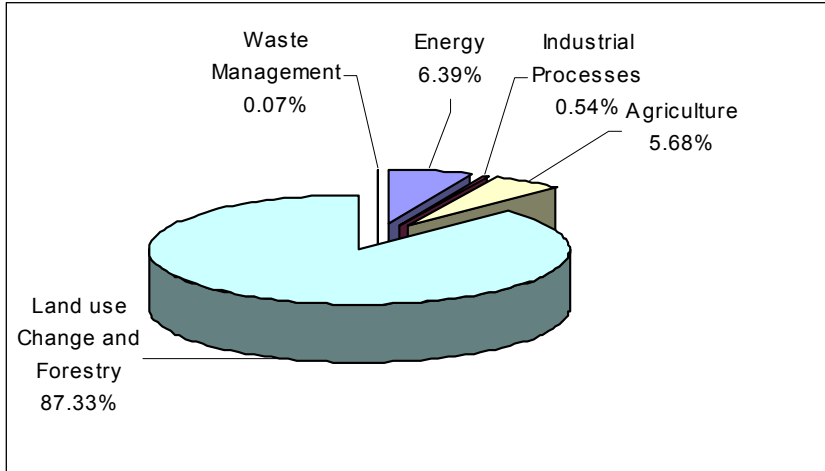
The major sectors addressed in the inventory include energy, agriculture, industrial process, waste management, forestry and land use. For each of these sectors an estimation of CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O and other gases has been done. The energy sector consists of combustion and non-combustion sub-sectors.

A summary of the greenhouse gas inventory for 1990 is shown on Figures 3.1 & 3.2. These figures provides a full account of direct (i.e. CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O) and non-direct emissions (i.e. CO & NO<sub>x</sub>) for the sectors of energy, industrial process, agriculture, land-use change and forestry and waste management. In each of these sectors the emissions from the sub-sectors are also estimated and presented. Of total gases emitted (64,885 Gg), CO<sub>2</sub> contributes 91 percent, CH<sub>4</sub> (2.8 percent), CO (6 percent), NO<sub>x</sub> (0.17 percent), N<sub>2</sub>O (0.01 percent). Figure 3.1 shows emissions of greenhouse gases in Tanzania in 1990.



**Figure 3.1:** GHG Emissions in 1990

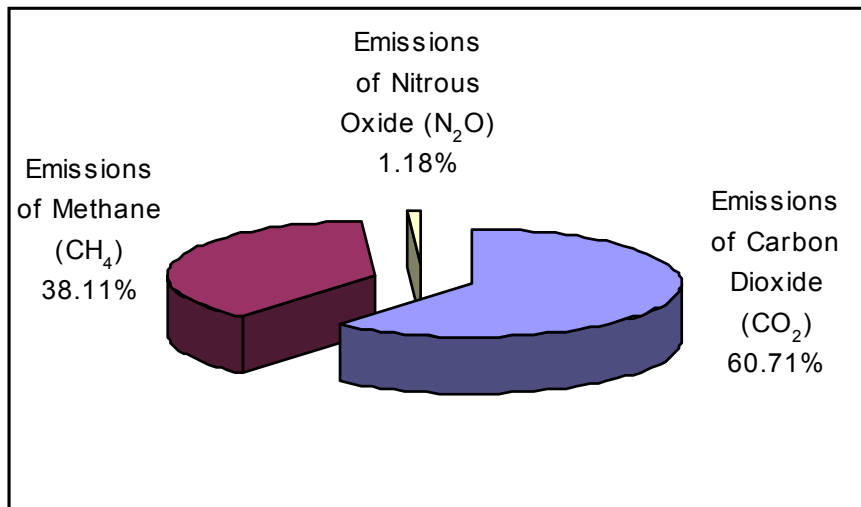
Land use and forestry was the major emitter of greenhouse gases (87 percent of all emissions) followed by the energy sector (6 percent) and the agriculture sector 5.7 percent. Least emitting sectors were industrial processes (0.5 percent) and waste management (0.07 percent). Figure 3.2 summarizes the GHG emissions by sector.



**Figure 3.2:** 1990 GHG Emissions by Sector

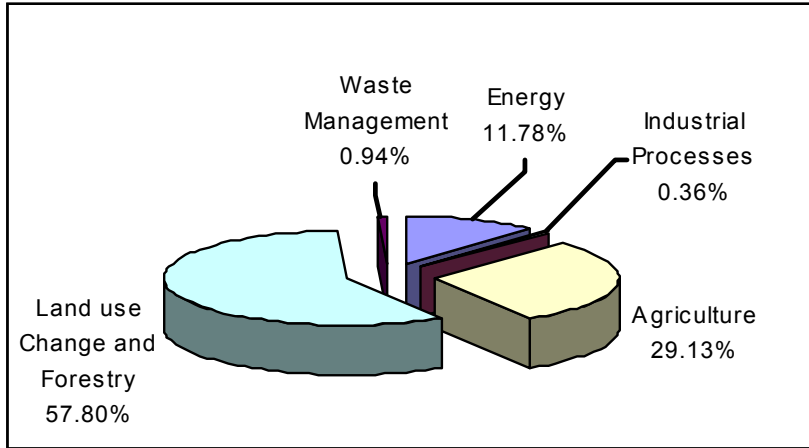
### 3.1.1 Global Warming Potential (GWP)

Global Warming Potential (GWP) for direct greenhouse gas emissions in 1990 with a 100-year time horizon has been calculated in accordance with the IPCC guidelines. As per the IPCC guidelines nitrous oxide has the highest GWP of 310 followed by methane with 21. Using the GWP CO<sub>2</sub> emissions have the largest share of (61 percent) of the inventory followed by methane (38 percent) and nitrous oxide (1 percent). Figures 3.3 and 3.4 show the greenhouse gas emissions by gas and by sector, respectively, using the GWP index.



**Figure 3.3:** GWP of Direct GHGs with a 100-Year Time Horizon for the Year 1990

The inventory also indicate that in 1990 land use and forestry was the major emitter of GHGs contributing 58 percent of all the emissions, followed by agriculture (29 percent), and energy (12 percent) (Figure 3.4). Waste management and industrial processes contributed small amounts of 0.9 percent and 0.4 percent respectively.

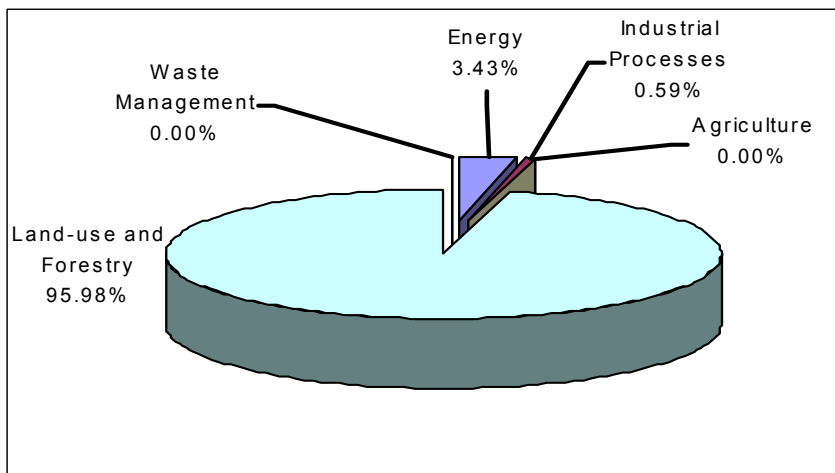


**Figure 3.4:** 1990 GHG Emissions by Sector using GWP Index

### 3.1.2 Carbon Dioxide (CO<sub>2</sub>)

Taking CO<sub>2</sub> as the main emission, land use and forestry is the major source emitting 96 percent followed by energy 3 percent and industrial processes, which contributed 0.6 percent of the total emissions. Removal of CO<sub>2</sub> is 6 percent of total CO<sub>2</sub> emitted by various sources.

Figure 2.5 shows carbon dioxide emissions from various sectors of the economy.



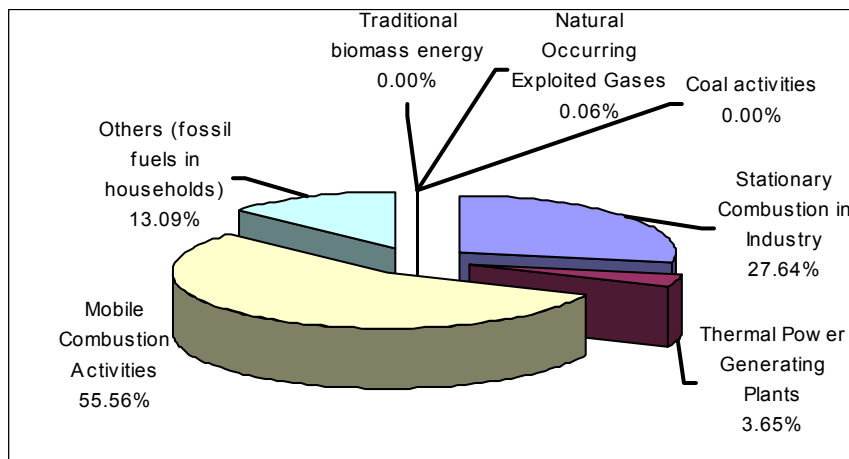
**Figure 3.5:** Carbon Dioxide emissions by sector



(i) The energy sector

The energy sector, the primary fossil fuel combustion sector, consists of industry, transport, household and commercial and energy transformation sub-sectors. The energy transformation sub-sector consists of thermal power generation plants by the power utility company and few commercial and residential users as well as petroleum refining.

In 1990 CO<sub>2</sub> emissions from fossil fuel combustion accounted for 2023 Gg. CO<sub>2</sub> emission from fossil fuel combustion from mobile sources including the transport transportation sub-sector and farm and construction equipment was the largest source accounting for 56 percent of total CO<sub>2</sub> emissions. Stationary combustion in industry, refinery and other fuel transformation accounted for 28 percent followed by 13 percent in the household and commercial sub-sector, and 4 percent in the thermal power generation (energy transformation). Figure 2.6 summarizes emissions of CO<sub>2</sub> in the energy sector.



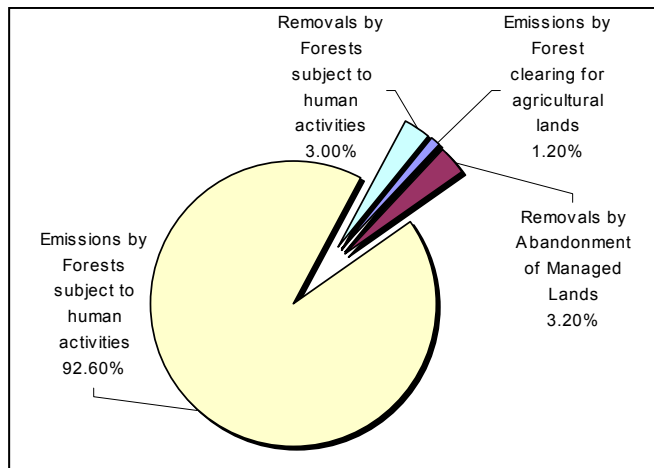
**Figure 3.6:** Carbon dioxide Emissions in the Energy Sector 1990

(ii) Land use and forestry

(a) CO<sub>2</sub> Emissions

The land use and forestry sector is the major emitter of CO<sub>2</sub> according to the national inventory report of 1990. It is also the only sink for the removal of CO<sub>2</sub> in the country. In 1990 this sector contributed 56,664 Gg of CO<sub>2</sub> to the atmosphere and removed 3,745.3 Gg of CO<sub>2</sub> from the same; the net emission was therefore 52,919 Gg. This sector comprised of forest and grassland clearing for agriculture, abandonment of managed lands, assumed to regrow naturally for 20 years and above, changes in forest and other woody biomass stocks and others (shifting cultivation and man-made flooded lands). Forests subject to human activities were the largest sources of emissions accounting for 93 percent of the total emissions, followed by forest and grassland clearing for

agriculture, which contributed 1.2 percent. Figure 3.7 shows emissions and removals of GHGs in the forestry and land use sector.



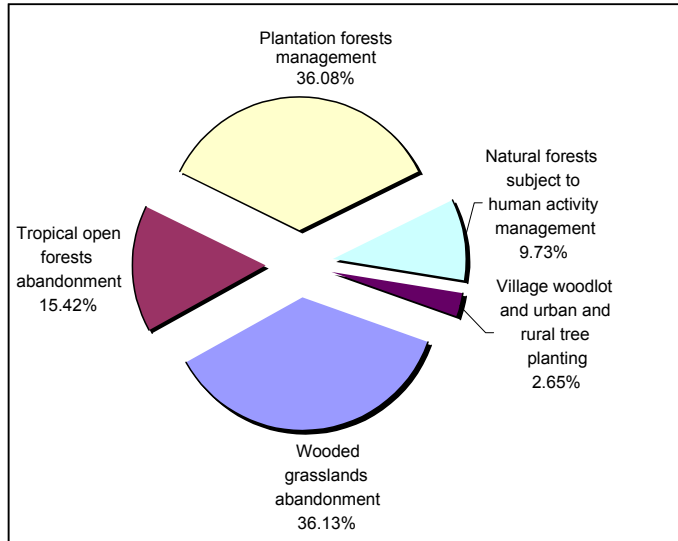
**Figure 3.7:** Land use and Forestry CO<sub>2</sub> Emissions and Removals

(b) CO<sub>2</sub> Removal

The land use and forestry sector is the major sink for CO<sub>2</sub>. In 1990 total CO<sub>2</sub> removal by change in forest and other woody biomass stock and the abandonment of management lands was 3,745.3 Gg. Forests subject to human activities (management of forests) accounted for half of the removals while another half was contributed by abandonment of managed lands.

- Management of forests comprises plantation forests, village woodlot, natural forests subject to human activity, wood exploited informally for woodfuel, and urban and rural tree planting.
- Abandonment of managed lands comprises the abandoned wooded grassland and tropical open forests.

Figure 2.8 summarises the CO<sub>2</sub> removals by sinks in the forestry and land use sector in 1990.



**Figure 3.8:** Carbon dioxide Removals by Sinks in Tanzania 1990

Plantation forests and abandonment of wooded grasslands were the largest sinks with a share of 36 percent each, followed by the abandonment of tropical open forests (15 percent). Other sinks resulted from management of natural forests subjected to human activity, (9.73 percent) and lastly, the village wood-lot and urban and rural tree planting (2.65 percent).

### 3.1.3 Remarks on GHG Inventory

**The study on the development of an inventory of sources and sinks of greenhouse gases in Tanzania cannot be considered to have come to an end. On the contrary it has provided a basis for future work including that of regular reviews and updates of the same. The study has also identified a number of areas on which further work needs to be done, including working on country specific emission factors.**

The results of the study shows that the major sources of greenhouse gases in Tanzania are in the land use, land use change, agriculture and the energy sectors, while the forestry sector provides a major sink. Using the Global Warming Potential, the major greenhouse gas is carbon dioxide, which contributes about 59% of all emissions followed by methane contributing about 40%. Carbon dioxide is the most important gas in the forestry and land use as well as energy sectors while methane is more significant in the agriculture and waste management sectors.

Tanzania is an insignificant emitter compared to other countries; emissions will grow especially in the energy sector. However, there is a need to use less polluting technologies and the development and use of clean technology and efficiency improvement has to be addressed.

### ***3.2 Technological and Other Options for GHG Mitigation***

A number of technological and other options for the mitigation of greenhouse gases in Tanzania have been identified in various sectors. Mitigation options identified are technological and non-technological. Non-technological options include such interventions as policy and behavioural changes.

Various sectors have been analysed and technological and non-technological options for the mitigation of GHGs in the respective sectors identified. The sectors have included:

- i) the energy sector, covering energy forecasts and energy supply analysis.
- ii) the industrial sector covering demand side analysis and energy efficiency as well as process emissions in cement and pulp
- iii) waste disposal management.
- iv) the transportation sector covering the demand side analysis and energy efficiency.
- v) the agricultural sector covering efficiency in agricultural practices and livestock keeping.
- vi) the forestry sector covering land use and forestry, land tenure, afforestation and reforestation.
- vii) the household and commercial sector covering demand side analysis.
- viii) macroeconomic analysis, energy pricing and marginal cost analysis and evaluating of the abatement scenarios.

The mitigation study has involved the analysis of both economic and technological development. A macroeconomic analysis has been carried out to develop the baseline and the mitigation scenarios. The analysis has also involved the identification and ranking of the mitigation options so as to enable planners prioritise the various options available in the menu.

## **4. AWARENESS ON CLEAN DEVELOPMENT MECHANISM (CDM)**

### ***4.1 Awareness Creation Workshop***

The Norwegian International Program for Petroleum Management (PETRAD) in collaboration with the Centre for Energy, Environment, Science and Technology (CEEST) organised a Workshop on awareness rising on Clean Development Mechanism (CDM) in Dar es Salaam, with a total of fifty (50) participants from Tanzania, Uganda, Kenya and Rwanda. However, due to communication and other problems participants from Rwanda were not able to participate.

The Workshop was relevant because Eastern Africa countries are currently putting their efforts on close ties in the economic and political areas and a number of sectors for

cooperation are being considered. Although there have been no specifics on cooperation in the climate change spheres so far, it is worthwhile to start having deliberations and awareness raising in areas of common interest in forums drawn up by members from the relevant countries. It is believed that such a spirit might pave the way for joint projects in the environment and other relevant sectors or might prepare the countries to take appropriate steps when eventually their cooperation overlaps with the petroleum management areas. Regional seminars like this have been held before. However, with the East African Community Treaty in the offing, a framework will be provided for co-operation in the energy and environment sectors.

There have been a lot of efforts to address anthropogenic activities that are said to result in global warming. The efforts, spearheaded by the United Nations, have resulted into different initiatives with the common goal of reducing the growth of emissions of greenhouse gases inter alia, by promoting climate friendly development strategies. One of the biggest climate change mitigation initiative unilaterally taken by over 150 countries was the setting up of the United Nations Convention on Climate Change (UNFCCC). The main objective was that of achieving stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

Under the Kyoto Protocol, the mechanisms of “Joint Implementation, “Clean Development Mechanism” and ”emission trading” have been introduced, but are still not operative. However, the pilot phase of “Activities Implemented Jointly” has given insights into and experience of how countries may co-operate within this sector. Under the Protocol it is only the CDM, which provides opportunity for a partnership between developed, and developing countries in addressing climate change. In order to be able to attract investments to Africa under the Clean Development Mechanism, both countries and private entities in Africa need to get focussed on the opportunities ahead.

CDM, as defined in article 12 of the Kyoto Protocol of the UNFCCC, has the major objective of assisting developing (Non-Annex I) countries in achieving sustainable development and in contributing to meeting the quantified GHG emission reduction commitments of developed (Annex I) countries. CDM is envisaged to provide opportunities for developing countries to promote sustainable development through enhancing capital flows for investment, technology transfer and capacity building.

As explained above, it quite certain that the different initiative undertaken to alleviate global warming will have an impact upon development strategies of developing countries, including those in the Eastern Africa region. It is for this reason that PETRAD/CEEST have taken the initiative to start discussions in Eastern Africa on awareness raising on climate change initiatives and optimal utilization of the initiatives for sustainable and clean development strategies.

## ***4.2 General objectives of the workshop***

CEEST contributed from her experience in global climate change issues, especially the evolution and subsequent implementation of the Climate Convention, the Kyoto Protocol and the CDM. Norway gave the developed countries' perspective of the CDM and attracting investments under CDM. International organizations (UNEP, UNIDO, and the World Bank) gave past experiences and lessons from similar initiatives.

The Workshop dwelt on awareness raising and information sharing on matters relating to climate change and CDM in the East African region, and how the envisaged CDM can be beneficial to the countries in the region. There were then deliberations on how the Eastern Africa countries can reflect the CDM on their sectors of energy and industry sectors, and participants investigated strategies for public, business and private players in the sectors to take onboard CDM investments in climate friendly projects. It was expected that at the end of the seminar there would be a consensus on guidelines for possible mechanism for development of CDM projects in Eastern Africa and identification of some possible CDM projects. The intention was to benefit from the views, the knowledge and the experience of a carefully selected group of stakeholders.

#### ***4.2 Specific Objectives of the Workshop***

Specifically the workshop focused on the following;

- ❖ To chart out future strategies to enable Eastern Africa actively cooperate in CDM matters.
- ❖ To create awareness on the opportunities of the CDM under the Kyoto Protocol and how developing countries may attract investments from Annex I countries within the Energy and Industrial sectors.
- ❖ Issues such as specific needs and special situations of Eastern Africa countries in relation to the industry and energy matters to fit into the CDM context
- ❖ The role of governments (practical experience in Eastern Africa on climate change and the envisaged CDM, technology co-operation, barriers, publicly owned technologies in management),
- ❖ The role of the private sector, the role of intergovernmental organizations and NGOs, and a list of issues and questions contained in the Convention (Kyoto Protocol on CDM)
- ❖ In addition special attention was given to issues such as brainstorming on the CDMs processing mechanisms within the Eastern Africa region. This looked into integration between the cooperation strategies in the relevant sectors and CDM mechanisms.
- ❖ To chart out future strategies to enable Eastern Africa countries actively participate in CDM.
- ❖ The workshop looked into technical aspects of the above issues.

#### ***4.3 Relevance of Awareness Creation on CDM***

It would be easier for people to implement climate change aspects in policies, plans and programmes if the general public were aware of its linkages with their daily lives, the necessity to take up action and what to do. People need to know that the climatic variations they had experienced are linked to the environmental degradation arising from human development activities. It is important for the people to be in a position to differentiate between the normal climatic variations they already know and the anticipated greenhouse-induced climatic change so that they can experience the extent of the damage/problems that could arise when global climate change occurs. Such an understanding of issues will help the implementation of adaptation responses in a manner most convenient and affordable to them. This can be done through the systematic upgrading of the indigenous techniques to accommodate the recent scientific and technological advancement caused by climate change.

The general public awareness of the climate change phenomena, impacts and responses is still very low. There is visible climate variability that goes unnoticed, as people do not differentiate between the normal and the abnormal, that is, the induced climate variability caused by climate change. To many people climate change does not seem to be a priority issue. This kind of perception is caused by lack of awareness on how climate variability and change impinges on their socio-economic development. It is therefore very crucial, for Tanzania, to initiate a comprehensive awareness programme targeting the different user groups of the environment. These groups include agro-pastoralists, pastoralists, industrialists, government agencies, private/public organizations, professional associations and communities.

A public awareness programme in Tanzania would need to encompass many important subjects relevant to the specific groups. The programme could cover, among others, the relevance of climate variability and change; the causes of climate change; the greenhouse gases mitigation options; the vulnerability of socio-economic sectors; and the extent, feasibility and viability of adaptation response options that have been tested and examined in the country and elsewhere. Stakeholders would need to be involved from the designing stage to ensure it captures all the relevant issues that need to be incorporated into this programme. Different methodologies will be applied including TV and radio programmes, newsletters and pamphlets. The programme will be run in English and Swahili (local language) in order to ensure that a large proportion of the population becomes aware of climate change issues.

## **5. CEEST INVOLVEMENT IN ENVIRONMENTAL INITIATIVES AS PART OF CAPACITY BUILDING**

The Centre for Energy, Environment, Science and Technology (CEEST) is an organisation whose aim is to develop and sustain expertise and a capacity for independent policy analysis, research, consultancy and information dissemination in the fields of energy, environment, water and sanitation and natural resource use and management. It is recognised and appreciated that the success of this endeavour will to a large extent

dependent upon the development, application, and judicious use of scientific principals and technology for development.

Specific objectives of CEEST are:

- To undertake studies in fields related to energy, water and sanitation, the environment, science and technology and development;
- To undertake studies, research and offer expertise in the management of natural resources including agriculture, and food production;
- To provide training in energy, water and sanitation, the environment, science and technology to researchers and students from within and outside the country through short term attachments;
- To publish and disseminate information on energy, water and sanitation, the environment, science and technology through seminars, symposia, workshops and the media;
- To offer expertise and provide services to government, non-governmental organisations, bilateral agencies and the private sector on matters related to energy, water and sanitation, the environment, science and technology and development;
- To exploit gender strengths in the furtherance of the above objectives;

## ***5.1 Strengths and Activities Undertaken***

CEEST has undertaken a number of studies and consultancies in the environment and the energy sectors in Tanzania and in the Southern African Region. CEEST has also organised several national and international workshops on various aspects of energy development and environmental protection.

### **5.1.1 Environmental Impact Assessments**

- In 2000 the Centre was contracted by Songas Limited to update studies on the Songo Songo Gas to Electricity Environmental Project. The studies involved were;
  - (i) Songo Songo Island Pre-acquisition Assessment
  - (ii) Ubungo Power Plant Pre-acquisition Assessment
- In 2000 the Centre was contracted by Songas Limited to perform addendum environmental studies on the Songo Songo Gas to Electricity Environmental Program. The studies included;



- i) Songo Songo Island Fauna Biodiversity study
  - ii) Songo Songo Island Flora Biodiversity Study
  - iii) Project Induced Impacts and HIV/AIDS Situation in the Project Areas
  - iv) Songo Songo Project Greenhouse Gas Emission and Mitigation Analysis
  - v) Songo Songo Project Risk Assessment Study
  - vi) Songo Songo Project Environmental Management Plan
- In 1997 the Centre was contracted by a Canadian based firm, NORECOL, DAMES and MOORE (NDM) to conduct an Impact Assessment for the Bulyanhulu Gold Mining Project. Areas covered in the assessment were
    - Archaeology and Cultural Resources study,
      - (i) Socio-economic assessment,
      - (ii) Land use Assessment and
      - (iii) Environmental Legal and Regulatory Review.
  - In November, 1996 the Centre was contracted by a Canadian based Company, Ocelot TransCanada Pipelines Limited (OTC) to conduct an Environmental Impact Assessment for the Songo Songo Gas to Electricity Gas Project. Areas covered under this programme were:
    - Songo Songo Pipeline Socio-economic Assessment,
      - (i) Songo Songo Project Archaeology Survey,
      - (ii) Songo Songo Pipeline Soil Handling and Conservation Assessment
      - (iii) Songo Songo Island Pre-acquisition Assessment and
      - (iv) Ubungo/EPP Pre-acquisition Assessment.
  - In 1995 CEEST and Arkel International, Inc. a firm based in Nairobi carried out a n Environmental Impact Assessment and the impacts of the sugar can production and processing on physical, biological and socio-cultural environment. The study also assessed the existing infrastructure.

### **5.1.2 Environmental Consultancy**

- In 2000, CEEST started implementing a GTZ sponsored project on Greenhouse Gas Mitigation and Other Environmental Benefits of Integrated East African Power Development.
- In January 1999, CEEST was involved in a project called Institutional and Legal Framework Environmental Management Project (ILFEMP). On this project CEEST role was to implement the ILFEMP Zonal Workshops in order to facilitate broad participation for coming up with an institutional and legal framework for environmental management in Tanzania. The project was coordinated by the Vice President's Office, Division of Environment, and was funded by the World Bank and DANIDA.

- In January 1998 CEEST in collaboration with a Denmark based firm, KAMPSAX, was involved to undertake a project titled “Capacity Building for Environment Management in Mwanza Municipality”. The project, sponsored by the DANIDA, aims at improving the urban environment in Mwanza through an increased capacity to sustain sound environmental management. This will be developed by adopting the Environmental and Planning Management (EPM) approach that focuses on broad-based participation and capacity building among relevant stakeholders for the institutionalisation of bottom-up planning. The project is estimated at six years.
- 
- In 1995, with financial support from the National Environment Management Council (NEMC), the Centre embarked on a study to assess urban air quality. The study assessed the emissions from urban traffic as well as noise level in selected areas in Dar es Salaam. The study also estimated sulphur dioxide (SO<sub>2</sub>) and suspended particulate matter and determine compliance with existing national or international air quality standard, laws and regulations.

### **5.1.3 Natural Resource Management**

- In April 1995, CEEST was the Convenor of the Workshop on Environmental Impact Assessment, which was held between April 24-28, 1995 in Swakopmund in Namibia. The Workshop focused on real examples of environmental impacts in the oil and mining sectors.
- In October 1995 the Centre was commissioned by the World Bank to co-ordinate a study on the Development of a Strategy for the Conservation of Coastal Biodiversity. The study objectives, among others, was to identify and analyse the implications of specific biodiversity objectives in relation to sectoral interests and programmes, and to develop specific recommendations regarding how those sectoral policies and programmes should be modified to best achieve those objectives. The study covered fisheries, forestry and agriculture, tourism, industries, mining and urban development.
- In 1994 CEEST embarked on a study on demand and management of urban water supply in Tanzania. This study is being carried out with financial assistance from the International Development Research Centre (IDRC). The main objective of this study is to analyse the water demand patterns and management from an end use perspective.

### **5.1.4 Energy Studies**

In 1990 the core CEEST staff participated in a three-year study to assess the energy use patterns from an end-use perspective in households, and in the industrial, transport, commercial and the informal sectors. The study covered Dar es Salaam, Mbeya and

Shinyanga regions of Tanzania as representatives of urban centres of different levels. This study was published in a special issue of the international journal "Energy Policy" Volume 21, Number 5 of May 1993.

Since 1992 the Centre in collaboration with the PETRAD Foundation of Norway has organised biannual Regional Seminars on Petroleum Policies for Sustainable Development. These seminars are held in Arusha, Tanzania. As a follow up to the 1994 seminar theme on "Environmental Protection and Safety in the Petroleum Sector in Eastern and Southern Africa", CEEST in collaboration with the PETRAD Foundation prepared a draft proposal for a SADC project on "Investigation of the possible Harmonisation of Laws, Rules, Standards and Regulations including Environmental Protection and Safety in the Petroleum Sector." This project was approved by the SADC Energy Ministers in June, 1995, and it is now being carried out whereby CEEST are the Project Consultants.

CEEST has been involved in the preparation of the SADC Energy Protocol. The Draft Protocol was adopted by the SADC Ministers of Energy in June, 1995. CEEST has been also involved in a review of the SADC Woodfuel Strategy, an activity under the SADC Energy Sector Technical and Administrative Unit (TAU).

Other regional collaborative programmes where CEEST is participating is the Southern African Energy and Environment Programme which aims at providing policy analysis for sustainable energy development and environment in post-apartheid Southern Africa. This project is a collaborative study among the Centre for Energy, Environment and Engineering, Lusaka, Zambia; Energy for Development Research Centre, Cape Town, South Africa; Southern Centre for Energy and Environment, Harare, Zimbabwe; and the Fridtjof Nansen Institute in Norway and CEEST.

The Centre, through its Chairman, has been involved in an independent project review of the Zimbabwe Photovoltaic for Household and Community Use, a UNDP/GEF Technical Assistance Project. The assignment was done for the United Nations Development Programme/Global Environment Facility Regional Bureau for Africa. The Chairman of CEEST is a member of the Scientific and Technical Advisory Panel of the project.

### **5.1.5 Climate Change Studies**

Since 1993 the Centre has been working on climate change studies on behalf of the Division of Environment of the Vice President's Office. These studies will enable Tanzania fulfil part

of its obligations under the United Nations Framework Convention on Climate Change (UNFCCC). The studies in climate change include, among others:-

- The Study on Sources and Sinks of Greenhouse Gas Emissions in Tanzania. The objective of the study was to establish an inventory of sources of emissions and removal by sinks of greenhouse gases in Tanzania. This project was funded by the Global Environmental Facility through the United Nations Environment Programme (UNEP).
- The Greenhouse Gas Mitigation Study. This study was a follow up of the greenhouse gas, emission inventory study funded by Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ). The study has explored technical and non-technical options for the abatement of greenhouse gas emissions in Tanzania.
- 
- The Study on the Assessment of Vulnerability and Adaptation to Climate Change. In 1994 the Centre embarked on a two-year study under the United States Support to Country Studies to address climate change issues. The study covers areas of potential vulnerability to climate change including the impact of climate change on agriculture, grassland and livestock, forestry, water resources, coastal resources and health.
- 
- The Development of National Action Plan for Climate Change. Currently CEEST is preparing a National Action Plan for Climate Change on behalf of the Vice President's Office. The process receive input from various climate change studies as well as country plan / programmes for economic development.
- 
- Greenhouse Gases Global Trends and Statistics. Since July 1998 CEEST has been contracted by the UNFCCC to prepare a database for Greenhouse Gases for African countries. The project aims at depicting the general trend of sources and sinks of Greenhouse gases in Africa.
- 
- CEEST has undertaken a rapid assessment of ozone depleting substances in Dar es Salaam. This work, undertaken in 1994, is one of the early efforts by Tanzania towards meeting its obligations under the Montreal Protocol on Substances that Deplete the Ozone Layer.
- Another GHG related study has been the comparative study on greenhouse gas emissions between Tanzania and Zimbabwe. This study has been carried out with the support of the International Development Research Centre of Canada (IDRC).
- *Regional Greenhouse Gases Mitigation Study*; It is recognized that greenhouse emissions mitigation options can be least cost when approached regionally. The Centre has worked on this aspect of mitigation in collaboration with the Southern Centre for Energy and Environment, Zimbabwe; the Centre for Energy, Environment, and Engineering, Zambia; EECG Laboratory Consultants,

Botswana; and the UNEP Collaborating Centre on Energy and Environment based at RISO at Roskilde, Denmark.

- *Economics of Greenhouse Gas Limitation*; The Centre has worked on this aspect of mitigation in collaboration with the Southern Centre for Energy and Environment, Zimbabwe; the Centre for Energy, Environment, and Engineering, Zambia; EECG Laboratory Consultants, Botswana as part of a GEF funded study under the auspices of the UNEP Collaborating Centre on Energy and Environment based at RISO at Roskilde, Denmark.
-



## **Country Context for Kenya**

Stephen Gitonga and Martha Mathenge

March 2002

## **CDM IN KENYA**

### **1.0 Introduction:**

Kenya is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC), signed in June 1992 and ratified on 30<sup>th</sup> August 1994. The Convention entered into force for Kenya on 28<sup>th</sup> November 1994. Kenya is waiting to ratify the Kyoto protocol, which is established under the UNFCCC. The UNFCCC also established the three international mechanisms known as the flexible mechanism under the Kyoto protocol. These mechanisms are the Clean Development Mechanism (CDM), Joint Implementation (JI) and Emission Trading (ET). Of the three flexible mechanisms, CDM appears most attractive for developing countries since it helps to: securing sustainable development, gain access to foreign direct investment and facilitate technology transfer.

The basic premise of the CDM is that the reduction in emission of Greenhouse gases (GHGs) achieved in the developing countries can be counted against GHGs reduction targets of the developed countries.

CDM is thus an important framework by which the North & South can work in partnership to achieve sustainable development and tackle the mitigation of climate change challenges. CDM if conceptualized properly will provide Kenya with the opportunities for poverty alleviation by attracting foreign resource for investments, increase resources for clean energy developments, provide a window for improving environmental management for industries, by introducing cleaner technologies and increasing capacity building opportunities among others.

### **2.0 Driving Force**

Foreign investments especially by the private sector generally are expected to be the driving force behind projects under the CDM.

The Inter-Ministerial Committee on Environment {**IMCE**} comprising of representatives from all key stakeholders has the Kenya Association of Manufacturers, (**KAM**) representing the Private sector. KAM is therefore faced with the arduous task of ensuring that the CDM is private sector driven. This is so because, the current lack of focus on the fact that CDM is intended to be private sector driven, influences the overall approach and the kind of projects being promoted for CDM.

### **3.0 Awareness Raising for the CDM**

The biggest hurdle that needs to be overcome in order to ensure effective implementations of CDM in Kenya is; increased awareness and much greater involvement of the part of the private sector than at present.

In Kenya, the Kenya Association of Manufacturers (KAM) represents the private sector in CDM matters. The private sector should be the driving force in CDM and must therefore make significant efforts to raise awareness among its members and other stakeholders.

Currently, the knowledge on CDM and involvement in activities related to the implementation of CDM in Kenya is restricted to related government departments, some Non Governmental Organizations (NGOs) and academic institutions. The Awareness Raising should therefore, in effect have maximum linkages to the grass root levels and not operate at high levels only. KAM should incorporate specific sessions/discussions on CDM into its environmental seminars, workshops and conferences. Case studies and experiences in CDM projects that have achieved success should be shared among all stakeholders and lessons learned embraced. Replication of successful CDM projects should be emphasized.

It is felt that only a well-informed business and industrial community can negotiate effectively with foreign investors. With an effective Awareness Raising, CDM can be structured to be an attractive business option.

The Awareness raising should cut across the industrial entrepreneurs, general public, financial agencies, industrial support services and local communities. This should go further towards the important task of identifying suitable stakeholders to undertake CDM activities. Actors should not be from the formal institutions only that hold knowledge of the CDM but need to be found in the private sector, reason being:

- Enable implementation of new projects in partnership with companies from developed countries.
- Generate the potential of substantial investment flow.
- Enable acquisition of new expertise and skills through technology transfer.
- Recognize potential for promoting policy changes that will improve the national investment environment.

#### **4.0 Transfer of Knowledge on CDM**

Information is empowering. The overall goal of the CDM is to establish as many projects as possible with the aim of stabilizing the concentration of GHGs in the atmosphere while at the same time contributing to sustainable development. Having this in mind, it is imperative that knowledge on CDM projects be transferred to achieve maximum additionality. Knowledge on how best to implement CDM projects should be between the academia, government, NGOs, local community and private sector.

Case studies of successful projects need to be highlighted through workshops, conferences, bulletins and magazines etc.

Failed CDM projects must also be highlighted and reasons for failure emphasized.



## **5.0 Experience involving local communities, government, NGO, and industry.**

Experience on CDM projects must involve local communities, government, NGOs, and private sector. Capacity building, training on technology transfer, awareness raising, procedures on assessment of CDM projects etc. need to cut across all the stakeholders actively involved in the CDM projects.

## **6.0 Analysis of projects in terms of poverty alleviation, capacity building, environmental technologies transfer and social benefits.**

The Kenyan CDM clearinghouse is responsible for carrying out the first project appraisal to verify that the project reflects the Kenyan development priorities and contribute to the country sustainable development.

## **7.0 Capacity Building.**

The Capacity Building should be a fundamental focus for the private sector while analyzing CDM projects. Selected projects must be in a position of:

- Enhancing the ability of stakeholders to identify requirements for gaining access to CDM and other mechanisms.
- Enhancing their ability to develop good CDM projects.
- Enhancing the ability of stakeholders to undertake all activities in the life circle of a CDM project.
- Enhancing the ability to identify and organize a project team capable of planning, evaluating, and promoting the project.

All projects should have strong capacity building elements for local technical and managerial personnel in order to sustain the overall long-term objectives. For each CDM project there should be project co – managers representing the investors and hosts. Capacity should be build both in the public and private sectors (**project implementers**) and non-annex 1 (**government**).

A framework for identifying capacity building needs is therefore essential so as to:

- ◆ Enhance ability of selecting projects, which contribute to sustainable developments.
- ◆ Enhance ability to prepare projects for the CDM market.
- ◆ Enhance ability to assist in securing financing for the non-CDM portion of the project.
- ◆ Enhance ability to negotiate Certified Emission Reduction Units (CERUs) and distribute cost savings.

Capacity of project implementers need to be build to enable them to quantify project costs and benefits, determine additionality, consistent with both sector and project level

baseline, and monitor/estimate reported and project emissions consistent with Validation and Monitoring protocols.

The capacity of non Annex 1 countries (governments) need to be strengthened to enhance their ability of:

- Screening projects for CDM
- Evaluating and comparing project risks.
- Certifying CDM emissions.
- Designing, implementing, monitoring and verifying the projects, as the protocol requires.

## **8.0 Poverty Alleviation**

The purpose of CDM is to assist parties not included in Annex 1 in achieving sustainable development among others. There is a general agreement that sustainable development requires the effective integration of three key elements: the economic, social and environmental dimensions of developments. Furthermore, the sustainable development framework incorporates a focus on the equitable distribution of wealth in the society, thus, aiming at poverty alleviation.

CDM projects should encompass a multiplier effect at the national level down to the grass root level. For Kenya Poverty Alleviation must be a key element of the sustainable development target for any development, including CDM project. It is important that CDM projects improve the welfare of the Kenyan population and moreover, Kenya should be in a position to define the direction of these improvements. While analyzing projects under CDM, elimination of unemployment, by creation of jobs, and introduction of new activities should be the foremost dictating factor.

## **9.0 Technology Transfer**

Technology transfer is an important issue under the CDM. It is an opportunity by the private sector to improve efficiency and reduce cost. For instance, substitution of biomass for energy imports for products processing will reduce cost of production, offer new opportunities for rural growers, and boost sustainable developments in the rural Kenya. Technology transfer should be environmentally sustainable, friendly, and innovative. It should be developed locally and be non-polluting.

Under the CDM, technology transfer should bring an opportunity for Kenya to add value to its goods rather than exporting raw materials. Suitable technology transfer in CDM projects should carry a warranty of reasonable duration and have proven operational capability. Care must be taken to prevent Kenya being used as a mere testing ground for new technological inventions.

To adopt successful technology transfer it is important that:

- (a) Technological needs should be identified.

- (b) An enabling framework at the national level should be created.
- (c) Business environment should be enhanced.
- (d) Capacity of institutions should be built.

The Kenyan climate technological needs should be identified by:

- Making use of Kenya's draft "First National Communication to the Conference of Parties".

Possible areas of focus to include;

- Decentralization of the national electrical grid network, i.e. creation of mini-grids solar, biomass, wind etc. This involves changing of the Power Act.
- Enhancing Energy efficiency for industrial, commercial and agricultural sectors.
- Increased geothermal electricity generation
- Increasing the market potential for Liquid Petroleum Gas instead of charcoal
- Tea drying using biomass
- Co-generation in sugar, tea etc. where possible

Certain barriers and obstacles that can hinder technology transfer under the CDM are:

- Lack of information and communication.
- Lack of insurance and rewards.
- Unstable micro and macro economic environment.
- Trade Barriers
- Lack of access to funds.
- Lack of standards and regulations.
- Lack of highly trained and skilled manpower.

These obstacles can be overcome through the development of a national strategy, the cutting of the red tape bureaucracy in the government, the building of capacity for installation and operation of the projects, products modification and marketing, needs assessments and technology selection and screening, the creation of funds to assist technology transfer for climate friendly technology, coherence with CDM. International cooperation programme on technology database, consultative process amongst the stakeholders and identification of the scope for international standard and norms should be the order of the day.

## **10.0 Environmental and Social Benefits**

Projects under CDM must be those that contribute to the reduction of GHGs emissions. Global warming by the greenhouse effect due to anthropogenic sources of GHGs and its implications to the global environment is the reason behind the formation of the UNFCCC. Therefore, CDM projects should meet the main objectives of UNFCCC to prevent dangerous anthropogenic interference with the climate system through the stabilization of atmospheric concentration of GHGs.

Project analysis should also consider CDM projects that embrace the sustainable use of local resources with little or no impact on the local environment to avoid indiscriminate

degradation of the environment that will eventually contribute to global warming and its related effect or any other environmental degradation.

The crucial challenges facing Kenya is reduction of poverty and unemployment. The development priorities aim at raising the standard of living through poverty alleviation and employment creation etc. CDM projects are focused towards sustainable development.

In Kenya, the majority of the poor are women. The Government does not discriminate on the basis of gender, but in practice gender imbalance does exist because of cultural and other related factors. Women are a major player in natural resource use. In Kenya therefore, if CDM projects were those that enhance equitable distribution of wealth this will help bridge the gap between the rich and the poor, they may also promote gender equity through empowerment of women in the various sectors of the economy. Incorporation of women in CDM projects will assure that women enjoy maximum participation in decision-making issues in the project implementation where applicable.

## **11.0 Assessment of Project in terms of GHGs emission reduction (baseline construction and additionality)**

CDM provides an opportunity for partnership among developing and industrialized countries to promote sustainable developments while reducing global emission of GHGs. The concept of additionality must be a significant component in any CDM project. Therefore, when assessing projects emphasis must be laid upon additionality.

Article 12 of the Kyoto Protocol requires that emissions reduction be *“additional to any that would occur in the absence of the certified project activity. Therefore additionality must not only focus on environmental additionality, but also towards financial, technological and investment additionalities.”*

Assessment of CDM with focus on environmental additionality will ensure that CDM activities result in a net reduction of GHG emissions with respect to what would have happened in their absence. Emissions reduction can thus be measured against an emission baseline that represents the projection of the emission that would have occurred under business – as – usual (BAU) circumstances.

Assessments of CDM projects in terms of technological additionality will ensure that CDM projects contribute to the transfer of suitable or environmentally friendly technologies for Kenya and therefore facilitating the path to sustainable industrialization. This will be in accordance with Sessional Paper NO. 2 of 1997 on Industrial Transformation to the year 2020 that aims at making Kenya a Newly Industrialized Country (NIC) by the year 2020 through the rapid industrialization process.

## **12.0 Base line Construction**

A well-defined baseline should be the basis of assessing any CDM project. The baseline indicates as accurately as possible, the expected level of future emission that would occur in the absence of the CDM projects.

National baselines can be used as a methodology in construction of baselines. National baselines attempt to gauge national and sectoral developments from some points in the past to some point in the future. Baseline construction must therefore, embrace the three concepts of “additionality”. This will help assess whether or not the CDM investment will lead to:

- An investment that would have occurred anyway.
- An investment that is planned but not yet financed.
- Most importantly, an investment that has environmental additionality.

Baseline construction will require investors to develop the case that investments satisfy at least the criteria that is environmentally additional. Baselines will also help project proposers calculate the number of Certified Emission Reduction units, (CERUs), that will be generated by the project.

Several practical problems are bound to arise that might hinder the procedure of calculating project baselines for energy related projects. Therefore, during the construction there is need for more precise data from all economic sectors. For energy projects, there is need for clear information on installed and effective electricity generating capacity and its performance. The power output from hydro, thermal, and geothermal, change according to climatic conditions and the status of the equipment used. In the industrial sector, there is little concrete or collated data on energy used patterns and GHGs as of now.

Operational costs in the baseline construction of CDM projects might increase considerably due to CER volume, evaluation and baseline determination. A robust national baseline against which proposed projects can be evaluated must therefore be developed. To address this, financial aid may be sought through local, bilateral and multilateral cooperation basis, which will help in the considerable reduction of costs to the private sector. However, in the immediate short term, in order to enable CDM projects to get off the ground quickly in Kenya despite the additional costs, project developers should develop their own project baselines in the absence of national baselines. Stakeholders in CDM should at the same time seek funds to carry out baseline surveys for the industrial sector.

### **13.0 Training of assessment of CDM projects (both GHG emissions reduction and sustainable development aspects)**

Training needs assessments (TNAs) surveys should be conducted to determine the training needs of all stakeholders in the CDM.

Stakeholders should be given comprehensive training that will help them on the long term to conduct technical appraisal, monitoring and evaluation of projects under the CDM. Local human manpower should be generated to ensure that locals are their own managers and can effectively understand the concepts underlying the CDM and projects under it. This will ensure suitability of the project.

Human resource development should be encouraged through the award of scholarships for training and exchange educational programmes for the purpose of gaining experience.

## **14.0 Conclusion & Recommendations**

Kenya has already prepared National Guidelines for CDM. Kenya is now in a position to ratify the Kyoto Protocol. Kenya should endeavour to attract foreign investments including the investments through CDM. The CDM investments will help towards Kenya's industrialization process and hence, sustainable development.

## **15.0 References:**

1. Maya R. S, Callaway J, Brooke C., Capacity Building Needs for CDM
2. National Environment Secretariat, Draft "First National Communication to COP" – Kenya.
3. Prof. Ogunlade Davidson, Technology Transfer & Climate Change – UNEP-Riso
4. Ottavia Mazzoni, "The Clean Development Mechanism" – Harmonizing the potential business opportunities and sustainable development requirement of Kenya.

## **16.0 GEOGRAPHY**

Kenya straddles the equator on the east coast of Africa, and is bordered by Somalia, Ethiopia and Sudan in the north, Uganda in the west, Tanzania in the south, and the Indian Ocean in the East. It covers an area of 583,000 km<sup>2</sup> (225,000 sq. miles). The topography of Kenya is remarkably diverse, and is broadly divided into four geoclimatic regions: the arid deserts of the north; the savannah lands of the south; the fertile lands around Lake Victoria Basin; and the highlands regions to the west which consist of a high plateau with an altitude of 1500 metres. The Great Rift Valley splits this plateau from north to south. The country has a wide range of climatic and ecological zones. The arid areas in the north and east have erratic rainfall patterns with averages of less than 600 mm, progressively increasing as one travels southwards, reaching an average of 900 mm or more in the south-western highlands. The Highlands are cool and agriculturally rich, and most of the large-scale farming activities are carried out in this region.

### **16.1 Economy**

The World Bank ranks Kenya amongst one of the poorest countries with over 50 percent of its population living below the international poverty line and an annual per capita income of about US\$330 (World Development Report, 1999/2000). Agriculture is the mainstay of Kenya's economy, contributing nearly one third of the Gross Domestic Product (GDP) and over 80 percent of employment (World Guide, 1998). The main cash crops produced include tea, coffee, horticultural products, pyrethrum, pineapples, sisal, tobacco and cotton. The tourist industry is also a very important sector, and is, by far, the largest single foreign currency contributor to the Kenyan economy. Liberalisation and privatisation of public enterprises was embraced as an economic policy since the early 1990s. However, the economy has been incapable of registering growth rates like those in past decades.

### **16.2 Human Development**

Kenya has an estimated population of 29 million (74% in rural areas), growing at 3.1 percent per year (UNDP, 1999). Much of the population is concentrated in the highland areas, which have a climate conducive for human habitation and fertile agricultural lands necessary to sustain these settlements. According to the latest UNDP figures (1999, the average life expectancy at birth is 58 years; infant mortality is about 74 per 1,000 live births, and literacy rate is about 79 percent (72% for women). The Kenyan government offers free education for the first eight years of school, but attendance is not mandatory.

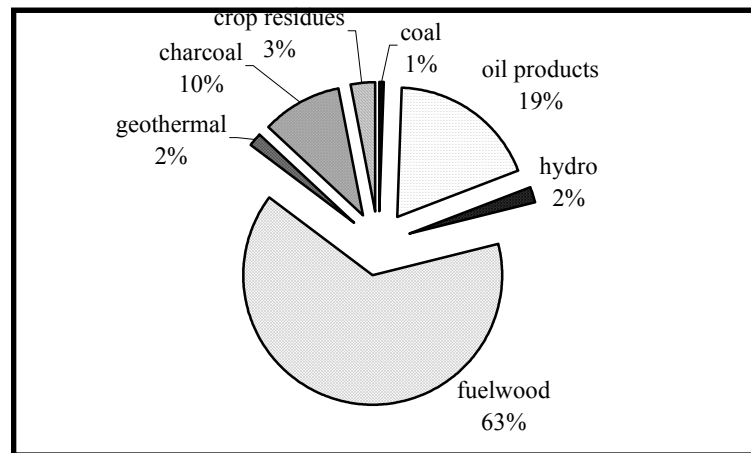
In terms of infrastructural development, Kenya reveals all the features of a least developed country. With safe drinking water and proper sanitation facilities available only to about 45 percent of the population, and all weather roads connecting only main towns and urban centres, more needs to be done to provide access to basic services to the

majority of Kenyans who are currently living under abject poverty. In addition to the fact that over half of Kenyans are now living below the internationally accepted poverty line, distribution of wealth is also unevenly distributed with the top 20 percent sharing 90% of the country's wealth while the remaining 80 percent share 10% of the wealth generated.

### 16.2.1 Energy Consumption

Traditional biomass fuels account for 76 percent of total of energy consumed in Kenya. In 1996, Kenya's total energy consumption was estimated at about 13.2 million ton oil equivalent, and rising at an annual rate of about 3 percent (UNDP, 1998). Notwithstanding the modest rise in annual energy consumption, the per capita consumption of the average Kenyan (at 476 kg oil equivalent) still remains amongst the lowest in the world.

Figure 1 shows that most of the energy consumption is met by traditional fuel(s) with fuelwood providing about 63 percent of the total energy needs and charcoal and crop residues accounting for 10 and 3 percent, respectively (KENGO, 1992). The share of fossil fuels and hydroelectricity is about 20 and 1 percent, respectively.

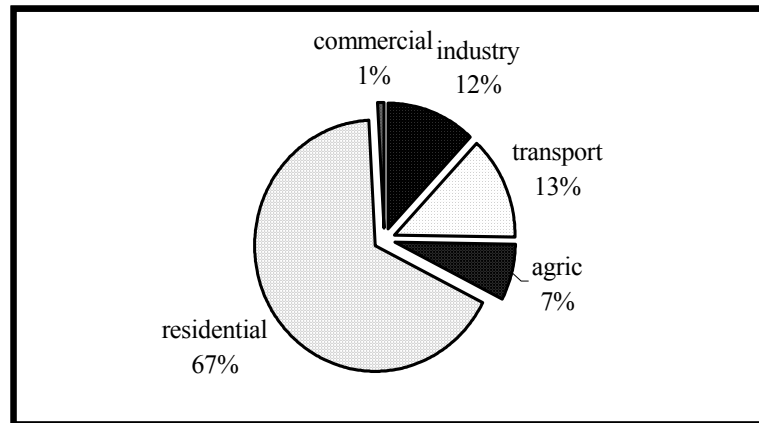


**Figure 1. Energy consumption profile (KENGO, 1992; IEA, 1997; UNDP, 1998)**

In terms of sectoral breakdown, most of the energy (67%) is used in the domestic sector mainly for cooking, space heating and limited lighting. The rest was consumed by the transport (13%), industrial (12%), agricultural (7%), and commercial sectors (1%). The rural sector, where about three-quarter of the population live, consumes over 75 percent of fuelwood, about 40 percent of the charcoal, and less than 8 percent of fossil fuels, hence illustrating the heavy dependence on biofuels by the rural communities. The use of electricity in rural areas is very low, accounting for less than 1 percent of all electricity generated in Kenya.

**Figure 2. Energy consumption by sector (IEA, 1997).**





### 16.2.2 Energy Supply

Kenya has limited source of identified reserves of commercial energy resources, which means that the country spends a considerable amount of its financial resources to pay for commercial fuels, mainly oil. Exploration for oil in the northern and eastern part of the country has been taking place for sometime, but so far there is little evidence of oil reserves of sufficient quantity to warrant large-scale investment.

The demand for electricity is expected to increase in line with industrial and urban expansion. However, the Government is also aware that effort should be made to make sure that the expansion does not create increased dependence on thermal generation plants. Surveys have shown that Kenya has an estimated total hydrogeneration potential of about 1200 MW, and given that 350 MW is currently obtained from hydroplants, there is some reason for optimism, at least for the short to medium term. A number of projects are underway which would bring the installed capacity in Kenya to about 780 MW (KENGO, 1992). It is worth noting here that a long-term view is required if Kenya is to generate the required 2000 MW by the year 2020. The plan needs to look into the ways the country can generate electricity using local energy resources such as hydro and geothermal, and also the possibility of importing electricity from neighbouring Uganda and Tanzania.

Other energy resources have also attracted attention in recent times. Studies have shown that some renewable energy technologies can be viable in Kenya given the appropriate capacity building requirements and financial mechanisms. Since the mid 1980s, the dissemination of photovoltaic systems in Kenya has been a dramatic success with over 80,000 solar home systems in use, and a large group of vendors, manufacturers, and installers growing rapidly (IPCC, 1998). Another successful initiative was the improved cookstove (ICS) programme, which promoted new charcoal (*jiko*) and wood stoves (*upesi*) that were more efficient than traditional biomass stoves, leading to fuel savings of 42 percent and 50 percent, respectively. By 1994, about 780,000 charcoal stoves (*jiko*) and 250,000 wood stoves (*upesi*) were disseminated, with figures expected to rise to about 1.6 million *jiko* and 500,00 *upesi* stoves by the end of 1999. Moreover, this

programme has brought about the emergence and participation of entrepreneurs and artisans whose number had grown to over 1000 by 1989, and ten years today, the number has risen significantly.

The 1980s also saw some large-scale experiments such as geothermal energy and ethanol production. By the mid-1980s, Kenya had an installed capacity of 45 MW geothermal plant, which has now been upgraded to 60 MW, and by 1995 geothermal plants were supplying about 8 percent of the total electricity production (UNDP, 1999). The lessons learnt from the geothermal programme is that while the resource is locally available, geothermal wells dry up and therefore the require the drilling of more wells to maintain the power output, which of course means additional costs. The manufacture of alcohol (ethanol), which began in the early 1980s, currently provides about 5 percent of petrol blend in Kenya. Although other renewable energy technologies such as small-scale hydro, and wind could, in the long run, make an impact, little has been done in the way of exploiting these resources on a commercial basis.

#### **16.2.2.1 Emissions**

Total CO<sub>2</sub> emission in Kenya in 1996 was in the order of 6.8 million metric tons, most of which was derived from biomass and fossil fuel use (World Bank, 1999). Methane gas emission from anthropogenic sources is also a significant contributor to the country's GHG inventory, largely originating in the agricultural sector. However, reliable data on methane gas emission in Kenya is yet to be published.

#### **16.2.2.2 Environmental Issues and Interventions**

There are a number of environmental problems in Kenya. Some of these are water pollution from urban and industrial wastes; degradation of water quality from increased use of pesticides and fertilisers; soil erosion and deforestation from clearance of land for agriculture and to meet growing energy demand; and desertification due to a wide-range of anthropogenic activities such as overgrazing and unsustainable land use.

Kenya does not have a comprehensive environmental policy or legislation. Instead there are a number of policies on soil conservation, food production, population, wildlife, livestock, water supply, energy, etc. A similar situation exists as regards to legislation whereby there are a number of legislation pieces which touch on environmental issues, but were not formulated within the broad framework of Environmental Planning and Management in mind. Similarly, activities are fragmented amongst several Ministries and institutions that have mandates related to some areas of environmental protection. Over the past few years, efforts to integrate activities in environmental management have led to the formation of the Inter-Ministerial Committee on Environment (IMCE). This committee, which draws on all government ministries as well as research and academic institutions, deliberates on recommending strategies for integrating environmental considerations into the country's development plans, which is the aim of the National

Environmental Action Plan (NEAP). The issues and problems dealt in the NEAP include:

- developing a national environmental policy for Kenya;
- strengthening and improving institutional coordination in environmental matters;
- improving environmental legislation;
- integrating population policies into the environmental framework and vice versa;
- developing environmental information systems to support environmental decision making;
- developing a national land use policy including the treatment of land tenure issues as needed.

### **16.2.3 Government Energy Policy Objectives**

Kenya's energy policy aim to:

- guarantee security supply of both electricity and petroleum fuels to the domestic economy consistent with growth in demand
- enhance energy supply and delivery capacity to all sectors of the economy including domestic households at a pace consistent with the growing demand through technically efficient but cost effective systems
- create an enabling environment for the private sector participation in the supply of energy including electricity
- Institutionalise and internalise environmental impact assessment and awareness of energy development and consumption and develop an internal capacity for the impact assessment and mitigation of negative effects and,
- promote energy conservation through use of technically efficient but cost effective supply and end-use technologies.

### **16.2.4 Development Objectives**

Most of Kenya's Five-Year plans in the past have emphasised economic growth as the single most important path to poverty eradication. Today it is clear that economic growth is not a panacea for the elimination of poverty given that it manifests itself in a variety of ways: low levels of incomes, lower life expectancy, poor access to essential services such as health, education, water, energy etc. Recognising the complexities of poverty and its alleviation has prompted the Kenyan government to formulate its National Poverty Eradication Plan (NPEP) which focuses on poverty eradication through the reduction of unemployment, social integration and the creation of an enabling economic, political, cultural and legal environment for social development. Some of the concrete targets of the NPEP are:

- achievement of universal primary education by the year 2015,
- creation of universal access to safe water by 2010,

- increasing participation of communities in the planning process,
- enhancing opportunities in economic production for disadvantaged and vulnerable groups.

The means by which such targets can be achieved is by:

- mobilizing assets and efforts of all the people in order to generate a viable economic activity,
- ensuring improvements in the smallholder agriculture as a means of accelerating economic growth,
- creating an enabling environment for catalysing and sustaining the contributions of the poor and low income groups to national development as well as doing away with all bureaucratic restrictions and discriminations
- enforcement of the rule of law to fight corruption and to secure a harmonious environment for sound management