



GOVERNMENT OF THE
DEMOCRATIC
REPUBLIC OF ETHIOPIA



INTERNATIONAL ATOMIC
ENERGY AGENCY

COUNTRY

PROGRAMME FRAMEWORK

1999 - 2005

For the Government:

For the International Atomic Energy
Agency:

Signature

Signature

Name and Title

QIAN Jihui
Deputy Director General
Head of the Department of Technical Co-operation
Name and Title

Place and Date

Place and Date

Vienna, 1999.04.14



GOVERNMENT OF THE
DEMOCRATIC
REPUBLIC OF ETHIOPIA



INTERNATIONAL ATOMIC
ENERGY AGENCY

COUNTRY

PROGRAMME FRAMEWORK

1999 - 2005

On behalf of the Government:

Name and Signature

Date

**On behalf of the International Atomic Energy Agency:
Deputy Director General
Head, Department of Technical Co-operation**

Name and Signature

Date

TABLE OF CONTENTS

	<u>PAGE</u>
1. <u>INTRODUCTION</u>	1
2. <u>NATIONAL DEVELOPMENT PRIORITIES AND ACTIVITIES RELEVANT TO THE TECHNICAL CO-OPERATION PROGRAMME</u>	1
2.1 Livestock Development	2
2.2 Water and Energy Resources Development	3
2.2.1 Development and Management of Surface Water Resources	3
2.2.2 Development and Management of Groundwater Resources	4
2.2.3 Development and Management of Geothermal Energy Resources	4
2.3. Higher Education in Nuclear Sciences	5
3. <u>SUMMARY OF RELEVANT PAST TECHNICAL CO-OPERATION ACTIVITIES</u>	5
3.1 Crop and Livestock Development	6
3.2 Isotope Hydrological and Geothermal Studies	6
3.3 Human Health	7
3.4 Additional Technical Co-operation Activities Related to Major Development Objectives	7
4. <u>PROJECTED PROGRAMME OUTLINE</u>	8
4.1 The Near-Term Core Programme	8
4.1.1 Integrating SIT into the National Effort for Tsetse Eradication in the Southern Rift Valley	8
4.1.2 Isotope Hydrological and Geothermal Studies	9
4.2 The Medium-Term Core Programme	9
4.2.1 Tsetse Eradication in the Southern Rift Valley	9
4.2.2 Water and Energy Resources Development	10
4.2.3 Higher Education in Nuclear Sciences	10
4.2.4 Human Health	10
4.3 General Support Activities	11

ANNEXES

Annex 1 - New Approach to Technical Co-operation

Annex 2 - Country Situation and Relevant Development Needs

ACRONYMS AND PROJECT CODES

1. INTRODUCTION

A Country Programme Framework (CPF) serves two closely related functions regarding future programming of technical co-operation between the IAEA and a given Member State. First, the development of a CPF stimulates clear communication among all those directly involved regarding the development priorities of the country on the one hand, and the management priorities and resources limitations of the IAEA on the other. The objective is to reach an agreement on future programming which focuses the limited resources available through the IAEA's Technical Co-operation Programme on a few areas of development that are of high priority to the Government and where technology available through the Agency can make a significant contribution. Identification of these select areas provides opportunities for establishing high quality projects, referred to as Model Projects in the Agency's terminology.

The second function served by a CPF is to record the agreement that is reached as a reference for use in preparing programme requests by the Member State, and in appraising those requests and allocating resources by the Agency. The CPF is intended to be a *concise working document* that should be renegotiated if and when critical circumstances change rather than a rigid document locking either party into a plan which may no longer serve mutual needs.

The primary audiences for a CPF are those who are directly involved with the TC Programme in the Agency and in the particular Member State. At the same time, CPF also serves as a useful source of information for higher levels of management in the country and in the Agency. (*For further details on the CPF please refer to Annex I*).

2. NATIONAL DEVELOPMENT PRIORITIES AND ACTIVITIES RELEVANT TO THE TECHNICAL CO-OPERATION PROGRAMME

Ethiopia's long-term development strategy is known as Agriculture Development Led Industrialization (ADLI). The major features of this strategy, as well as the general development status of Ethiopia, are thoroughly reviewed in UNDP documents on the First Country Co-operation Framework (CCF) covering the period 1997-2000. The CCF was prepared by the Ministry of Economic Development and Co-operation (MEDaC). The basic approach taken through ADLI is to use productivity improvement in small holder agriculture, which is the dominant feature of the economy at present, as the economic basis for an increasing shift to industrialization and services. This provides a preliminary indication of two high-priority areas in which nuclear technologies can make the greatest contribution, namely, agriculture and increased water and energy supply that will be required for increased food production, industrialization and general development.

Specifically, the agriculture sector policy and strategy identify "improvement in the country's livestock resources" as one of several priority areas, and the even more specific need for "support to veterinary services and pest management" is identified. Similarly, the energy sector policy and strategy emphasize "the need for the expansion of geothermal energy". Another important topic which is vital to development in Ethiopia and to which the Agency has contributed is the judicious exploitation of water resources. The country is endeavoring to develop its water resources and isotopic techniques in hydrology can provide important information which cannot be obtained through more conventional means.

Consistent with government policy to promote science and technology in higher education, the teaching of nuclear sciences is receiving a great deal of attention at national level. Finally, the health sector is another area in which the TC Programme has contributed significantly and will have to continue to contribute. The health sector policy mainly stresses the need for improvement in primary and preventive health care measures, to which the diagnostic capabilities of a national network of nuclear medicine services are certainly relevant. Major government programmes to which the IAEA's programme can make direct contributions are underway in all of these areas. *(For further information, on the Country Situation and Relevant Development Needs please refer to Annex 2).*

2.1 Livestock Development

Ethiopia has an estimated cattle population of 30 million animals, which is the largest in Africa. Trypanosomiasis is regarded as the most hazardous of the animal diseases prevalent in Ethiopia both in terms of the direct effect on livestock and the indirect effect of preventing, or seriously limiting, the use of large areas (135,000 to 220,000 km²) of fertile land in the western and southwestern parts of the country. Approximately 10 million cattle and an equivalent number of other livestock are continuously at risk. The Government of Ethiopia is seriously engaged in several efforts to control and eradicate the vector for trypanosomiasis, the tsetse fly. With the assistance of several international organizations and donors, a few projects are underway in different parts of the country. These projects are based primarily on the use of targets, insecticide impregnated traps, pour-on and the SIT. Past experience with attempts at tsetse control by chemical methods has indicated that the long term costs of insecticides, targets, servicing of targets, personnel, etc., involved are very high. Moreover, it has not been possible so far to establish a sustainable tsetse control programme using these methods. The Government has, therefore, committed an estimated \$43.8 million from a combination of the national budget and contribution from bilateral and multi-lateral donors (including the IAEA) to a major new project in which suppression of the tsetse population by conventional means is followed by application of the Sterile Insect Technique (SIT). The goal of this project, is to transfer the SIT technology to Ethiopia, build national capability in the application of SIT, and eradicate tsetse flies from an area of approximately 25,000 sq. km in the Southern Rift Valley of Ethiopia over the next ten years. The project gets technical support from the IAEA which has unique technical expertise in SIT.

The SIT project is an Ethiopian project with full commitment from the Federal Government of Ethiopia. The Ethiopian Science and Technology Commission is the Governing body for the project at the national level. The project also has full support and commitment from the Southern Nations Nationalities and Peoples Regional Government which is the major counterpart to ESTC in the implementation of the project. A number of local and international research and academic institutions also provide technical backup to the project either through their participation in the project's Technical Advisory Group (TAG) or by directly involving themselves in its technical activities. The TAG of the project is chaired by the director of the Animal Resources Research Department of the Ethiopian Agricultural Research Organization, EARO. The Ethiopian Ministry of Agriculture and all Heads of the concerned Regional Agricultural Bureaus are members of the Project Steering Committee (PSC) which is the final policy decision making body of the project.

A second main thrust of livestock development efforts in Ethiopia in which the IAEA has been and will continue to be active, although on a less significant scale, is concerned with

efforts to eradicate the Rinderpest virus and other major animal diseases such as Foot and Mouth Disease and tick-borne diseases. Activities in this area are concentrated in three Ethiopian institutions. These are the Faculty of Veterinary Medicine of the Addis Ababa University in Debre Zeit, the National Veterinary Institute also in Debre Zeit, and the National Animal Health Research Centre, NAHRC, under EARO.

2.2 Water and Energy Resources Development

The critical role of water and energy resources in the sustenance and development of human societies cannot be over-emphasized. Water is a critical constraint not only to agricultural output, but also to health and nutrition. It is to be expected that the development of water resources will contribute towards improving food security, health and sanitation, and therefore, to the reduction of poverty in general. Ethiopia, a country of substantial water resources potential including a hydropower potential of over 160,000 GWh/yr, is one of the poorest countries in the world and a frequent victim of drought and famine. Therefore, one of the challenges to be met is to develop these resources so that they can sustainably support development initiatives in agriculture, industry, health, transport and general welfare of the people.

In order to strengthen the effort to develop, utilize and manage the water resources of the country, Ethiopia has established the Ministry of Water Resources at the Federal Level and Regional Water Resources Bureaus at the Regional States level. Both the country and UNDP have designated water resources development as an important area for intervention, and the Agency's expertise in isotope hydrology can be an important supplement to these efforts.

The Ministry of Mines and Energy, in the current Federal arrangement of governance, plays more of a regulatory and policy role with operational activities devolving to the level of the regions. (The same is true for the Federal Ministry of Water Resources (MoWR). But the MoWR has the additional responsibility of administering and managing trans-regional and trans-boundary rivers of the country.) The development of the power sector at the moment is the sole responsibility of the Ethiopian Electric Power Corporation (EEPCO) formerly known as the Ethiopian Electric Light and Power Authority (EELPA). Nonetheless, the new economic policy of the country encourages the participation of private investment in the power sector. The Ethiopian Institute of Geological Surveys (EIGS) which is under the Ministry of Mines and Energy is actively involved in the exploration and monitoring of the geothermal fields of the country. The EIGS in co-operation with EEPCO will continue to spearhead the development of geothermal energy in Ethiopia.

2.2.1 Development and Management of Surface Water Resources

Ethiopia has a rich water resource potential with an annual runoff of over 110 BM³, though much of it drains outside the country unutilized. Out of the nine major rivers, except for the Awash and the Omo, seven (Abbay (Blue Nile), Tekeze, Wabishebele, Baro, Genale, Angereb and Mereb) flow outside of the country.

The spatial and temporal availability and distribution of the water resources of the country vary very widely.

Spatially, the distribution decreases from west to east enormously. 82% of the surface water potential is generated by 4 basins located in the western part of the country representing only 40% of the total land area, while most of the remaining 60% of the land area of the country is under water stress or scarcity. The per-capita availability of water is about 2000 m³ which is clearly not very comfortable, for water stress and scarcity are defined as 1000-1700 m³ and less than 1000 m³ per capita respectively.

There is also great fluctuation in the volume of runoff during the year. In general, with the rain falling in a concentrated manner within 3 to 4 months of a year, a short period of high flows is followed by a period of very low flows. This undesirable pattern compounded by the rugged topography of the country, and the related problems of increased deforestation, erosion and sedimentation make water-shed management an important area of intervention.

Excluding the nine major saline lakes, like Lake Beseka, Ethiopia has 11 fresh water lakes and 4 storage dam reservoirs. Based on some earlier studies, the development potential of these lakes in fisheries, tourism and resort, inland water ways and irrigation is high. Nonetheless, detailed limnological study of Ethiopian lakes is at its infancy and is, therefore, an important target area for future work.

2.2.2 Development and Management of Groundwater Resources

Groundwater plays a versatile role in Ethiopia in that it is a major source of water supply for domestic uses, industries, livestock development, as well as for irrigation to a smaller extent. The geology of Ethiopia ensures the availability of useable groundwater in various parts of the country. Some rocks provide good transmission capacity of rainfall to recharge aquifers, produce springs and feed perennial stream flows. Although detailed assessment of the groundwater resource of the country is lacking, preliminary studies estimate Ethiopia's water resource at about 2.6BM³.

In Ethiopia annual rainfall varies from less than 100 mm along the border with Somalia and D'jibouti to over 2,400 mm in the South-west highlands, with a national average of about 700 mm/year.

In the vast arid-zone of Ethiopia groundwater is more available throughout the seasons than surface water. In these regions groundwater is by far the major source of water supplies, particularly in the dry season. In recent years groundwater has also become more important in urban water supply. Addis Ababa is soon going to get 35% of its water supply from groundwater sources when the Akaki Water Supply Project, based on integrated deep water wells from the Akaki plains, down-stream of the capital, is completed. Similarly, big cities like Dire-Dawa and Harar in the eastern part of the country and Mekelle in the north, are expected to get a significant portion of their water supply from groundwater sources. Cognisant of the capacity requirement imposed by this current shift towards enhanced exploitation of ground water resources, the Government has taken steps to create an Institute for Groundwater Management.

2.2.3 Development of Geothermal Energy Resources

Energy plays a vital role in economic development but Ethiopia currently generates and consumes only about 400MW of electrical power, mostly from hydroelectric sources. Moreover, 94% of the current energy usage of the country is supplied from sources such as

wood and animal waste, which causes severe deforestation and soil erosion. Fortunately, Ethiopia is well endowed with geothermal energy sources. Studies commenced as long ago as the early 1970's, with the help of UNDP and others, have identified specific geothermal sources suitable for power production which have potential to supply up to 30% of Ethiopia's future power requirements. The Government of Ethiopia has since then been actively involved in developing this resource. As a result, over 18 specific areas of the Rift Valley with potential for geothermal development have been identified and are at various stages of exploration and development. Of a total of over \$81 million which have been invested in this effort, approximately \$36 million have been made available by the Ethiopian Government. The balance has been provided through the Government by various bilateral and multilateral donations. The IAEA's expertise in the use of isotopic techniques as one of the important tools for the development of geothermal resources is highly relevant. Isotopic techniques can be of considerable value in helping Ethiopia make most effective use of the investment it has already incurred through their unique role in the monitoring and management of operational geothermal power plants. They can also continue to serve an equally important role in future geothermal exploration activities.

2.3 Higher Education in Nuclear Sciences

It is recognized that without a strong base in basic sciences, including physics, progress in science and technology, and hence in sustained socio-economic development, is unattainable. Contemporary science is not only a powerful intellectual resource for understanding nature, but also yields rapid, inestimable returns for sustainable socio-economic development and the quality of life. In recognition of this the Ethiopian Science and Technology Commission together with the Ministry of Education and the universities is undertaking a study on the current status and future prospects of basic sciences in Ethiopia. At the University level, this study focuses both on the education and the research aspect. The draft document prepared for physics highlights the nuclear physics teaching and research supported by the Agency under the project ETH/1/002 and the need to build on the achievements made so far.

3. SUMMARY OF RELEVANT PAST TECHNICAL COOPERATION ACTIVITIES

Ethiopia became a Member State of the Agency in 1957. Applications of ionizing radiation in the country began in 1970 when the Institute of Pathobiology (IPB) of Addis Ababa University acquired a Co-60 source and other basic equipment. The assistance of the Agency until 1998 amounted to slightly over US 6.0 million, with the major shares going to human health and agriculture. However, the TC programme in Ethiopia has expanded substantially during the past two years to exceed US \$ 1.0 million in 1998 largely due to the implementation of a Model TC project on tsetse eradication (ETH/5/012).

In September 1978 the Ethiopian Science and Technology Commission (ESTC), which is a governmental Agency headed by a Commissioner, was assigned the responsibility of co-ordinating the Agency technical co-operation programme in the country. Following the organisation of a seminar by the ESTC in March 1987 and a subsequent Country Programming and Review Mission undertaken by the Agency in April 1991, a significant improvement in the TC programme was noted.

3.1 Crop and Livestock Development

The TC Programme during the last 10 years has included four projects in subjects directly related to livestock development. The earliest of these, ETH/5/007, was aimed at improving livestock productivity through the control of diseases by means of radiation attenuated vaccines. This work was carried out at the National Veterinary Institute at Debre Zeit. The Agency's Programme has also supported work at the Institute of Agricultural Research at Holetta on the use of urea/molasses/mineral blocks as feed supplements, which has shown considerable potential for improving livestock and milk productivity. This was done under ETH/5/009 between 1991 and 1996. The National Animal Health and Research Centre (NAHRC) is the counterpart for an active project, ETH/5/010, in which nuclear and nuclear-related techniques are being used to improve the diagnosis and monitoring of livestock diseases, especially rinderpest and trypanosomiasis. Activities under this project have made an important contribution to Ethiopian participation in the Pan African Rinderpest Campaign. The project has also contributed to the preparation for the major national tsetse control and eradication project, ETH/5/012, launched within the framework of the 1997-1998 TC Programme cycle. This project is discussed further in Section 4 on core activities in future programming.

The assistance of the Agency in the area of crop development in Ethiopia is more recent and has focused so far on tef improvement using mutation breeding techniques through the implementation of a TC project, ETH/5/011, since 1995.

3.2 Isotope Hydrological and Geothermal Studies

Support to the national programme for developing geothermal resources was initiated in 1993 through ETH/8/003, *Isotope Study of Geothermal Fluids in the Rift Valley*. The main objective of the project was to conduct both stable and radioactive isotope studies through the establishment of a functional laboratory with trained specialists capable of carrying out isotopic investigations by themselves. The studies were pursued under a subsequent TC project ETH/8/004, which has just been completed.

Support for hydrological studies has been provided through the regional Model Project, RAF/8/022, *Isotopes in Groundwater Resources Development*. In Ethiopia activities under this project focused on the Moyale region in southern Ethiopia, and contributed to the training of local scientists and technologists in the appropriate use of nuclear isotope techniques for gathering and analyzing hydrological data. Groundwater is the major source of water for human consumption and for cattle south of the Dawa River near the border with Kenya. Development of available groundwater is required to support the growth of towns such as Moyale and to improve the condition of the nomadic population in the area. The initial goal of the project was to determine the recharge rate of the shallow aquifers in the Moyale region using tritium and carbon 14 isotopes.

More recently, a TC project ETH/8/005 was initiated to assist, through the use of isotopic techniques, in elucidating the mechanisms which are causing an alarming increase in the level of Lake Beseka. The lake is located some 200 kilometers east of Addis Ababa and has grown from some 3 km² to 35 km² in the past 30 years, causing a major disruption of important transportation links and threatening to pollute an important river in the area.

The Ethiopian Institute of Geological Surveys, EIGS, deals with ground water and geothermal energy resources exploration. However, close collaboration with the Federal Ministry of Water Resources and the concerned Regional State Bureaus of Water Resources in the water sector, and the Ethiopian Electric Power Corporation (EEPCO), formerly known as the Ethiopian Electric Light and Power Authority, in the energy sector, would be necessary as these are the institutions that go into the development of these resources.

3.3 Human Health

The Agency has assisted Ethiopia in establishing the Nuclear Medicine Unit at the Tikur Ambessa Hospital of Addis Ababa University through three TC projects (ETH/6/003, 005 and 006) over the past 10 years. The radio-immunoassay and in-vivo sections are now fully functional, with the latter equipped with both a rectilinear scanner and a gamma camera. The radiopharmaceutical section is also well equipped for routine production of the conventional radiotracers. This Nuclear Medicine Unit is the only one of its kind in the country and thus must serve as a referral centre for patients all over the country. It also serves as a teaching unit and is involved in research in nuclear medicine. The on-going TC project, ETH/6/008, aims at the decentralisation of nuclear medicine services to Gondar about 750 km north and Jimma 400 km south-east of Addis Ababa.

Two projects have supported the establishment of the Radiation Therapy Unit at this same hospital in Addis Ababa. The main teletherapy unit was provided through ETH/6/004, and a facility for brachytherapy was added under ETH/6/007.

Isotopic techniques to assess the prevalence of malnutrition, especially among women and children in Ethiopia were introduced under the TC project ETH/7/003. This project was implemented at the Ethiopian Health and Nutrition Research Institute and helped to build up local capability in three main nutritional topics, namely, body composition, vitamin A uptake and breast milk uptake. The latter component is being further consolidated through the implementation of a new TC project ETH/7/004.

3.4 Additional Technical Co-operation Activities Related to Major Development Objectives

During the last 10 years, the IAEA has supported the establishment of a nuclear instrumentation repair and maintenance capability within the National Scientific Equipment Centre through two projects, ETH/4/002 and 003. The Centre is under the Ethiopian Science and Technology Commission (ESTC).

Radiation safety is an essential consideration in all aspects of a nuclear programme, and the Agency has assisted Ethiopia in establishing a national radiation protection service. Following the enactment of the Radiation Protection Law in December 1993, a National Radiation Protection Authority was created under the Ethiopian Science and Technology Commission.

The TC project ETH/1/002 was first approved in 1993 with the objective of establishing a nuclear physics laboratory at Addis Ababa University. As a result, some components of nuclear physics are now being taught at both the undergraduate and graduate levels making use of a variety of laboratory instruments provided through the TC Programme including a gamma spectrometer, a neutron counter, detectors and a liquid nitrogen plant.

4. PROJECTED PROGRAMME OUTLINE

Consistent with recommendations from the Agency's Board of Governors, the New Strategy for Technical Co-operation and the objectives of Country Programme Frameworks, future programme planning discussed in this section is organized into three categories.

The first category referred to as the Near Term Core Programme includes the highest priority activities which have Model Project potential, and for which the bulk of the country's TC Programme budget will be devoted.

The second category includes those activities which are projected to become the next set of core projects. Support for these activities will be concentrated primarily on building those components of infrastructure and technical capacity, including human resources development, that are expected to be required for the next set of core activities and which require a significant lead time. Support for appropriate feasibility studies can also be included in this category.

The third category identifies the support that is essential for the continuation of ongoing activities, including those initiated through previous TC projects, which might otherwise lapse or fail.

The programming plans outlined here emanate from numerous consultations between the relevant national authorities and staff members of the Agency. They are consistent with Government's priorities with regard to the utilisation of nuclear techniques for socio-economic development.

4.1 The Near -Term Core Programme

4.1.1 Integrating SIT into the National Effort for Tsetse Eradication in the Southern Rift Valley

The highest priority future activity related to the application of nuclear technology in Ethiopia, both for the Government and the Agency, is clearly the tsetse eradication programme in the Southern Rift Valley. A relatively small part of this area is used intensively for farming and grazing, with a total livestock population of nearly 2 million animals, while a vast portion of the area is untouched due to trypanosomosis/tsetse risk. It was selected as the target area for this project because it is not only heavily infested but also is, or can be, sufficiently isolated from other infested areas to minimize the threat of reinfestation.

The Ethiopian authorities have established a phased approach to the eradication endeavor. Phase one will be devoted to preparatory activities and Phase Two to tsetse eradication in a limited portion of the target area. Complete eradication in the entire target area (~25,000 km²) will take place during Phase Three. A Model Project has been launched under the 1997-1998 TC Programme to support the national programme. Project activities have so far focused primarily on the establishment of the necessary infrastructure and the collection of baseline data. The total cost of the project over the next 8-10 years is estimated to be about US\$ 43.8 million, including government contributions, bi-lateral funding, the Agency's core TC

financing, and extrabudgetary contributions to the TC programme. The Agency's financial contribution to the total cost is expected to be of the order of 10-15%.

4.1.2 Isotope Hydrological and Geothermal Studies

Continuing the major national effort to develop geothermal resources, the Government is soon going to commission the Aluto-Langano Geothermal Power Plant designed to produce an initial energy output of about 7 MWe. The design includes later expansion to 15 MWe and finally to 30 MWe. The Agency has been assisting in the use of isotopes and geochemical techniques to investigate the origin and flow of fluids in the system. These are important inputs in formulating development strategies in the area. To accomplish this, previous efforts to support the exploration and exploitation of geothermal resources through ETH/8/003 and ETH/8/004 will be expanded and consolidated through the implementation of a new Model Project on Water Resources Development, ETH/8/006, with a view to provide a conceptual hydrochemical model for exploration and exploitation of the Aluto-Langano and Tendaho sources.

Important information regarding the amount of groundwater available to the Moyale region from several different aquifers has already been gathered and analyzed under the regional Model Project RAF/8/002. However, it is clear that more detailed information is required to effectively plan water development and management activities in this area. The Agency will continue to support these efforts through the new Model Project ETH/8/006. Further, under this project it is intended to develop long term strategy for groundwater resource assessment on a national scale. This strategy is to be implemented with short term projects executed sequentially. Initially, they are likely to include the assessment of recharge rates and dynamics in the aquifers for Addis Ababa, Mekelle and Dire Dawa through the use of nuclear techniques. This work would concentrate on mapping the extent of the productive aquifers identified, obtaining more detailed information on conventional hydrological parameters, and monitoring the effects of groundwater exploitation. With regard to the studies on the Akaki aquifer, which already accounts for about 30% of the water supply to Addis Ababa, close collaboration with the "Agence de Co-opération Française" and the UN Agency, HABITAT, is envisaged.

It also appears that this is an appropriate time for the government to design and implement an appropriate engineering solution based on the study of the Lake Beseka problem. The latest data indicate that the rate of rise of water in the lake has accelerated over the last four years. The Ministry of Water Resources has committed substantial funding to study the problem and develop an engineering plan to control the lake level. The results from initial isotopic samples should be available in the near future and can be used to guide future work. The presence of distinct isotopic characteristics for the different sources of water need to be confirmed and data gaps remaining to be filled need to be identified. Additional sampling should address seasonal variation in recharge to the lake as well as the spatial distribution of sources around the lake and variations in the composition of the water itself. A similar approach is envisaged for Lake Awassa, which is also experiencing an alarming rise in its level.

4.2 The Medium-Term Core Programme

4.2.1 Tsetse Eradication in the Southern Rift Valley

The national plan to eradicate the tsetse fly from a 25,000 km² area extends over the next 8 to 10 years. The need for the IAEA technical and financial support for the SIT component of this effort will remain critical throughout the entire programme, especially in view of the specialised nature of this technique and the expertise available almost exclusively in the Agency. Therefore, to a great extent, the Model Project and extensions thereto are expected to remain as the dominant part of the core programme in Ethiopia for the foreseeable future.

4.2.2 Water and Energy Resources Development

Major national efforts to develop and manage water and geothermal resources will certainly continue for many years. Isotope technology will play a relatively small but important role in this effort. Given the high priority the Ethiopian Government attaches to natural resources protection and management and the development of water and energy resources, and given the commitment of the Agency to support the country in these priority areas, the relevant technology and experience can effectively be transferred within the medium-term. The Agency has already approved a multi-disciplinary project on Isotope Techniques for Water Resources Management (ETH/8/006) that comprises groundwater, geothermal and surface water studies (including lake level rise problems). This project is the second largest project ever in the TC Programme of Ethiopia, following the SIT Project. Other than the above three components of the approved project, problem oriented studies in the area of erosion and sedimentation, pollution and urban hydrogeology are anticipated to be initiated in the future. More importantly, isotope hydrology will be incorporated in the curriculum of earth sciences and civil engineering fields at graduate and undergraduate levels in Addis Ababa University and the Arba Minch Water Technology Institute.

4.2.3 Higher Education in Nuclear Sciences

The Ethiopian-IAEA technical co-operation programme has always made a unique attempt to focus its efforts on end-user oriented activities with visible socio-economic returns. This will continue in a much strengthened manner in the future. Nonetheless, to service the growing areas of applications in a sustainable manner and to internalize the technology transfer realized through the TC Programme, there is a justified need for establishing and strengthening the teaching and research of nuclear sciences at both undergraduate and graduate levels in the medium term. The scope and modality of this initiative will have to be elaborated in the next two years within the framework of the national effort to strengthen basic sciences education and research highlighted in section 2.3. Possible collaboration with UNESCO in this regard will be further investigated.

4.2.4 Human Health

As indicated earlier (Section 3.3 above) Ethiopia and the IAEA have co-operated to a significant extent in the recent past on developing improved national nuclear medicine and radiotherapy facilities. Taking these developments further, the decentralisation of nuclear medicine services is being implemented under the on-going TC project, ETH/6/008, by establishing clinical diagnostic services at two teaching hospitals in Gondar and Jimma. Because of the considerable time needed to train the required manpower, this development will proceed relatively slowly and in measured steps. Radioimmunoassay services, with the associated quality control and data processing, are being established at these two centres. The radiopharmaceutical production facility in Addis Ababa will also be further expanded to

enable it to provide the new centres with the necessary reagents. Later, depending on an assessment of demand trends, it would be appropriate to consider adding the capability for local production of reagents. Eventually, addition of nuclear imaging capability through the provision of gamma cameras might be desirable.

It is mutually agreed to be premature to begin a process of similarly decentralizing radiotherapy services. There is however, the need to improve the capabilities in Addis Ababa through the acquisition of a simulator, an adequate treatment planning system and safety equipment.

With all of these considerations in mind, it is clear that the area of human health , including nuclear medicine and, to a lesser extent, radiotherapy, will require a modest level of Agency support during the next few years.

4.3 General Support Activities

Support for on-going co-operative endeavours in several areas, and one or two new areas as well, is projected, primarily through a variety of regional projects.

In the general field of livestock development, animal disease surveillance and monitoring at the National Animal Health Research Centre currently being implemented under ETH/5/010 could continue to receive support under the regional Model Project, RAF/5/043, Assistance to Complete Eradication of Rinderpest in Africa.

Also in agriculture, but dealing with improvements sought in the production of important crops, current activities under the national TC project ETH/5/011, Improvement of Tef Through Mutation Breeding, could be pursued under the regional project, RAF/5/042, Development of Improved Crop Varieties.

Strengthening of Radiation Protection and Environmental Monitoring Services in Ethiopia has been considered within the framework of the Regional Model Project on Upgrading Radiation Protection Infrastructure, RAF/9/024. Further support in this field is expected to continue during the next several years.

Finally, it is expected that Ethiopia will also benefit from participation in the following regional projects.

RAF/0/011	Human Resource Development and Nuclear Technology Support
RAF/0/012	Institutional Support for Least Developed Countries
RAF/4/014	Maintenance of Medical and Scientific Instruments
RAF/5/040	SIT for Tsetse and Trypanosomiasis Management in Africa
RAF/5/036	Increasing Food Security in Sub-Saharan Africa
RAF/5/041	Animal Feed Supplementation Packages
RAF/5/045	Biofertilizers to Increase Smallholder Crop Production
RAF/5/046	Increasing and Improving Milk and Meat Production
RAF/6/014	Improvement of Clinical Radiotherapy, and
RAF/6/018	Consolidated RIA Capability for Tumor Markers
RAF/6/022	Sustainable Regional Capability in Nuclear Medicine
RAF/6/023	Expanding Nuclear Medicine Services
RAF/8/028	Investigating Dam and Reservoir Leakages and Safety

ANNEX I

NEW APPROACH TO TECHNICAL CO-OPERATION

1. BACKGROUND

One of the key issues discussed during the Third Policy Review Seminar in September 1994 was how best to ensure that the Agency technical assistance is in line with Member States' national development goals and priorities.

There was agreement that **Medium Term Country Plans** for the application of nuclear technology to support national development objectives could provide the desired frame of reference and strategy for a country's technical co-operation programme with the Agency. Member States were encouraged to prepare such Medium Term Plans. In the absence of formal Medium Term Plans other relevant documents could be used depending on conditions and practices prevailing in different countries to prepare a strategy for the future co-operation.

It was also agreed that based on *Medium Term Country Plans* or other relevant documents and information received from Member States, the Secretariat should elaborate a concise **Country Programme Framework (CPF)** for Agency technical co-operation with each recipient country. The paper would show the key areas where nuclear applications can play significant role in reaching national development objectives and where the Agency should concentrate its technical co-operation efforts and resources. The Frameworks, covering a period of 4-6 years, will have to be established in close co-operation with - and endorsement of - the country concerned. They would provide a frame of reference for individual project but would not in themselves have to be project-specific so that a flexibility can be maintained.

In all of the above, the IAEA Secretariat has taken note of the view expressed during the Seminar that in some cases, for example in countries without an established institution responsible for planning the peaceful uses of nuclear energy, the involvement of national planning authorities may be desirable and useful in establishing Medium Term Country Plans involving technical co-operation with the Agency. This should be left to the judgement of the Agency's designated national counterparts in each country. These would, where appropriate, initiate and carry out such internal consultations.

This particular Country Programme Framework outlines an initial 6-year strategy for focused IAEA technical co-operation efforts in Ethiopia. Once agreed, it should reflect the considered view of all concerned parties on how best to utilize assistance from IAEA and national counterpart institutions in supporting the current country's goals and priorities.

In particular, the document is intended to:

- i) facilitate a dialogue between the Government and the IAEA for programme development and implementation;
- ii) maximize co-ordination and complementarity of IAEA technical co-operation with other donor assistance;
- iii) *maximize harmonization of technical assistance with other forms of assistance; and*
- iv) assist in undertaking "programme-driven" resource mobilization within the international community for the purposes of social and economic development of the country.

2. BASIC PRINCIPLES OF TECHNICAL CO-OPERATION

The basic principles of technical co-operation under this Country Programme Framework are:

The actions to be funded under this programme are an integral part of and support the **sectoral priorities** established by the Member State. Therefore, the national planning authorities and Atomic Energy Commissions or equivalent organizations play a key role in assessing the priority needs of the countries, identifying the priority sectors and areas for co-operation, and subsequently evaluating and proposing the projects to be funded under the bi-annual Programme Cycle.

- The Country Framework covers at least a two programme cycle period (4 years). As a consequence, the priority areas for co-operation focus on the medium (rather than short) term priorities of socioeconomic development.
- In order to achieve **impact**, this technical co-operation pursues a limited number of sectoral objectives. Sectoral concentration, is, wherever possible, combined with geographical concentration thus ensuring that a small number of the highest priority projects are allocated a significant financial appropriation.
- Technical co-operation is implemented on a decentralized basis. The national recipients of assistance are closely involved in the preparation and later on will have the **main responsibility** for the execution of the projects.
- Particular attention will be paid to the involvement of the Government and private institutions, nuclear research institutes, and universities in the implementation of the projects, notably in association with national organizations **where the necessary infrastructure is available.**
- The final selection of the projects to be funded by the IAEA within the framework of this technical co-operation is the responsibility of the Department of Technical Co-operation of the IAEA. The basic aspects for consideration during the appraisal of projects for approval are as follows:
 - The project is oriented towards the **end user**
 - The project responds to a **major need** of the country
 - The project is **realistic**
 - The project has strong **Government commitment** (sustainability)
 - **Nuclear technology** plays a role
 - The project has visible social or economic **impact**
- The Technical Assistance project requests presented by Governments to the Agency will be detailed in close co-ordination between the Agency and the national counterparts, in case they are approved by the Agency, bearing in mind the above features and possibility for attracting funds from international financial institutions and possible donor countries. In so doing, collaboration with other International Organizations will be sought and duplication of efforts will be avoided.

Country Programme Frameworks will not only facilitate a development oriented national TC programme, but will also provide an opportunity to initiate a regional programme where distinct benefits can be derived through co-operative activities. Such activities will normally cover three or more recipient Member States. These Regional Projects are in addition to the activities planned under the Regional Agreements (ARCAL, AFRA, RCA).

COUNTRY SITUATION AND RELEVANT DEVELOPMENT NEEDS

Geographic, Demographic and Socio-economic Features of Ethiopia

Ethiopia covering an area of about 1.1 million square kilometers, extending between latitudes of 4° and 15° north, is the ninth largest country in the African continent. It is located in the "Horn of Africa" and is bordered by Somalia and Djibouti in the East, Kenya in the South, Eritrea in the North, Sudan in the West. Its altitude ranges from 150 meters below sea level to about 4600 meters above sea level. Ethiopia has diverse physical features that cause a great variety of climatic conditions, thus resulting in a multitude of agro-ecological zones. Following the recent creation of Eritrea, the country is now land-locked.

The population of Ethiopia is estimated to be over 60 million (the third largest in Africa), growing at a rate of 3.0 per cent. To bring the rapidly growing population under control, the Government adopted a population policy in April 1993. The major objective of the policy is to close the gap between high population growth and low economic productivity through the promotion of a holistic integrated economic and social development approach.

Over 85 per cent of the population currently live in rural areas. With a life expectancy at birth of 47 years, an adult literacy rate of 33 per cent and with GNP per capita currently estimated at US\$ 130, Ethiopia is one of the poorest countries in the world. Over 50 percent of the population are estimated to be under chronic poverty. Ethiopia's social indicators are also one of the poorest in Africa. It is classified, as one of the 33 Least Developed Countries (LDCs) in the African region. The Government's poverty reduction strategy focuses on a combination of promotion of sustained economic growth, increased social sector investments, and promotion of country-based initiatives through the Ethiopian Social Rehabilitation and Development Fund (ESRDF). The ESRDF involves community-based micro-projects for rural water supply, small-scale irrigation, health, education, urban sanitation and local capacity building.

The overall economy of Ethiopia is largely dominated by the performance of the agricultural sector which itself is subject to vagaries of weather and related natural and man-made factors. Consequently, GDP growth has been registering year to year fluctuations which are highly correlated with fluctuations in GDP originating from agriculture. Industrial development is primarily dependent on agricultural growth for the supply of its inputs. The agricultural sector contributes over 50 percent to the GDP, over 90 percent to export revenues, 85-90 percent to the total employment, and over 70 percent to the country's raw material requirement for large and medium size industries that are agro-based. Crop production is estimated to contribute around 60 percent, livestock around 30 per cent and forestry and other sectors around 10 percent of the total sectoral outputs. Ethiopia's export is dominated by unprocessed agricultural outputs. Coffee alone accounts for over 60 percent of total exports. The livestock population of Ethiopia is estimated at well over 55.2 million, with cattle, sheep and goats accounting for about 54, 21 and 17 percent, respectively, with the balance covered by asses, horses, camels and mules. Ethiopia's cattle population is the largest in Africa, and among the top ten in the world (about 30 million). However, tsetse flies infest some 150,000 square kilometers, which represent more than 20 percent of the total arable land, thus exposing over 20 million heads of cattle, sheep and goats to risk of acquiring tsetse-borne trypanosomiasis at any time.

Ethiopia is well endowed with water resources. It has an estimated mean annual run-off of 111 billion m³ from its twelve major river basins and about 2.6 billion m³ of exploitable ground water resources. 30% of the total land area of the country, including the Abay (Blue Nile), Baro-Akobo and Omo Basins, accounts for about 75% of the annual flow; whereas, 22% of the surface area of the country accounts for a mere 1%. 90% of the surface water resource of the country (100 billion m³) flows out of the country of which 66% is from the Abay. Regarding its temporal distribution, 80-90% of the discharges of the major rivers occur during the period July-October in conjunction with the rainy season which, in most parts of the country, occurs during the period from mid-June to mid-September. During this period the rivers also carry high amount of soil; estimated at 2500 tons/m² from the Abay Valley, for example. Though the water resources potential of the country is quite considerable, due to the uneven spatial and temporal distribution, water resources development in the country is very limited.

It is established that Ethiopia has 3.5 million hectares of suitable land for large scale irrigation, of which only about 3% is developed. The gross hydropower potential of the country is of the order of 650 billion KWh/year of which the economically exploitable potential is about 120-160 billion KWh/year. However, less than 2

percent of this potential is being used at present. Only 26.3% of the population have access to clean and safe water supply and over 93% of the population have no sewerage facilities. The annual per capita water consumption of Ethiopia is only 2,350 m³ as compared to an average of 6,440 m³ for the whole of Africa. Though it is estimated that 20,000-40,000 tons of fish can be exploited annually on sustainable basis from inland lakes and rivers of the country, the current level of production is about 4,300 tons per year.

Currently Ethiopia generates most of its electricity from hydropower sources. Previous studies which commenced as long ago as the early 1970's with the help of the UNDP, have identified suitable geothermal fields for power production which, in time, could be developed to supply up to 30 percent of Ethiopia's future power requirements. At Langanjo, in Central Ethiopia within the Ethiopian Rift Valley, the Government has launched the construction of an 8 MWe pilot geothermal power plant as a first step towards the exploitation of the Aluto geothermal field. Over eighteen potential geothermal fields have been identified in the Ethiopian Rift Valley, covering 150,000 square kilometers, and are at various stages of exploration and development. In two of the explored areas, eight wells have been drilled in Aluto-Langanjo and four in Tendaho. Preliminary studies indicate that the exploitation of these geothermal reservoirs may be economically viable.

Following two decades of political, economical and social turmoil, the economy is showing signs of recovery. The Ethiopian economy achieved high growth rate for the third consecutive year in 1996/97: 5.4% in 1994/95, 10.6% in 1995/96, and 7.0% in 1996/97. The performance was aided by good weather but it also reflects success in stabilization policies. In general, performance in the areas of macro-economic management has been satisfactory. The greatest challenge in the medium-term and beyond is sustaining high GDP growth rate if Ethiopia is to attain the goal of doubling its per capita income in 15 years. This implies an average annual real GDP growth rate of 7-8 % assuming a decline in the annual population growth rate from the current 3.0% to 2.5%. The high GDP growth rates, averaging 7.0% per annum, achieved during 1994/95 - 1996/97 raised the hope that this goal is achievable. However, adverse weather conditions (El-Nino) resulted in negative agricultural growth rate in 1997/98 and slowed down overall GDP growth rate to 2.8%, thus underlining the linkage between weather conditions, performance of agricultural output and overall GDP growth rate. Reducing the reliance on rain-fed agriculture by intensifying irrigated agricultural production is therefore a challenge to be faced in the medium term. This issue is to be carefully addressed in the Food Security Investment Programme. Increased use of fertilizer and improved seeds, which are already being emphasized, should further improve agricultural performance.

Development Policies, Strategies and Programmes

The economic policy of the Federal Government currently being implemented is the economic policy that was issued by the Transitional Government of Ethiopia in 1991. Although the policy is intended to serve the transition period it, however, is open to continuity during the post-transition period with the necessary adjustments. The policy is the basis for long-term economic development. The major economic policies that encompass the economy are to replace the previously centrally planned with market oriented economy (reduced role for the state sector and promotion of private investment); to promote public involvement in development; to mobilize external resources; to involve National and Regional organs in economic management; and to prepare macro-economic policies consistent with the new economic policy.

With regard to the agricultural sector, the economic policy confirms a re-orientation of government support away from state farms to peasant agriculture. The policy accords priority for the construction of rural infrastructure, expanded distribution of agricultural inputs and provision of extension services. Although priority will be given to the development of peasant agriculture, large scale modern farming is not ignored. The policy gives priority to the conservation and development of natural resources which will have a major impact on the country's over all economic development.

Concerning the industrial sector, the economic policy gives emphasis to limiting the role of the state and reforming enterprises. State ownership of industry will be limited to a selected number of key establishments that are essential for the development of the economy. Industries under state ownership will be large-scale fertilizer and pharmaceutical plants and industries which supply strategic raw materials to major chemical industries.

Ethiopia's long-term economic development strategy designed to implement the economic policy is termed Agricultural Development Led Industrialization, ADLI. The strategy was formulated within the framework of the transitional economic policy. The goal of the development strategy is to achieve rapid and sustainable

economic growth by improving the productivity of the agricultural sector and building-up an agro-based industrial sector which is labour-intensive and utilizes local raw material.

The industrial development strategy of ADLI relies predominantly on an expansion of the manufacturing sector directed primarily for the domestic market using labour-intensive technologies and domestically available raw materials. Agriculture will constitute a large market for industrialization in terms of consumer goods and to some extent capital goods. This will help to strengthen the linkage between industry and agriculture. According to the strategy, industry will contribute to economic development along two lines. First, it will shift labour from agriculture and generate wage employment on a fairly wide basis. Second, it will create an expanding domestic market for goods and services. Thus it will lead to the transformation of the economy.

The strategy accords due consideration for the development of economic and social infrastructures that support the development of agriculture and industry. With respect to economic infrastructure, the transport sector will be strengthened with the view to reduce unnecessary marketing expenses and to promote commerce. Effort will be exerted to make the country self-sufficient in construction materials, particularly metal and cement. Energy resources will be developed to encourage and support central and regional industrial development and to reduce the excessive dependence upon fuel-wood. Regarding social infrastructure, education, health, environmental sanitation and water supply will be expanded in line with the objectives of the strategy.

The Ethiopian People's Revolutionary Democratic Front (EPRDF), the ruling party, has formulated a five-year development programme for the country which is in line with the economic policy and development strategy. The target of the development programme is to ensure rapid economic development that benefits people at all levels. The programme aims to register an economic growth of 7-10% per annum over the five-year period based essentially upon the implementation of rural and agriculture oriented development projects.

ACRONYMS AND PROJECT CODES

ACRONYMS

CPF	Country Programme Framework
IAEA	International Atomic Energy Agency
TC	Technical Co-operation
ADLI	Agriculture Development Led Industrialization
CCF	Country Co-operation Framework
UNDP	United Nations Development Programme
MEDAC	Ministry of Economic Development and Co-operation
SIT	Sterile Insect Technique
ESTC	Ethiopian and Technology Commission
TAG	Technical Advisory Group
EARO	Ethiopian Agricultural Research Organization
PSC	Project Steering Committee
NAHRC	National Animal Health Research Centre
MoWR	Ministry of Water Resources
EEPCO	Ethiopian Electric Power Corporation
EELPA	Ethiopian Electric Light and Power Authority
EIGS	Ethiopian Institute of Geological Surveys
IPB	Institute of Pathobiology
MWe	Mega Watt Energy
AFRA	African Regional Co-operative Agreement for Research Development and Training Related to Nuclear Science and Technology
GNP	Gross National Product
LDCs	Least Developed Countries
ESRDF	Ethiopian Social Rehabilitation and Development Fund
GDP	Gross Domestic Product
EPRDF	Ethiopian People's Revolutionary Democratic Front
GWh/yr	Giga Watt Hour per Year

PROJECT CODES

ETH/1/002	Teaching Applied Nuclear Physics
ETH/4/002	Nuclear Instrumentation
ETH/4/003	Establishment of a National Nuclear Instrumentation Unit
ETH/5/007	Animal Science
ETH/5/009	Animal Science (Phase II)
ETH/5/010	Diagnosis and Monitoring of Rinderpest and Trypanosomiasis
ETH/5/011	Improvement of Tef Through Mutation Breeding
ETH/5/012	Integrating SIT for Tsetse Eradication
ETH/6/003	Radioisotopes in Nuclear Medicine
ETH/6/004	Radiation Therapy
ETH/6/005	Radioisotopes in Medicine (Phase II)
ETH/6/006	Production of RIA Reagents and Radiopharmaceutical Kits
ETH/6/007	Upgrading Radiation Therapy Facilities
ETH/6/008	Expanding Nuclear Medicine Services
ETH/7/003	Use of Isotopes in Assessing Micronutrient Deficiencies
ETH/7/004	Evaluation of Supplementary Infant Feeding Practices
ETH/8/003	Isotope Study of Geothermal Fluids in the Rift Valley
ETH/8/004	Isotope Hydrological and Geothermal Studies of Rift Valley
ETH/8/005	Use of Isotopes in the Study of Lake Beseka
ETH/8/006	Isotope Techniques for Water Resources Management
RAF/5/043	Assistance to Complete Eradication of Rinderpest in Africa
RAF/5/042	Development of Improved Crop Varieties
RAF/8/022	Isotopes in Groundwater Resources Development
RAF/9/024	Upgrading Radiation Protection Infrastructure