



THE UNITED REPUBLIC OF TANZANIA

# THE ENERGY POLICY OF TANZANIA

Ministry of Water, Energy and Minerals—April, 1992

# **THE ENERGY POLICY OF TANZANIA**

## ABBREVIATIONS

CAMARTEC	Centre for Agricultural Mechanization and Rural Technology
CCM	Chama Cha Mapinduzi
CIDA	Canadian International Development Agency
ECA	United Nations Economic Commission for Africa
ERP	Economic Recovery Programme
FAO	United Nations Food and Agriculture Organization
GASCO	Gas Supply Company
GDP	Gross Domestic Product
GNP	Gross National Product
KBO	Kagera Basin Development Organization
KILAMCO	Kilwa Ammonia Company
LPG	Liquified Petroleum Gas
NESP	National Economic Survival Programme
NGO	Non-Governmental Organization
PTA	Preferential Trade Area
R&D	Research and Development
SAP	Structural Adjustment Programme
SADCC	Southern Africa Development Coordination Conference
SIDA	Swedish International Development Agency
STAMICO	State Mining Corporation
TANESCO	Tanzania Electric Supply Company Ltd
TPDC	Tanzania Petroleum Development Corporation
UNESCO	United Nations Education, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
TIRDO	Tanzania Industrial Research Development Organisation
TWICO	Tanzania Wood Industries Company
TIPER	Tanzanian and Italian Petroleum Refinery Company Ltd
ESAMPDC	Eastern and Southern Africa Minerals Resource Development Centre

## CURRENCY EQUIVALENT

Tsh.197 = US\$ 1.0, as of December, 1990.

## MEASUREMENTS

Bbl	Barrel	= 0.15899 Cubic metre; 42 US gallons; 35 Imperial gallons
CF	Cubic foot	= 0.02822 Cubic metre
GWh	Gigawatt hour	= 1,000,000 Kilowatt hour (KWh)
K(k)	Kilo	= 1,000
kV	Kilovolt (kV)	= 1,000 Volts

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## **INTRODUCTION**

### **The Role of Energy in National Development**

1. The main goal of any nation, Tanzania included, is to promote social and economic development. Put simply, this relates to the uplifting of the welfare of the people through measures taken in accordance with agreed principles and strategies. In the case of Tanzania the guiding principles are socialism and self-reliance.
2. Energy is a prerequisite for the proper functioning of nearly all sub-sectors of the economy. It is an essential service whose availability and quality can determine the success or failure of development endeavors. The importance of energy as a sector in the national economy cannot, therefore be overemphasized. Yet energy cannot be developed and its use managed in isolation. Energy policies and plans must be consistent with national economic planning and their implementation must be synchronized with the policies, plans, and strategies of other sectors.
3. It is in the light of the foregoing that an overview of national economic policies and plans should precede the elaboration of an energy policy. The success of strategies for the implementation of such policies in the short, medium and long term have a great bearing on the energy sector's need to support these strategies. An overview of the national economic policies and plans is presented below, therefore, in order to set the context in which the energy sector plays now, and is expected to play, a useful role in facilitating the implementation of development efforts in all sectors of the economy.

### **The Long Term Perspective Plan**

4. Up to 1981, mainland Tanzania had implemented three five year development plans; the first one from 1964/65 to 1968/69, the second one from 1969/70 to 1973/74 and the third one from 1976/77 to 1980/81. The three successive plans were part of the first long-term perspective plan (1964/65-1980/81). The second long term perspective plan was launched in 1981. The major objectives of the Long-Term Perspective Plan (1981-2000) are:
  - i) to consolidate and expand the national economy at an average GDP growth rate of 6 percent;
  - ii) to increase the mining sectors's contribution to GDP from 0.5 percent in 1980 to 2.4 percent by the year 2000;
  - iii) to increase the contribution of industry sector to GDP from 9.3 percent in 1980 to 16 percent by the year 2000;
  - iv) to increase the contribution of transport and communications to GDP from 6.3 percent in 1980 to 8.4 percent by the year 2000;
  - v) to increase the contribution of the water and energy sectors to 1.7 percent of the GDP by the year 2000, rising from 0.8 percent in 1980; and
  - vi) to increase the shares of construction, commerce, finance and services (administration, education, health, etc.) to 6 percent, 9 percent, 9 percent and 10 percent respectively by the year 2000.

5. The Five Year Plan 1980/81 - 1985/86 was conceived to be the first phase in the implementation of the Long-Term Perspective Plan 1981-2000. In order to implement the objectives of the plan, it was envisaged that 51.4 percent of resources would come from external sources and 48.6 percent from internally generated funds. For various reasons, the objectives of the Plan were not realised. Two programmes were instituted in its place, the Structural Adjustment Programme (SAP) and the National Economic Survival Programme (NESP). Under these programmes, which in effect supplemented the Plan, all new development projects were postponed or cancelled except for those whose positive impact on the national economy would be felt soonest.

### **The Economic Recovery Programme**

6. The continuing decline in industrial and agricultural production during the period 1980-1985 led to increased inflation and a decline in the standard of living. In order to arrest the decline, the Economic Recovery Programme (ERP) 1986/87 - 1988/89, was adopted in 1986. The major objective of ERP was to increase GDP at an average rate of 4.5 percent per annum between 1986 and 1991. The following areas were given priority:

- i) increasing both food and cash crops production through use of corrective production incentives, by strengthening the marketing system, having timely crop collection and marketing, and injection of more investment into agriculture;
- ii) increasing foreign exchange revenues from export proceeds by 11.6 percent in 1987, 19 percent in 1988 and 19 percent in 1989 from US \$ 400 million in 1988;
- iii) rehabilitating basic economic infrastructure especially in the transport, communications, energy and water sectors in order to support the production sector fully;
- iv) raising industrial capacity utilization from 20 percent to 60 percent at the end of the programme, with the objective of increasing the industrial sectors contribution to the GDP by channelling investment resources, especially foreign exchange to key and productive industries; and
- v) minimizing the gap between government revenue and expenditure and improving the balance of payments situation by pursuing prudent monetary, fiscal and budget policies.

7. The first phase of the economic recovery programme ended in June 1989. The second phase whose broad objectives are those stipulated above has been formulated to take into account experiences of the first phase of ERP, especially in so far as the basic services were affected. The second phase is therefore essentially an economic and social recovery programme.

### **Programu ya Chama Cha Mapinduzi (CCM) 1987 - 2002 (The Party Programme)**

8. In 1987 the Party, CCM, promulgated the Party Programme for the period 1987 to 2002. The Programme was conceived as a result of the normal process of reflections on and review of the implementation of the directions contained in the Arusha Declaration and as further expanded by Party Guidelines of 1981, and the CCM Constitution of 1982. As a result guiding principles towards the achievement of better and higher standards of living of the people and improvement of the national economy for the 15 years from 1987 to 2002, have been articulated.

9. Paragraphs 94 to 98 of the Party Programme underscore the importance of energy in national development and spell out what the thrust should be in the development of this sector. In particular, the Programme notes the vast energy resource potential in the country in respect of hydropower potential, coal, natural gas, and biomass. The latter, it is stressed, will continue to be the major source of energy for the foreseeable future. It is therefore stipulated that it is essential that the country protects and increases the biomass resource base for both energy supply and environmental reasons. We shall return to these observations in more detail later in this document.

10. Furthermore, in an accompanying statement to the Party Programme, the Party's directions in the country's socio-economic development have been elaborated in a document entitled "Maelekezo ya Chama Kuhusu Maendeleo ya Uchumi na Jamii Katika Kipindi cha 1987-1992."

11. Part B of the statement gives guidelines to various sectors on main areas of emphasis for the period 1987-2002. In Section V of Part B, paragraphs 91 and 92 contain specific directions on the energy sector, including mention of specific projects such as the proposed Mchuchuma Coal Development Project and oil prospecting.

12. Section VII is about a sector whose development is already related to energy use, the forestry sector. Paragraph 94 sub-paragraphs (I) to (IV) are relevant. They all provide direction in the development, production, and use of forests and trees. Section VIII is also pertinent, underscoring the need for the protection of the environment, setting a basis and the context of energy sector objectives in the contribution to environmental protection and minimisation of environmental degradation.

### **The Second Union Five-Year Development Plan 1988/89-1992/93**

13. The Second Union Five-Year Development Plan 1988/89 - 1992/93 has been prepared taking into account the experiences of the severe economic situation in the years 1981 - 1986 and draws heavily on the Economic Recovery Programme. It is in line with the thrust of the Party Programme and Directions of the Party on the Economy and Society. The main objectives include:

- i) to continue with efforts towards food self-sufficiency;
- ii) to increase and improve on the production of goods and services; and
- iii) to safeguard the past gains through strengthening of social and economic services.

14. In the energy sector, the main thrust is development and use of indigenous energy sources, and efficient utilization of energy.

15. The above discussion gives the basic framework within which a national energy policy can be enunciated. In particular, as will be seen below, the energy policy direction and implementation strategies must be consistent with the general direction of the economy for energy to play a meaningful and supportive role in the service of all other sectors. The following chapter therefore spells out, in a consistent manner, the major objectives and directions of the National Energy Policy. Strategies for the implementation will be highlighted in the consideration of intersector relationships and in the discussion on energy sub-sectors.

16. Furthermore, this National Energy Policy document incorporates the strategies and policies relating to energy which have already been adopted for other sectors, e.g. the policies on transport, agriculture, science and technology, and water.

## **ENERGY RESOURCES AND USE PATTERNS**

17. Trees are the main source of biomass-based fuels. The total forested area of Tanzania is 28 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. The forest areas are being harvested at a rate faster than the regeneration rate of forests. Woodfuel in the Tanzania context cannot, therefore, be classified as a renewable source of energy.

18. Beside woodfuels, the country has considerable biomass resources in the form of Forest and Agriculture residues. To a varying extent possibilities exist for the economic conversion of these resources to electricity and energy for industrial and domestic purposes. Presently limited forest and agricultural residues are being used for electricity and mechanical power generation as well as fuelwood substitute in various parts of the country. The current size of forest and crop residues are estimated at 1.1 mill. tonnes and 15 mill tonnes respectively per annum and could account for at least 10% of the nation's energy requirement.

19. Coal and natural gas are the other indigenous commercial fuels of high potential. Coal reserves are estimated at about 1,200 million tonnes of which 304 million tonnes may be considered proven. Natural gas exists at Songo Songo and Mnazi Bay. A field with 29.02 billion cubic metres of proven, probable and possible recoverable high quality natural gas has been discovered at Songo Songo. The Mnazi Bay discovery is yet to be delineated but is potentially an important resource of indigenous energy.

20. Hydroelectric energy is the single most important indigenous source of commercial energy in the country. The country has a potential of 4.7 GW of installed capacity and about 3.2 GW of firm capacity. Only 10 percent of the potential installed capacity has been developed.

21. Solar, wind and geothermal energy are virtually untapped energy resources. The mean solar energy density is of the order of 4.5 kW per square metre per day, an indication of a good potential for use as an energy source. Except for the problem of site-specificity, low speed windmills have a potential in the country. Uranium deposits are known to exist in Tanzania.

22. Tanzania's energy demand and end-use pattern is characteristic of a developing economy. Woodfuels such as fuelwood, charcoal and agricultural residues account for 92 percent of final energy consumption. On the other hand, the so called commercial fuels, electricity and petroleum, account for 0.8 and 7.2 percent of final energy consumption respectively. It is estimated that in 1989 Tanzania's final energy consumption was 15.0 million Tonnes of Oil Equivalent (TOE). The per capita energy consumption was therefore of the order of 0.65 TOE.

23. In 1965 Tanzania consumed 337,000 tonnes of petroleum products. By 1986, the level of imports had increased to 855,000 tonnes. The transport sector accounts for nearly 51 percent of petroleum used in the country. The industry sector accounts for 26 percent and the household sector, 10 percent of consumption. The rest is accounted for by other sectors.



24. Tanzania is a relatively small consumer of electricity. In 1988 the consumption stood at 1060 gigawatt-hours (Gwh) which correspond to a per capita consumption of 46 kWh. This consumption is only 10% of the average for all developing countries and 1 percent of the average for industrialised countries. Those who have access to electricity constitute a mere 5 percent of the entire population. The long term goal in this sub-sector is to double the per capita electricity consumption by the year 2005.

25. Consumers of electricity have been grouped into 10 categories. Domestic (29.33%), Light Commercial (10.69%), Light Industrial (4.17%), Industrial (12.61%), Agricultural (5.61%), High Voltage Supply (14.03%), Heavy Commercial (13.6%) , Public Lighting (0.43%), National Urban Water Authority (4.39%), and Zanzibar (5.14%).

## **POLICY OBJECTIVES**

26. Energy is a critical input into the development process. There cannot be sustainable development and the satisfaction of basic needs of society without sufficient and efficient supply and use of energy. In addition, the overall policy objective of energy development in the country will therefore be to provide an input into the development process of the country through 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.

27. Much of the demand for petroleum products comes from the transport and industry sectors and, to a limited extent, power generation. Almost all petroleum products consumed as fuels in the industrial sector are used in the production of process heat or process steam. A reduction in the use of these fuels can, therefore, be effected by harnessing indigenous energy resources. Tanzania has abundant coal, natural gas hydropower and biomass in the form of forestry and agricultural wastes which could potentially be used as substitute for imported petroleum.

28. The overall goals of the National Energy Policy will therefore be the following:

- i) to exploit the abundant hydro-electric sources;
- ii) to develop and utilise natural gas resources;
- iii) to develop and utilise coal resources;
- iv) to step up petroleum exploration activities;
- v) to arrest woodfuel depletion by evolving more appropriate land management practices and more efficient woodfuel technologies;
- iv) To develop and utilize forest and agricultural residue for power and cooking energy production.
- vii) to minimise energy price fluctuations in order to contribute to stability of prices in general through strengthening and rationalisation of energy supply sources and infrastructure and a rational energy pricing structure; and

- viii) to develop human resources for development of energy technologies development.
- xi) to ensure the continuity and security of energy supplies;

29. It is furthermore recognised that the thrusts of ERP and the Second Union Five Year Development Plan are towards the revival and rehabilitation of existing infrastructure. While the long term strategy of the National Energy Policy is the reduction of dependence on external energy sources and rational management and utilization of our resources, the immediate, short and medium term strategies of the National Energy Policy will include:

- i) more efficient use of energy in the transport and industry sectors;
- ii) rehabilitation of the electric power generation, transmission and distribution infrastructure;
- iii) rehabilitation and rationalization of the petroleum refining, storage and distribution infrastructure;
- iv) generation and distribution of electricity at affordable prices and commensurate with demand;
- v) supply of electricity to small townships and industries lying adjacent to and far off the grid system starting with agro-based industries and using alternative sources, respectively;
- vi) development and dissemination of efficient woodfuel conversion and utilization technologies and introduction of coal stoves for domestic purposes in order to reduce the depletion of wood;
- vii) investigation of the potential of geothermal energy in the country;
- viii) development and utilization of natural gas and development of associated conversion and end-use technologies;
- ix) development and dissemination of simple and affordable electric stoves and appliances for rural and urban households; and
- x) development and dissemination of simple and affordable kerosine stoves for rural and urban households.

## **ENERGY SUPPLY**

### **Biomass**

30. The biomass resource in Tanzania is comprised of fuelwood and charcoal from both plantation forests and natural forests, agricultural and forest residues, and animal wastes. This resource accounts for over 92 percent of final energy consumption in Tanzania in 1989 and will continue to dominate the national energy balance for the foreseeable future.

31. The total biomass resources in Tanzania for 1990 has been estimated to be 27.0 million tonnes of oil equivalent (TOE) from natural forest mean annual increment; 1.04 million TOE from forestry and forest industry surplus and residues and 3.1 million TOE from agricultural residues giving a total potential biomass

resource of 31.14 million TOE. This estimate of the potential is based on the assumption that 80 percent of the mean annual increment can actually be harvested and that all agricultural residues can actually be used as fuel. Even with these very optimistic assumptions the biomass fuel balance is estimated to be negative in 1990 for the following regions: Kilimanjaro, Mara, Mwanza, Shinyanga and Dar es Salaam.

32. The assumptions above yield a large national biomass balance of about 17.6 million TOE if only the demand for biomass for cooking purposes is considered. Transportation of biomass from regions with a positive balance to regions with a projected deficit is generally a more expensive option than the establishment of fuelwood plantations in regions with a negative biomass balance.

33. The problem of negative biomass balance is especially acute around the urban centres of Dar es Salaam, Dodoma, Mwanza, Arusha and Moshi. Projections of the demand in these urban centres shows that if the demand is met from natural forests in the peri-urban areas, serious local deforestation may result. Studies will, therefore, have to be done in the very short term to identify the economically and financially least cost methods of meeting the urban cooking demand.

34. Preliminary results comparing six alternative end use scenarios using a traditional charcoal stove and a traditional kiln, a traditional stove and an improved kiln, an improved efficiency charcoal stove with improved charcoal kilns, liquefied petroleum gas (LPG), electricity from the grid and electricity from an isolated thermal generating plant has shown that using improved charcoal kilns and improved charcoal stoves is, economically and financially, the least cost option to both the user and the nation.

35. Some of the residues which can be readily used as fuel are those from saw-mills and agro-processing industries. Residues from saw-mill industries such as saw dust offcuts, leftover slabs and from agriculture such as corn cobs, rice husks, coconut shells and cotton stalks must be used as an energy source in areas where the residues are produced. Where it is considered economic and where sufficient resources are available, production of carbonized briquettes from the forest and agricultural residues will be developed and utilization promoted.

36. Animal wastes, mainly cowdung, will continue to find use as a household energy source in rural areas. The use of animal wastes to produce biogas is discussed later.

## **Petroleum**

37. The objectives of the National Energy Policy with regard to the petroleum sub-sector are implicit within the energy sector's overall short and long term objectives stated above. Because the major problem in efforts to develop the petroleum sub-sector is the high cost of petroleum procurement to the national economy, the policy objectives of developing and utilizing indigenous hydro-electric, coal and national gas resources and stepping up oil exploration activities are consistent with the goal of reducing our dependence on imported petroleum through energy substitution. They are also consistent with the objectives of increasing energy supply security and reducing energy price fluctuations.

38. Furthermore, the overall policy objectives for the short and medium term of having more efficient energy use in the transport and industry sectors and rehabilitating the petroleum refining, storage and distribution infrastructure, imply for the petroleum sub-sector, a net reduction in the final cost of petroleum products to the economy per unit of production by minimizing waste or loss of petroleum products and the resources needed to procure, refine, and distribute them.

39. The principles guiding the formulation of strategies to meet the above policy objectives in the petroleum sub-sector are presented below for each of the main areas of the sector's activity and development.

#### **Procurement**

40. Crude oil and petroleum products shall be procured from such sources and on such terms as are consistent with the need to maintain steady and reliable supplies, at minimum landed cost, and with maximum satisfaction of domestic requirements or minimum net cost to the national economy.

41. Because of the unique, critical, and strategic nature of petroleum with respect to the national economy and to its socio-economic development, the Government will continue to exercise control over the purchase and importation of crude oil and refined as well as other petroleum products. Thus the Government will articulate the parameters within which Tanzania Petroleum Development Corporation will negotiate and conclude long term supply contracts.

#### **Development**

42. The implementation of new projects in the petroleum sub-sector will be supported by the Government only if, after being subjected to rigorous financial, social and economic cost-benefit analysis, they are assessed to result in net benefits accruing to the country after taking all associated risks into account. Furthermore, approval of such projects will be subject to its being satisfied that adequate consultations and coordination with all the other sectors or sub-sectors whose input into the projects will be necessary, have taken place. It must be demonstrated that each new project will fulfil one or more of the petroleum subsector's policy objectives prior to its implementation.

43. The development of the petroleum sector, in terms of projects and programmes, will be guided by the need to satisfy demand for petroleum products by existing and future consumers at least cost in order to attain the objective of minimizing the net cost of petroleum procurement to the economy. Close liaison and coordination with major petroleum product consuming sectors (e.g. transport and industry) will be established in order to ensure that petroleum product supply and demand related investments are assessed and developed simultaneously.

44. Generally, new projects which it is demonstrated will result in net earnings or savings of foreign exchange, or which will increase the availability or reduce the economic cost of petroleum products used in the country will be supported.

45. The Government will continue with its policy of facilitating supply of crude oil and refined petroleum products to land-locked neighbouring countries through Tanzania ports and the inland transport network.

46. Where this is assessed to be in Tanzania's political, social and economic interest on the basis of cost-benefit analysis, joint procurement of crude oil and refined products with other countries shall be considered and promoted.

#### **Refining, Processing and Storage**

47. The role of the domestic petroleum refining and processing industry within the context of National Energy Policy is to improve the security of supply of products the industry produces and to reduce the net

cost of petroleum imports by increasing their net value-added in the country. Existing processing facilities will be encouraged to improve their operation and operate economically in order to increase their value added. The Government will promote new facilities that are assessed to be economically and financially viable.

48. Petroleum processing facilities such as refineries and other petro-chemical plants tend to be strategic investments. The Government, shall therefore promote the public ownership of such facilities to the extent that resource availability permits. However, where private institutions wish to invest in processing projects which are assessed to result in net benefits to the national economy they will be allowed to invest on terms and conditions that promote the realization to the relevant policy objectives and fair return on the investment on the part of the investors.

49. The refinery (TIPER) will be rehabilitated and expanded in order to satisfy the country's requirements for petroleum products and where possible to meet part of the demand of neighbouring countries.

50. In order to ensure continuous availability of petroleum products, storage capacity will be increased from the present 30 days supply to at least 60 days supply. In the medium term, efforts will be directed towards the creation of national strategic petroleum reserves.

### **Distribution**

51. The distribution of petroleum products using modes, routes, and facilities which result in the least economic cost will be encouraged and promoted. Investments which facilitate the delivery of products at minimum cost (e.g. marine vessels, pipelines, railway, loading and unloading facilities, storage tanks, oil tank wagons, jetties) will be supported by appropriate measures such as the pricing of petroleum products, so that fair returns on the relevant investments are attained.

52. The agricultural sector is the mainstay of the economy and the bulk of the population lives in the rural areas. Petroleum distribution should cater for the needs of the sector and the rural areas. TPDC will therefore take a leading role in ensuring distribution of petroleum products.

53. Efforts will be made to minimize the haulage of petroleum products by road beyond a 300km radius from the point of supply where rail or marine transport is a viable alternative. The role of the Ministry responsible for energy in these efforts will be to mobilize the required resources to effect the desired changes in distribution patterns, and to provide incentives and disincentives through the petroleum pricing mechanism in consultation with the transport sector.

54. The allocation of petroleum products to the different distributors and marketers will be made on the basis of their individual and collective ability to deliver the products to their customers at minimal cost to the national economy. The number of companies to be permitted to engage in petroleum distribution and marketing operations shall be determined on the basis of consideration of the need to maintain healthy competition and high standards of service to consumers on the one hand, and the need to optimize the use of all marketing and distribution facilities (or to minimize distribution costs) on the other.

## **Exploration**

55. Petroleum exploration is a risky undertaking which requires large amounts of capital in the form of skilled manpower, technology, and finance, which Tanzania does not possess. Since 1981, petroleum exploration has been carried out in the country by international oil companies using their own resources on the basis of agreements under which these companies bear all the risks associated with exploration and share any petroleum discovered and produced commercially with the Government. Such arrangements are in accordance with the provisions of the Petroleum (Exploration and Production) Act 1980.

56. The Government, due to limited resources, will engage itself in the financing of petroleum exploration activities only to the extent necessary to acquire sufficient data and information relating to the petroleum prospects of different areas in the country in order to attract the interest of international companies to carry out capital intensive exploration leading to the drilling of wells. The Government will also continue its efforts to mobilize funds in the form of grants or soft loans specifically for petroleum exploration.

57. Exploration agreements with overseas companies will for the time being, be based on the model production sharing contract as updated from time to time. These agreements will specify durations, minimum work programmes, minimum amounts to be spent in carrying out the work programmes, training of Tanzanian personnel, cost recovery and profit oil allocation, among other things. This, together with the provisions of the Petroleum (Exploration and Production) Act 1980 relating to the discovery, development, and relinquishment of contract areas will create an enabling environment which will ensure that the pace of exploration activities is accelerated.

## **Conservation**

58. Since the first oil crisis in 1973, the Government's fuel conservation measures have focused on controlling the supply of petroleum products and limiting their consumption through legislation and regulation. Supplies were controlled by the introduction of regional fuel allocation, rationing, restriction of the time during which petroleum products could be sold, and a ban on unauthorised driving of motor vehicles for 16 hours from Sunday afternoons to Monday mornings.

59. The powers of the Government to reinvoke the conservation measures in the case of emergency will remain in the statute books. The basic elements of the conservation measures will then be reverted to but will be modified by conditions obtaining then and the experience gained during the period 1973 - 1986.

## **Natural Gas**

60. Development of natural gas resources at Songo Songo and Mnazi Bay to substitute expensive imported petroleum fuels will be encouraged and promoted. Investments which would facilitate delivery of natural gas to Dar es Salam for use in industries, transport, power generation and in the commercial and household sectors will be supported with appropriate measures such as provision of incentives to industries to convert to natural gas, appropriate gas tariffs to motivate consumers, and advisory services to consumers on the uses of gas. Efforts will also be made to ensure the reliability of supply to consumers. Development of natural gas resources will also take into account the use of natural gas as a feedstock to chemical industries including manufacture of fertilizers and methanol. The main thrust of the development of natural gas resources will be the establishment of necessary infrastructure as well as to make operational the gas utility (GASCO) to carry out management and operation of the system. Standards and regulations will be established on the transportation and use of natural gas to ensure safety of installations and personnel.

## **Electricity**

61. The policy with regard to electricity generation is to continue putting emphasis on the exploitation of the ample hydropower resources. In addition extension of the transmission lines and the expansion of the distribution network will be undertaken in order to bring more load centres, into the interconnected largely, hydro-based grid.

62. To meet its objective of supplying electricity for various economic activities, TANESCO has over the years planned and implemented new generation and transmission projects. The overriding planning objective has been the exploitation of Tanzania's large hydropower resources in order to reduce dependency on biomass fuels and imported petroleum. Parallel with the expansion in the hydroelectric generation capacity has been the expansion of the transmission network to bring hydroelectricity to large load centres formerly supplied with thermal electricity such as Iringa, Mbeya, Dodoma, Shinyanga, Mwanza, Tabora and Musoma.

63. On the generation side for example, the least cost expansion plan for using hydroelectric resources requires that the next generation increments after Mtera be in that order, the redevelopment of the Pangani system (60 MW), Downstream Kihansi (162MW), Upstream Kihansi (45MW), Masigira (80MW), Rumakali (204MW) and Mpanga (160MW) respectively.

64. A least cost generation development sequence using natural gas from Songo Songo for power generation has been studied. Results show that utilization of gas in industry and for power generation in Dar es Salaam is marginally more economic than the all hydro sequence. Diversification of sources, lessening of dependence on petroleum products and the need to utilize indigenous sources of energy makes the sequence involving natural gas attractive. Construction of a pipeline from Songo Songo to Dar es Salaam, the distribution network, conversion of industries to gas and development of gas power station will be implemented as soon as possible. In addition the utilization of the Mnazi Bay gas for onsite electricity generation should be expedited. Expanded use of coal for power generation will be studied.

65. Decisions either on which generation expansion sequence to follow or on the timing of the generation projects will require continuous monitoring and updating of TANESCO's **Power Sector Development Plan (1985 to 2010)**. TANESCO will, therefore, build in-house capacity for updating the plan and advising Government accordingly.

66. Transmission and distribution systems will be developed, expanded and rehabilitated in such a manner as to enhance reliability. Regular repairs and preventive maintenance of the electricity network will be carried out.

## **Rural Electrification**

67. Since all regional headquarters have been electrified, efforts will be focused on the electrification of all district headquarters by the year 2005. In this regard, first priority will be given to districts and areas with agro-based industries and other community productive power needs which are within an economic break-even distance from the interconnected grid in order to use relatively cheaper hydropower. Second priority will be given to districts and areas with agro-based industries and other community productive power needs but which are outside the economic break-even distance from the grid.

68. For districts where it is uneconomic to obtain electricity from the grid, alternative electric power sources will be sought. In considering the alternative sources preference will be given to the exploitation of micro and mini-hydro sites.

69. The Government will finance part of the rural electrification projects that are found to be uneconomic though not financially viable. A rural electrification fund will be established by the government to further the objectives of rural electrification. A surcharge on tariffs will be used to raise revenue from electricity consumers for this fund. Furthermore, considering the linkage between the petroleum sector and woodfuel use, TPDC will contribute a certain percentage of its gross profit to the Rural Electrification Fund. Duties and taxes add to the cost of rural electrification. The Government will waive these duties and taxes for furtherance of rural electrification programmes.

70. For forests and agro-processing industries considered uneconomic to be supplied with electricity from the grid, alternative power sources will be sought. Among the alternative options to be given priority is the production of electricity by these industries through combustion or gasification of their own wastes. Possibilities of synchronizing such power plants to the national power grid will be looked into.

71. In order to accelerate the pace of rural electrification and reducing the costs of implementing the schemes, self-reliance will play a key role. In this context communities will be requested to contribute by way of waiving compensation due to farmers and property owners along the transmission line routes and substation plots; and whenever possible providing labour in assisting the implementation. The resulting savings from this waiver which can be as high as 30% of the total local cost component will reduce the implementation costs for the projects. Furthermore communities will be mobilized to organize themselves into construction brigades and assist in trace clearing and digging of holes at nominal fees. In addition communities will be required to provide partial finances towards meeting financial costs of these projects. Significant savings in costs will be realized compared to conventional ways of electricity supply.

### **New and Renewable Energies**

72. New and renewable energy technologies will be developed to ensure efficient utilization of fuelwood and charcoal and where possible to substitute for petroleum products. Efforts will be made to develop technologies which address energy needs of women especially those in rural areas.

### **Wind and Solar Energy**

73. Wind energy in Tanzania has been used to pump water for irrigation and to meet domestic and stock water needs. Few attempts have been made to use wind for electricity generation.

74. There have been several attempts at local design and manufacture of windmills but none of the local designs has been successfully disseminated. The introduction of imported windmill designs has also met with limited success even in areas such as the interior plateau in the centre of Tanzania which have good wind regimes. The reasons for failure seem to be:

- i) production of poorly designed or expensive prototypes;
- ii) introduction of windmills for demonstration purposes only;



iii) lack of maintenance and spares and lack of skills for repairs; and

iv) lack of reliable data on wind characteristics to aid in the siting of windmills.

75. Successful exploitation of wind energy will depend on entrepreneurship on the part of local organizations and businesses to develop a sound design of a local windmill, mounting dissemination programmes with an effective extension network to help in maintenance, training of personnel for the repair and maintenance of windmills and the creation of a national wind characteristics data base to aid in the siting of windmills. The Government will assist in these endeavors.

76. The utilization of solar energy in Tanzania is still in its infancy. Solar energy can be used directly for water and space heating, drying, distillation and adsorption cooling whereas indirect uses include mechanical conversion and electricity generation. There is a wide potential for using solar water heaters in the country. In order to reduce use of wood and oil for water heating purposes therefore, all new community construction projects and hotels will be required to install solar water heating equipment.

### **Geothermal Power**

77. Geothermal sources do exist in Tanzania. Active volcano centres, the rift system, numerous geological faults and hot water springs, are an indication of the possible occurrence of sub-surface steam or hot water reservoirs that may be used for the generation of power: The Olkaria geothermal development in the Kenyan part of the rift system has increased the possibility of this occurrence in areas of Tanzania adjacent to it.

78. Geothermal sources are expensive to develop. The capital expenditure on initial investment is high and the mineral content of the hot water and steam is such that pollution can be a serious problem.

79. With the large potential of hydropower, coal and natural gas, lesser priority will be accorded to the development of geothermal resources in the immediate future except where exploitation of geothermal is the least cost alternative to providing electricity to a location. Studies to assess the magnitude of this resource will however, be undertaken.

### **Coal**

80. Tanzania has proven coal reserves of 304 million tonnes and inferred reserves of about 1,200 million tonnes. The use of coal as a substitute fuel in industries such as the Southern Paper Mills and Mbeya Cement Factory, power generation, agriculture and households will be promoted and increased through:

- i) investment to provide an efficient coal transport and distribution system;
- ii) investment in the expansion of coal mining;
- iii) investments in industrial and agricultural coal-using facilities and conversion of some existing facilities to using coal;
- iv) acquisition of skills in coal usage, including development and popularisation of suitable coal stoves;
- v) investment in mine-mouth power plants; and

- vi) investment in the improvement of the quality of coal.

## **ENERGY END-USE SECTORS**

### **Agriculture**

81. The Government, through the Agricultural Policy of Tanzania, emphasizes increased output and efficiency of agricultural production at village level. This increase in production can be achieved either through an increase in the area under cultivation or through an increase in productivity per hectare. Both of these measures can be effected through an increase in both direct and embodied energy inputs into the agricultural system.

82. Timely delivery and efficient use of energy inputs into agriculture will have positive effects in crop production. The energy policy goal in respect to this endeavour will be to ensure that energy inputs are available in enough quantities and at appropriate times for use in farming and transport activities; it being understood that the sector will endeavour to minimize the quantity of energy input for a given quantity of crop produced or maximize the amounts of crops produced for a given energy input.

83. An increase in direct energy inputs into village level agricultural production will require the use of tractors and/or animal-drawn implements for farming and village-level transport and the use of small scale, human or draught-animal-powered technologies for village-level crop processing. Where feasible, such small scale technologies will also be powered using renewable resources such as micro-hydropower plants, wind or solar energy sources.

84. Tanzania has an irrigable land of about 990,000 hectares but only 13.5% of this area is presently under irrigation. The National Food Self-sufficiency (NFS) programme envisages an average annual growth rate of irrigated land of 9.3%. Energy policy goals with respect to this endeavour will be to ensure that energy inputs in enough quantities at least cost are available to support irrigation. Attention will also be put to the availability of energy inputs to small holder irrigation schemes.

85. Village-level crop processing is also a major user of energy (mainly biomass energy) and the energy end-use efficiency in crop drying will be increased in order to arrest local deforestation. Improved efficiency barns for curing tobacco, drying tea and smoking fish will be introduced to reduce the woodfuel used in crop processing. Research and development on the use of solar crop driers and coal based driers will also be given emphasis.

### **Industry**

86. In the industry sector, a major policy objective on energy end-uses is the progressive reduction of dependence on imported energy through the use of demand management to reduce the negative effects of continued dependence on imported petroleum products.

87. Activities in energy auditing in industries and in industrial energy conservation were started in Tanzania in 1982 by TIRDO when energy audits were done on 16 industries most of which were based in Dar es Salaam. Only major losses were dealt with and recommendations were made on ways in which losses could be reduced with emphasis being placed on the most cost effective solutions requiring the minimum foreign currency expenditure.

88. The activities in energy auditing and in providing expert consultancy services to industry on industrial energy conservation will be expanded and consolidated. Since experience indicates that boilers and steam systems are a predominant source of potential energy savings in industry and since most of these savings can be effected through simple housekeeping measures, statutory regulations to ensure implementation of recommended measures will be considered. Duties and tax incentives will be provided with respect to equipment purchased for implementation of energy conservation measures.

89. Industry energy audits will be made mandatory in order for the country to identify and benefit from the potential for energy savings.

### **Household**

90. About 85 percent of the population of Tanzania can be classified as rural, living in about 8,700 villages. The major energy end-uses in the household sector are cooking, heating, and lighting.

91. Fuelwood, agricultural residues and, to a much lesser extent, charcoal are virtually the only fuels used to meet the energy needs for cooking, heating and lighting in rural areas. Fuelwood and charcoal consumption represented 92.0 percent of total final energy consumption in Tanzania in 1989 of which about 80.0 percent was used for domestic cooking and heating. Commercial fuels including kerosene, electricity and Liquefied Petroleum Gas (LPG) accounted for about 1.0 percent of domestic energy requirements.

92. Rural and urban households in Tanzania consume the largest share of final energy. Since most of the energy consumed by households is fuelwood and charcoal, deliberate efforts will be taken to manage the demand for these fuels. Villages will be encouraged to establish homestead woodlots.

93. The current programme for introducing efficient woodfuel conversion and utilization technologies will be greatly expanded. The implementation of the programme will have to rely on the various Government and non-Government Institutions including the involvement of small fabrication workshops in the informal sector with the Ministry responsible for energy providing advisory support and a coordination function.

94. Where appropriate, house designs exploiting solar energy for both space and/or water heating will be developed and where feasible these designs will be adopted for dissemination.

95. Expansion of the electricity distribution systems and the manufacture and dissemination of simple and cheap electric cookers will be effected in order to enable households to substitute electricity for fuelwood and charcoal.

96. The abundant coal resource available in the southern regions of Tanzania can also be exploited as a long term substitute for fuelwood and charcoal. Coal usage as a household fuel can only succeed, however, if the coal distribution system is improved, stoves and pots suitable for coal usage are made available to consumers and the level of awareness of coal usage in the households, including safety, is raised.

97. Households in areas with adequate numbers of livestock can use biogas as an energy resource for cooking, heating, refrigeration and lighting. The exploitation of biogas as an energy source will require the formation of biogas plant construction teams and the design, fabrication and dissemination of biogas end-use devices.

98. Households and Institutions with adequate organic feed material would be urged to use biogas as fuel for cooking, lighting, refrigeration and powering stationary engines such as water pumps and grain mills

where it is considered socio-economically viable. In this respect increased biogas energy utilization will require the strengthening of the existing and the formation of new and more appropriate biogas promotion public and private institutions. Efforts aimed at lowering the current high costs of biogas units and increasing skilled construction personnel will be made.

99. The efforts by CAMARTEC and other institutions and individuals in biogas construction will be encouraged and expanded. The CAMARTEC biogas unit design will be evolved into a standardised design at national level for units of that size.

### **Transport**

100. The transport sector accounts for almost 50 percent of petroleum consumption in the country. The foreign exchange implications of this are enormous, with the sector accounting for a substantial amount of free external earnings. On the other hand, for petroleum products to be used, they must be delivered to the point of end-use. Timely delivery of petroleum depends on a reliable transportation system. The transport and energy sectors are therefore very closely interlinked.

101. The large share of the transport sector on the country's petroleum requirement is such that even minor reductions in consumption by this sector can lead to significant savings in the foreign exchange costs involved in petroleum imports. How petroleum products are used in this sector, efficiently or otherwise, is therefore an important consideration in any energy strategy.

102. In the case of motor vehicles, energy use is directly related to the capacity of the engine, the efficiency of petroleum consumption of the engine, driving habits, age of motor vehicles, road conditions, and traffic congestion, among others. For a country which does not manufacture motor vehicles, it may not be easy to specify the engine standards on fuel efficiency. However, an import duty arrangement which penalizes fuel guzzler vehicles can serve the same purpose. The present system where the import duty increases progressively with the engine capacity is beneficial because it inherently discourages imports of large capacity engine vehicles. On the other hand, import duty on vehicles decreases with an increase in the age of vehicles. This encourages import of old second hand vehicles, a measure which leads to more demand on petroleum because the efficiency of an engine decreases with age.

103. Driving habits of many motorists leave a lot to be desired. Motorists are conscious of only the pump prices of petroleum products. They are not conscious of the fact that the way vehicles are handled on the road and how regularly they are serviced has a bearing on the vehicle's consumption of petroleum. Proper and regular engine tuning, including change of spark plugs, cleaning of the carburetor system, change of tyres and so on, do improve the efficiency of use of petroleum.

104. The transport system of a country has a great bearing on the consumption of petroleum. Energy-wise, the railway and marine modes of transport are by far more efficient means than road transport especially for long distance transportation. Ideally therefore lorries and passenger vehicles should be used for short distances preferably as feeders to the railway and ocean-going vehicles and intra-city transport. Beyond a break-even distance, usually 300 km, lorries are less efficient than either the railway or marine modes.

105. Road conditions are a determinant of vehicle energy use. Rough and pot-hole-filled roads necessitate frequent braking and acceleration. This causes wasteful use of energy in petrol and diesel powered vehicles compared with coasting on smooth, well-surfaced roads.

106. The foregoing, therefore, necessitate a strategy based on the following considerations:-

- i) endeavours will be made to ensure import of more energy efficient vehicles. Energy efficiency will be made one of the consideration in issuance of import licenses for new vehicles;
- ii) as for second hand vehicles imported, a penalty will be paid for import of old vehicles and this penalty shall increase with the age of the vehicle;
- iii) motor manufacturing firms will be encouraged to embark on local manufacture of standardized commonly used spare parts for regular maintenance of motor vehicles in order to ensure their availability at low cost;
- iv) regular efficiency, safety and road worthiness inspection will be made on all vehicles and will be a condition for renewal of road licenses;
- v) whenever possible use will be made of the railway system and ships for long-distance haulage as these are energy efficient modes of transportation; and
- vi) loss of energy and its direct translation to loss of foreign exchange due to bad road conditions will be a an important consideration in the requirement for maintenance and repair of roads.

107. Various modes for urban transport will be looked into including railway transport in urban centers. The possibility of using electric trams will be considered. Deliberate efforts will be made to shift emphasis from private to mass transport in urban areas. To supplement urban and rural transportation the production and use of bicycles will be expanded. Urban planning will have to take into account the above and other energy related aspects.

## **CRITICAL FACTORS IN POLICY IMPLEMENTATION**

108. Strategies adopted in order to realize the National Energy Policy objectives have been discussed. In all efforts to satisfy demand by developing, procuring and utilizing available energy resources, technology, pricing and the preservation of the environment play a critical role in determining the outcome of these efforts. In addition, the ability to monitor and assess the effectiveness or otherwise of policies and their implementation strategies is essential if the strategies are to be revised so as to remain effective in a continually changing environment.

109. These considerations point to the necessity for establishing appropriate instruments for policy implementation. Therefore such issues of technology, pricing, preservation of the environment, information systems and international cooperation will be given special attention in the national energy development.

### **Technology**

110. One of the main objectives of the National Science and Technology Policy is reduction of technological dependency. The Government will aim at making Tanzania self-reliant and self sufficient in energy technologies.

111. Tanzania has a long history of using energy technologies. The first public supply of electricity in Tanzania was, for example, established by the Germans in Dar es Salaam in 1908 whereas exploration for oil started in the coastal areas in 1952. The country will therefore harness the accumulated experience in order to develop indigenous capabilities in the local manufacture of most of these technologies. The goal will therefore be to meet an increasing share of technological needs of these sectors from local manufacturers.

112. There are three main types of energy technologies: end-use technologies, transformation technologies and transmission or transportation technologies:-

- i) energy end-use technologies embrace devices such as electric motors, cookstoves, air-conditioners, internal combustion engines, electric heaters, furnaces and refrigerators;
- ii) transformation technologies of interest to Tanzania involve electricity generation, charcoal production, biomass gasification, refinery operations, windmills, solar thermal energy systems and photovoltaic systems;and
- iii) transmission technologies available in Tanzania include electricity transmission and distribution networks and the distribution networks for petroleum products, fuelwood and charcoal.

113. The overall policy objective will be to make Tanzania self-reliant in energy technologies. In this regard, deliberate steps will be taken to develop:

- i) local manufacturing capabilities of whole technologies or of parts and components of certain key technologies;
- ii) local research and development capabilities to spearhead the development of indigenous energy technologies;
- iii) capabilities for carrying out consultancy and services activities in energy technologies; and
- iv) manpower training in energy technologies.

114. To give effect to the general policy objective above, each of the major energy parastatal organisations (TANESCO, TPDC, STAMICO etc.) will be required to draw up short term, medium term and long term energy technology development programmes whose objective will be the building up of relevant in-house and national capabilities in local manufacturing, carrying out research and development, carrying out consultancy services and manpower training. The energy parastatals will be encouraged to initiate plans and participate in joint venture basis in the manufacture of components of the relevant technology.

115. Each parastatal will also be required to work closely with the National Centre for the Development and Transfer of Technology and with the Ministry responsible for science and technology to ensure that the objectives of the Tanzania Commission for Science and Technology Act of 1986 relating to the transfer, adaptation and development of technology are achieved in the areas of responsibility of the energy parastatal.

116. Besides the general policy objective there will be specific objectives for each type of energy technology. On end-use energy technologies the objective will be to expand and diversify present local manufacturing of end-use devices and to carry out research and development on the local production of more energy

efficient end-use devices.

117. On transformation technologies the objective will be to initiate local manufacture of parts and components of such technologies, to build up indigenous capabilities for the local design and construction of micro and mini-hydropower plants, to improve the energy efficiency of transformation technologies and to build up local capacity to plan for the expansion of the electricity generation system and the servicing and improvement of petroleum refining operations.

118. On transmission technologies the objective will be the building up of local capacity for manufacture of parts and components of transmission equipment and improving the energy efficiency of transmission and transportation networks and build up in-house capacities to plan, design and implement transmission/transportation projects.

119. Specifically, with 50 years of experience in electricity generation, transmission and distribution, TANESCO will endeavour to plan, develop, and implement a hydropower scheme using own personnel, starting initially with a mini-hydro scheme. In this regard domestic capabilities for engineering and construction of small hydro systems based on extensive use of local materials will be harnessed. A domestic manufacturing capability for small hydro-turbines and related components of a simple, robust and easily maintained design will be established at least in the next ten years.

120. For the petroleum sector research and development will be focused in addressing the concern of the industry in the areas of distribution and end-use. In particular TPDC will be required to come up with designs of kerosine burners for use in rural and urban areas for cooking and lighting. In addition TPDC will develop a standardised pump for use in the country at service stations, and efficient burners for LPG. TPDC shall also develop lubricant additives from locally available resources.

121. Technological research, development and demonstration projects are expensive in both local and foreign currency and require highly trained manpower with first class information storage and retrieval systems, libraries, laboratories and workshops. The successful development of many areas of technology will necessarily require creation of successful energy research and development (R&D) capacity and the creation or promotion of mutually beneficial regional institutions for the development of energy technologies.

## **Pricing**

122. Energy pricing is an important aspect of any energy policy and is also an effective tool in the implementation of that policy. An important consideration in the exploitation of an energy resource, and its use, is that energy must be delivered to the point of end-use and be made available at a cost that is affordable to the consumer. A prohibitive price easily leads to substitution with other sources, or to termination by the consumer of an activity, rendering costly investment in the exploitation of the resource uneconomic. Likewise, a price that is too low means a subsidy to consumers. If this is effected by a utility, it renders future investments in the sector unattractive and makes recovery of investment costs and sustenance of its services equally difficult.

123. Stability of energy prices is another important policy consideration. Energy price fluctuations will be kept minimal, especially in cases where such fluctuations are not a result of external factors such as sudden oil price rises at international markets or changes in the relative values of currencies relevant to the determination of prices of energy. Stability of energy prices is a contributory factor to stability of prices in general and to planned development.

124. In the light of the aforesaid, therefore energy pricing will not simply be left to the market forces. In addition energy pricing will also be used as a tool to effect conservation, environmental protection and as a means of encouraging exploitation and use of indigenous resources.

125. The above considerations are relevant to what are referred to as commercially traded fuels: petroleum and electricity. Biomass energy prices depend, on the other hand, essentially on the supply and demand environment. Charcoal and fuelwood prices in towns generally fluctuate with availability or otherwise of these resources. A general observation is that prices in towns will generally increase in time, it being an indication of the dwindling supply in the locality and the consequently increasing transport costs. It has to be accepted that for a long time to come biomass prices will not be determined through intervention.

126. The public electric power system consists of an interconnected grid and isolated power systems. The interconnected system provides for the bulk of the revenues from electricity sales. Yet the distribution of arable land in the country is such that the more agriculturally productive areas have the least grid coverage. More important, these are the areas which by and large provide the bulk of export earnings that are used for the retirement of loans that have made possible the establishment of the interconnected system. A justification therefore does not exist for the removal of geographically uniform pricing, whatever the theoretical rationale. Electricity tariffs will therefore continue to be pan-territorial.

127. Electricity pricing will be based on long-run marginal cost pricing modified by such considerations as equity and social and developmental considerations. Pricing will reflect the need for the sector to contribute significantly to its own future development, including a contribution to rural electrification, development of its own internal capacity for research, development and production of essential requirements.

128. Electricity is an important service and a necessary resource for economic development. While it is essential to price electricity at an economic value, cross-subsidisation, as a deliberate tool to effect social equity, and growth objectives is normal in utility pricing. Pricing will be used to stimulate or moderate energy use in a particular consumer category. For example, it will be essential to keep domestic tariffs, especially for low income earners, at a reasonable minimum, so as to extend the benefits of electricity to a wider section of the society, taking into account the fact that only a small percentage of the entire population has access to electricity. Likewise, and as a short term measure, subsidisation of the agricultural sector will be essential in efforts to revive agricultural production as part of ERP. A targeted approach to cross-subsidisation will therefore continue to be an important tool in stimulating economic development.

129. At present, the average price of petroleum products in the country reflects full financial cost recovery. It would not be in the interest of the country to subsidise consumption of petroleum products. Cross-subsidisation, however, has been and will continue to be used as a deliberate means of influencing patterns of demand for energy and stimulating production in different sectors of the economy.

130. So far cross-subsidisation has been geographic and product-wise. Officially, gasoline prices are supposed to be the same at all regional centres whereas prices for other products are the same at all depots in the country. In order to effect regional price parity, a transport equalisation fund has been established in order to cover the delivery costs of petroleum to the regional centres. Consumers outside regional centres pay the full cost of delivery of the products they receive.

131. Experience has shown that the transport equalisation fund is sometimes not adequate to fully cover the costs. Furthermore, in order to minimize the resultant losses, the oil marketing companies prefer to sell in Dar es Salaam some of the products destined inland. In order to attract transporters to deliver products



to the regions, therefore, regional authorities, in their capacities as Assistant Price Commissioners, have often added on to the uniform price, a mark-up that reflects delivery costs of the products.

132. Product-based cross-subsidisation is effected by depressing the prices of diesel, industrial diesel oil and sometimes fuel oil and kerosene and increasing the prices of premium and regular gasolines, and liquified petroleum gas (LPG). As a short term strategy, product-based subsidisation can be effective in terms of equity considerations in the case of kerosene prices and minimisation of transport costs in order to stimulate economic growth, in the case of long distance haulage, passenger transport and power production in isolated stations.

133. In the long term, however, product-based cross subsidies introduce a disequilibrium in the pattern of use and could be costly to the economy. For example, dual purpose kerosene (DPK) and diesel are both middle distillates and for many tasks they are essentially interchangeable. Pricing must therefore reflect this reality. On the other hand, pricing diesel significantly lower than gasolines introduces in the long term a shift in the pattern of vehicle importation towards more diesel powered ones, lowering the demand for gasolines and consequently the ability to effect cross-subsidisation. In addition, considerations have to be made of prices across the borders of the country. A much lower price of a product than that obtaining across the border is an incentive for cross-border traffic in the product. For a country like Tanzania which has borders with eight other countries, such traffic could be significant. Full cost recovery will, therefore continue to be the basis of petroleum products pricing.

134. Efforts will be made to minimise the negative effects of cross-subsidies in petroleum pricing in the short term aiming, at the removal of cross-subsidies in the medium and long term. Furthermore and in view of sizeable cash outlays arising out of small increments in price of products, pricing will also reflect the need for this subsector to invest in exploration, research and development, storage and transportation, and investment in other energy related activities such as rural electrification, energy conservation and the development of alternative sources of energy.

#### **Environment, Health and Safety issues**

135. The relationship between man and the environment in which he lives is one of interdependence. Man survives when the wider environment is conducive to his survival. Likewise destructive activities of man destroy the balance in the ecosystem leading to such effects as climatic changes, wind and water-based soil erosion, destruction of arable land, floods, siltation of dams, advancement of deserts and others. The fragile nature of the balance in the ecosystem cannot be overemphasised.

136. The interaction between energy and the environment is evident at all the stages of the energy "system", from exploration for energy resources, conversion of energy from one form to another, and finally the usage patterns of energy. Environmental impacts must be considered at each stage in the chain.

137. Exploration for new energy sources in our case is exploration for oil. The stage at which environmental considerations become paramount is the acquisition of seismic data. This is usually in virgin land, sometimes in game reserves, national parks and in lakes and off-shore. It requires clearance of vegetation for seismic lines over long distances on land. Acquisition of actual data requires the use of explosive materials such as dynamite. In the case of marine seismic data acquisition can lead to destruction of marine environment including marine life.

138. Exploration for oil and gas can at times lead to blowouts. The resulting fires can lead to loss of life, property and destruction of the environment. Blowouts can also happen in the course of exploitation of oil and gas. A case in point is the disaster of the blowout of Songo Songo well No. 4.

139. The immediate concern to the country now is the environmental impact in the exploitation of wood both for fuel, industrial purposes and clearance of forests for additions to farmland, and in some cases unsuitable farming methods. No comparative figures exist today for the degree to which each of the above mentioned reasons and others account for deforestation in the country. We will however concern ourselves here with energy-related exploitation of wood.

140. In the rural areas wood for fuel is acquired through collection of twigs, shrubs and deadwood. One cannot therefore apportion this practice as a major cause of loss of vegetation. In towns however, wood is commercialised. In this case traders buy wood from fellers. Vegetation in the hinterland of major towns has suffered as a consequence.

141. The worst offender in the case of exploitation of wood for fuels is the practice of charcoal making. The commonly used earthmound kilns on average require 12 tonnes of wood in order to produce 1 tonne of charcoal. For ease of storage and transportation, charcoal is the preferred alternative to fuelwood of most low and middle income households in the country. The impact on the woodland surrounding towns and municipalities is visible.

142. Another slow and destructive effect of exploitation of wood as an energy source is in crop-drying. For example, it requires 130 cubic metres of wood to cure every tonne of tobacco. A total production of 11,554 tonnes in 1989, therefore, required a total of 1.5 million cubic metres of wood. A total of 17,000 hectares of natural woodland had to be cleared for that season alone. In order to reduce this destruction, therefore, commercial tobacco farms will be required to plant trees and use more efficient barns.

143. Tanzania is well endowed with hydropower potential. Much of this potential, however, cannot be taken for granted. It will remain a potential as long as deliberate measures are not taken to protect the sources of the river's water-sheds. Almost all the potential is in the Wider Rufiji Basin covering Ruvuma, Iringa, Mbeya, Morogoro, Dodoma, and Coast regions.

144. The exploitation of hydroelectric power requires construction of dams to create reservoir lakes. Lakes take up arable land. The immediate areas to reservoirs have to be protected to minimise siltation. Lakes create changes in the micro-climate. Flora and fauna are likewise affected. The interaction between the energy planner and the environmentalist is therefore essential in planning for hydropower exploitation.

145. In the case of petroleum where a discovery is onshore and far from an export terminal or a refinery, product transportation will invariably be by pipeline, with possibilities of major leaks which could lead to fires and pollution. Where crude oil is imported, leaks of oil from tankers are a real possibility. This could lead to destruction of marine and other life including fish, plants and birds, as well as pollution of beaches.

146. Carbon dioxide emission to the atmosphere world-wide has led to the green-house effect. In addition the use of chlorofluorocarbon causes partial destruction of the ozone layer, and the consequent green-house effect. Forest and bush fire prevention will assist in minimizing carbon dioxide emission.

147. The production of electricity is being considered in the development of the Kabulo and Mchuchuma Coalfields. It is essential to remind ourselves of possible environmental consequences of the conversion of coal to electricity. Sulphur emission into the atmosphere could lead to acid rain, with consequent destruction

of forests and agricultural land. The experiences of Canada, the USA, the Scandinavian countries, and the United Kingdom are all pertinent here.

148. In order for the energy sector to contribute to the preservation of the environment the following measures will be taken:-

- i) laws and regulations relating to the protection of hydropower sources will be reviewed and strengthened . Where necessary, new laws will be enacted.
- ii) laws and regulations regarding the protection of existing reservoirs for hydropower will be reviewed and strengthened;
- iii) environmental impact assessment will be undertaken before the exploitation of new energy resources;
- iv) oil and gas pipeline regulations will be drafted and will include provisions relating to environmental impacts of oil/gas pipeline transport;
- v) efforts will be made to substitute other sources such as electricity and coal for woodfuel for tobacco curing and tea drying;
- vi) tobacco curing and tea drying will be encouraged to initiate woodlots for wood production;
- vii) the design and production of more efficient tobacco curing barns will be encouraged and supported;
- viii) afforestation and reforestation campaigns will be continued and will include, among other efforts, a public awareness campaign and the proclamation of a national tree planting and national environmental awareness days;
- ix) environmental considerations will feature in the planning and design of coal fired electric power stations including use of modern pollution control equipment;
- x) environmental experts will be consulted in oil exploration and production activities;
- xi) forest and bush fire prevention measures will be reinforced;
- xii) safety, security fire prevention and fire fighting measures in all the energy subsectors will be reviewed and strengthened.
- xiii) green house gas emissions (carbon dioxide, methane and nitrous oxide) from industry and transport sectors will be monitored.

149. There is a clear linkage between energy production, transmission transportation and utilization activities, and the health of energy personnel and end users. Negative aspects of this linkage result from the health hazards associated with handling of some of the primary energy sources and associated activities such as coal and gas production and handling such secondary sources as oil products improper handling of raw material for production of biogas can also be a health risk. Coal, charcoal and wood fuels can also be risky to the health of end-users. Efforts will be made to research into, monitor and minimise where possible negative

health effects associated with energy production, transmission/transportation and utilisation.

150. Safety is a very important consideration in the petroleum industry mainly because of the inflammable nature of petroleum fuels. Safety of petroleum installations must be assured. Existing standards and regulations on safety of installations, handling of products and of personnel will be reviewed and strengthened.

151. Construction of electricity facilities, their repair and maintenance involve dangerous activities. Transmission and distribution lines carry high voltages which are dangerous. Safe working procedures will be adhered to in order to avoid loss of human life.

152. Machinery and household appliances which use electricity, petroleum products and gas could be dangerous if not used or handled properly. The Government will review laws and regulations related to the use of these items. On the other hand, end-users will be educated on safe ways of handling machines and appliances.

### **Women and Energy Development**

153. More than 80% of the country's population is in rural areas where sixty per cent of the economically active population comprises of women. Energy is critical for meeting basic needs, production of food and generation of income. The most important uses of energy are fuel for cooking, food processing and small scale industries such as ceramics, pottery, brewing etc. Wood and other biomass fuel comprise about ninety per cent (90%) of the national energy balance and as much as ninety per cent (90%) of this fuel is consumed in households. A discussion on energy use in households and rural industries is a discussion on women and development.

154. As a result of the indiscriminate use of biomass energy resources, majority of the rural population are now facing a growing shortage of fuel. This shortage is leading into an increasing burden on the part of women who are responsible for gathering and use of fuel in addition to their productive and reproductive tasks.

155. The development of efficient biomass conversion and utilization technologies will be promoted for use in rural and urban areas with a focus on the improvement of the women's welfare. Devices which will save on labour, time and improve the environment will be encouraged so as to reduce the drudgery in women's work.

156. Efforts will be initiated to train women with the help of training aids such as solar powered devices in areas without electricity. The programme will involve energy conservation, nutrition, hygiene and family planning. Where electricity is available in the rural areas, deliberate efforts will be made to disseminate and popularise simple electric stoves and other electric appliances for income generation and social welfare improvement.

157. It is recognized that there is a gender imbalance in the workforce in the energy sector. In order to redress this situation deliberate efforts will be made in the following areas:

- i) to employ more women in the energy sector;
- ii) to ensure that the career development of women employees is emphasised;

- iii) to encourage women to enter into energy related consultancy; and
- iv) to encourage young women to pursue studies which will lead to future careers in the sector.

### **Energy Information Systems**

158. Development of suitable energy strategies depends to a large extent on information. Energy information arises from or pertains to the production, conversion, flow, storage, and uses of energy. It also encompasses the technology management and other activities that are necessary for the production and use of energy to produce goods and services needed by society. It is upon energy information circulation that optimum use of energy and its application to development, will depend.

159. Energy supply information, especially in the commercial sector, is fairly easy to obtain. Activities related to this are usually documented by utilities. Widening of the scope of energy analysis to include energy end-use broadens the perspective of energy information. In particular, information regarding detailed patterns of use of biomass derived fuels is scant.

160. Transportation accounts for 50 percent of commercial energy use. While it is easy to obtain records of amounts imported, refined and transported, not much information is kept on the end-uses in this sector.

161. In the case of the industry sector, likewise, it will be essential to document the level and distribution of industrial energy use by carrier and economic activity. As for the non-commercial sector, it will be essential to obtain and quantify information pertaining to the entire ecosystem in the chain of use on top of information on production and sales.

162. Identification of the broad areas of energy information requirements is one aspect of energy information. Equally important is matching specific energy information requirements to information user needs. User categories include, among others, decision and policy-makers, planners, researchers, educators, students, field workers, and the general public.

163. In order to attain the above objectives therefore, resources will be provided in order to enable the creation of a national numerical and non-numerical information system and service related to energy. Effective linkages will be established among the Ministry responsible for energy, the energy parastatal organisations and other relevant internally and externally based organisations. This endeavour will require establishment of standardised technical procedures in the acquisition, consideration and processing of the information. Deliberate efforts will be made to increase the understanding of energy usage patterns and the acquisition of the related information for policy and planning purposes.

### **Institutional Framework**

164. The policies and strategies spelt out above require a review of the institutions related to energy development. While by and large the present set up is adequate to initiate the implementation of new plans based on this policy review, and implementation of on-going plans, a change in perception on part of some institutions will be necessary. In a few cases a restructuring of existing institutions or creation of new ones will be a necessary part of the energy development process. Presented below are organisational arrangements required for the implementation of ongoing plans that will be evolved from strategies and policies.

## **Policy and Planning**

165. The Ministry responsible for energy will continue to be the Government institution responsible for overseeing and guiding the development of the energy sector in order to meet the goals of energy development. In order to discharge this responsibility, the Ministry's task will be to evolve policy initiatives on the sector. This will require assessment and analysis of developments in all sub-sectors of the energy sector.

166. It will be the task of the Ministry to coordinate energy related activities and advise and give general and specific directions on appropriate actions to be taken so as to promote the development of the sector. The Department of Energy will therefore need to develop the requisite capabilities in the technical, economic, financial, social, and legal aspects in order to effectively promote the Government's sectoral development goals. To facilitate these endeavours, the Department of Energy will devise a viable and efficient system for the collection, storage, and retrieval of information on all aspects of energy.

167. The energy sector's function is merely to provide a service to all other sectors. Institutional links with other sectors in so far as policy-decision making is concerned are essential for the promotion of the energy sector goals. In the programme-based approach to development planning, the projects and activities of the energy sector will, of necessity, be linked with developments in the recipient sectors. In this connection the Ministry will need to liaise and cooperate with many other governmental departments and institutions under other Ministries.

168. The Ministry has to date evolved a good working relationship with the Ministry responsible for natural resources. The Department of Energy works closely with the Department of Forestry in biomass energy development. In order to avoid duplication in this area, while the two Ministries/departments will cooperate and liaise in all aspects of biomass energy, the Ministry responsible for energy will concentrate on the conversion and end-uses of biomass while the Ministry responsible for natural resources will continue with its leading and traditional role on the development of the biomass supply base.

## **Electricity Development**

169. Electricity development embraces the development of production, transmission, distribution, and end-use infrastructure. The development of institutions to perform this task requires an assessment of how effectively these institutions can perform the various tasks in the system from production to end-use.

170. Starting with the upstream of electricity development, while TANESCO is the major producer of electricity the Government has given a mandate to other organisations to exploit the hydropower resources and to install thermal-based generation. In all cases the Ministry responsible for Energy regulates the development through the powers vested in it by the Electricity Ordinance. In the case of the Rufiji Basin, the Rufiji Basin Development Authority has a mandate to develop the hydropower potential of the Basin. The potential in the Basin accounts for over 95 percent of the potential hydropower sources in the country. In respect of power production, therefore, the question is not whether or not TANESCO has a statutory monopoly to develop major hydropower or thermal based schemes, but whether or not the goals of the energy policy on electricity development can be achieved by the virtual monopoly of TANESCO or through the separation of the generation function from the transmission and distribution of electricity. There will be an electricity board for power policy and planning and below it there will be two separate organisations one responsible for generation and transmission and the other responsible for distribution and customer services.

171. Where TANESCO has not established a public power supply system private electricity generation and distribution will be encouraged. The tariffs applicable to such schemes will be reviewed by the government. TANESCO will be required to purchase excess electricity from private power supplies and co-generation at mutually agreed prices.

172. Expansion of the transmission network will be TANESCO's focus in the near and medium term. However the costly investment in the grid system can only be beneficial if a larger percentage of the population has access to electricity. Expansion of the distribution networks will be an important aspect of institutional reorganisation of the company. Furthermore, in order to reach a larger part of the population, TANESCO will be required to develop stronger supplier-customer relationships than is existing now. TANESCO will be required to develop customer advisory services to reach out to the consumer and follow on the customer end-use patterns including appliances used and their development and offer expanded end-use advisory services.

173. Whereas the population in the country is mainly concentrated in rural areas, the bulk of the power generated in the country is distributed in urban centres. In order to promote economic activities and employment opportunities in the rural areas, a rural electrification programme was initiated in 1966. The policy recommendation on the establishment of a Rural Electrification Fund and the restructuring of the power sector will be adequate to accelerate implementation of rural electrification.

174. Following the above observations, the Electricity Ordinance of 1957 (Cap 131) will be amended so as to accommodate the policy objectives and proposals.

#### **Petroleum Development-**

175. TPDC was established by the Government as a national petroleum enterprise to be its implementing arm of the policies covering all aspects of the petroleum industry from exploration and production through distribution. The objectives of the Petroleum Corporation, as spelt out in the Tanzania Petroleum Development Corporation (Establishment) Order, 1969 include, among others:

- i) the development of an adequate industrial base for the petroleum industry;
- ii) exploration and production of petroleum; and
- iii) carrying out standard activities of an oil company including procurement of supplies, refining, distribution and storage facilities.

176. Marketing activities which include procurement of supplies, monitoring and overseeing distribution of oil product will continue to be the predominant activity of TPDC, at least until an oil discovery is made. The marketing directorate of TPDC will be further strengthened. In addition because of the large number of contracts including sales and purchase agreements entered into by TPDC, the legal department/unit will be strengthened.

177. To date no oil has been discovered. However, recoverable gas in commercial quantities has been discovered. Preparations for domestic utilization of gas will require more emphasis on training in order to acquire skills in gas production, transport and utilization. The prospective nature of our sedimentary basins is such that exploration for oil will continue and the need is still there for skill acquisition and training in exploration.

178. TPDC is in the downstream activities indirectly through BP and AGIP. TPDC, however, has a mandate to enter directly into marketing. TPDC will be encouraged to enter into downstream activities directly and to expand its oil distribution fleet into a fully fledged oil distribution network.

179. The development of an adequate industrial base in the petroleum sub-sector will require, among other things, involvement in research and development. The directorate responsible for research and development will therefore be strengthened.

180. A separate company GASCO has been nominally established to deal with natural gas. In view of the need to develop the gas resource this resource company will be made fully operational.

#### **New and Renewable Energy Development**

181. The decentralised nature of new and renewable energy sources is such that their development depends on initiatives and efforts of the communities in their neighbourhood. Non-Governmental Organisations (NGO's) especially, have been particularly active in this regard. Schools, youth camps, hotels and other such places with concentrations of people are ideal for the development of community renewable energy development schemes. NGO's will be encouraged and assisted in their efforts to initiate and implement decentralised energy projects. They will also be encouraged to form a national association of NGO's involved in energy so as to exchange information, experience and skilled personnel.

#### **Consumer Protection**

182. The Minister responsible for energy will appoint an independent consumer protection committee to deal with consumer complaints in respect of services provided to them by energy service institutions.

#### **Human Resource Development**

183. The attainment of the National Energy Policy objectives will to a large extent depend on human resource development in the sector. There will be a need to have adequate skills in the various sub-sectors. Of importance will be the attainment of a good balance between and among skills. Adequate and attractive incentive schemes will be required in order to attract and retain qualified manpower. Training including continuing education at all levels and in the various institutions will be emphasised. Efforts will be made to introduce energy and environment related subjects in school curricula. Furthermore the mass media will be sensitised in order to provide education and information on energy and environment issues to the public. Efforts will be made to strengthen existing energy institutions and at an appropriate time endeavours will be made to make them multi-disciplinary in nature.

#### **International Cooperation**

184. Tanzania is a member of the United Nations (UN). It is also a member of the Organisation of African Unity (OAU) and the Commonwealth. In the sub-region, Tanzania is a member of the Frontline States, the Southern Africa Development Coordination Conference (SADCC), the Preferential Trade Area (PTA) and the Kagera Basin Development Organisation (KBO). Tanzania also recognises the long standing links with other East African States, Kenya and Uganda.



185. Within the UN system, Tanzania is an active member of such organisations as the United Nations Education, Scientific and Cultural Organisation (UNESCO), United Nations Industrial Development Organisation (UNIDO), United Nations Food and Agriculture Organisation (FAO) and the United Nations Economic Commission for Africa (ECA), among others. It is also a member of the Non-Aligned Movement, the African, Caribbean and Pacific (ACP) group and the Eastern and Southern African Mineral Resources Development Centre (ESAMRDC).

186. All the above organisations deal with energy in one way or another relating it to activities and programmes falling within their mandates. Tanzania will cooperate and work closely with the various agencies of the UN system and other multilateral and regional groupings in the evolution of strategies for the implementation of programmes relevant to development efforts. In particular, and taking into account its commitment to regional cooperation, Tanzania will continue to be active in the SADCC Energy Sector and PTA's Industry Sector of which the energy sub-sector forms a part.

187. Tanzania borders eight states. Some of Tanzania's energy resources are common to two or more states. Tanzania will encourage joint development of such resources as a way of fostering cooperation and collective self reliance in energy. Furthermore, Tanzania will continue to facilitate movement of supplies of energy, especially fuel, to land-locked neighbours. In case of electricity Tanzania will consider positively mutually beneficial power exchange mechanisms between it and other countries.

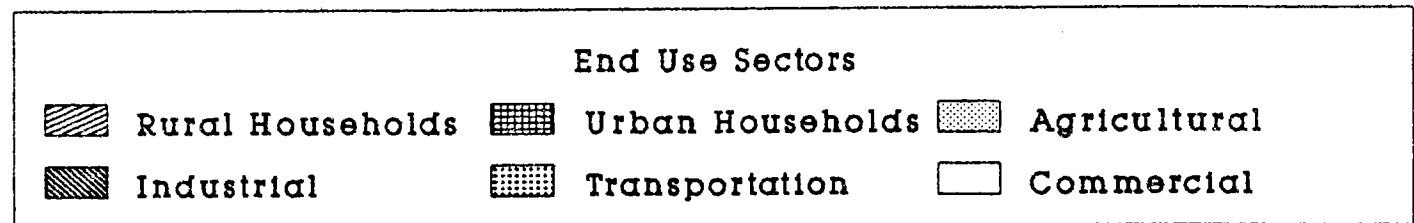
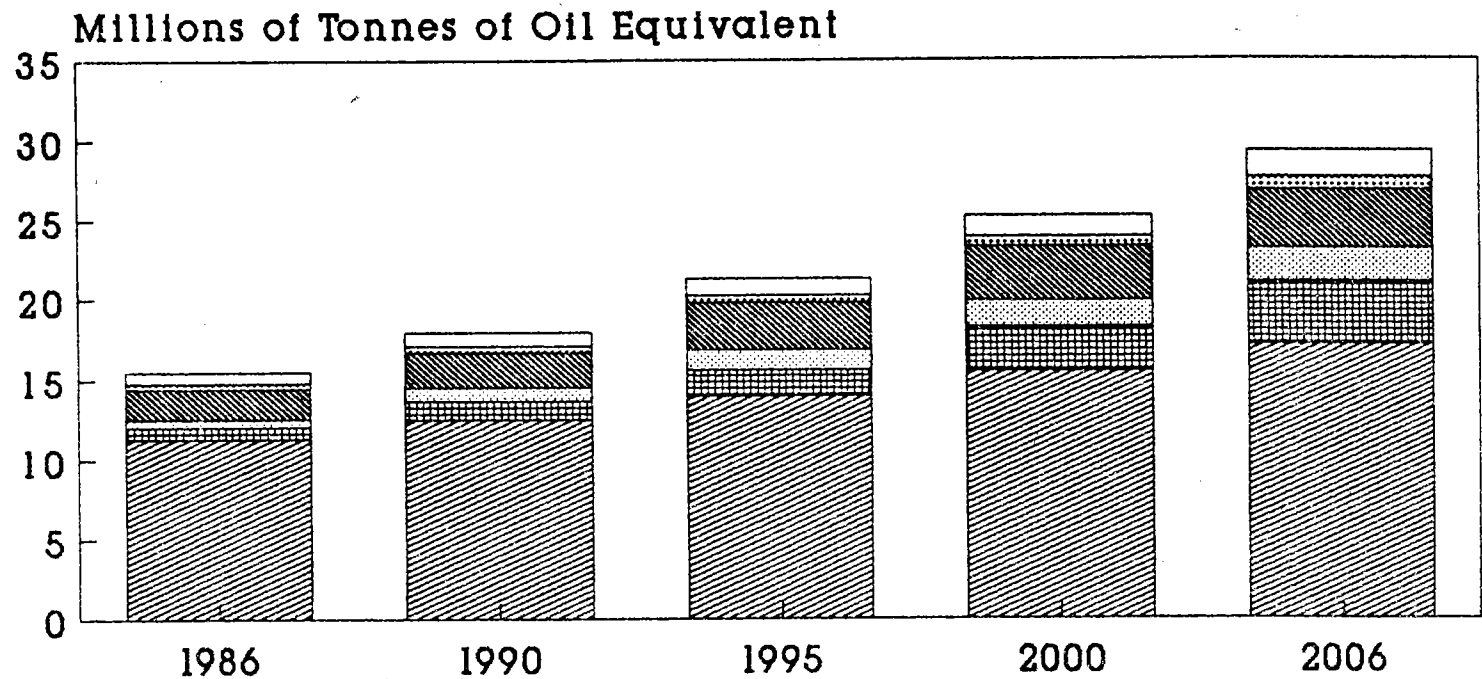
188. While the stress in the implementation of programmes in energy is on self-reliance, it is recognised that external assistance and participation will be needed. The participation of multilateral banking institutions such as the World Bank, the European Investment Bank and the African Development Bank will be sought, especially making use of their soft loan facilities. Bilateral assistance will be a significant factor in the development of the energy sector. Continuation of traditional assistance from such countries as Austria, Canada, China, Czechoslovakia, Democratic People's Republic of Korea, Denmark, Federal Republic of Germany, Finland, France, India, Ireland, Italy, Japan, Kuwait, Netherlands, Norway, Spain, Sweden, United Kingdom, Yugoslavia and others will be sought.

189. Tanzania is an observer in the African Solar Energy Centre based in Bujumbura, Burundi. Endeavours will be made to elevate the observer status to full membership. Tanzania will continue its membership and effective participation in the World Energy Conference.

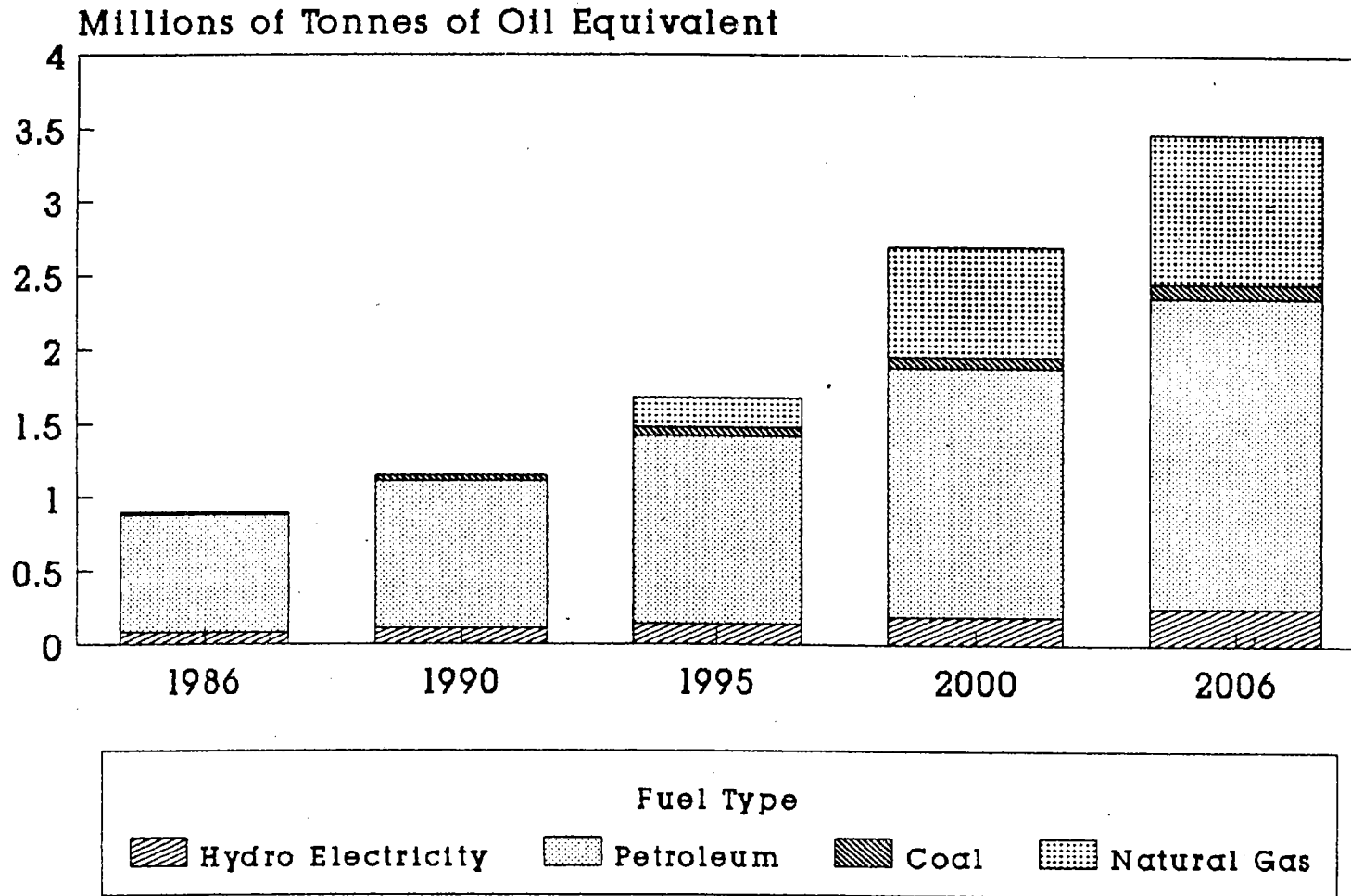
## **POLICY REVIEW**

190. The policy initiatives stipulated above and the associated programme will be subject to periodic reviews once in five years to coincide with preparations for the five-year national development plans.

# TANZANIA TOTAL ENERGY DEMAND



# TANZANIA COMMERCIAL ENERGY DEMAND



# TANZANIA NON-COMMERCIAL ENERGY DEMAND

