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DEVELOPMENT AND INTERNATIONAL ECONOMIC CO-OPERATION: IMPLEMENTATION
 OF THE DECISIONS ADOPTED BY THE GENERAL ASSEMBLY AT ITS SEVENTH
 SPECIAL SESSION

Preliminary study on the possibility of establishing an
 international energy institute within the framework of
 the United Nations system

Report of the Secretary-General

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I. INTRODUCTION

1. At its seventh special session, in September 1975, the General Assembly addressed itself, inter alia, to the problem of providing more effective assistance in the energy field to developing countries. Following the increase in the price of energy in 1973 and 1974, international attention was focused upon the role of energy in the world economy and the Assembly, in paragraph 2 of section III of resolution 3362 (S-VII) of 16 September 1975, invited the Secretary-General to carry out a preliminary study and to report to the Assembly at its thirty-first session on the possibility of establishing within the framework of the United Nations system, an international energy institute to assist all developing countries in energy resources research and development.
2. The interpretation of the wording of the resolution is of particular importance in assessing the scope of action which the General Assembly wishes to assign to any new institute which may be created. It is understood that the term "possibility" implies that this study is required to evaluate whether or not an institute is needed and, if so, to assess the contribution it might be expected to make towards meeting the special needs of developing countries, in particular, in the field of energy resources research and development.
3. A vast amount of energy research and development work, involving the expenditure of enormous sums of money, is being undertaken around the world and some of this activity could and should be adapted for the benefit of the developing countries. Research in some specialized fields of energy is in progress in developing countries and the results of this could, with advantage, be given wider circulation. Considering the amount of resources being expended in this field, an insufficient attempt has been made on a global basis to provide necessary links between these various activities.

II. INTERAGENCY TASK FORCE

4. The Secretary-General, in implementing General Assembly resolution 3362 (S-VII) consulted the concerned organizations and agencies within the United Nations system, including the regional commissions, and, in view of the ramifications of the question, convened an interagency task force to discuss the matter. 1/

5. The consultations between the Secretary-General and the competent organizations within the United Nations system have revealed a considerable divergence of views on the need for an international energy institute. While some organizations felt that the need for such an institute is at present not fully evident, others were of the opinion that an international energy institute should be set up as soon as possible. As to the functions, whereas certain organizations agreed with the idea that any new mechanism within the United Nations system should complement rather than duplicate or take over work being undertaken elsewhere, others felt that an international energy institute should be a very strong and visible entity within the United Nations system and would inevitably mean that some of the functions now performed by others would have to be transferred to the proposed institute. However, it was generally agreed that there was a need for a careful appraisal of the situation before proceeding to consider the desirability of the specific proposal for the establishment of an institute.

1/ The agencies and organizations of the United Nations system engaged in energy-related activities include the following (see annex for details):

- (a) United Nations and its regional commissions;
- (b) United Nations Conference on Trade and Development (UNCTAD);
- (c) United Nations Environment Programme (UNEP);
- (d) United Nations Industrial Development Organization (UNIDO);
- (e) United Nations Development Programme (UNDP);
- (f) United Nations Institute for Training and Research (UNITAR);
- (g) Food and Agriculture Organization of the United Nations (FAO);
- (h) The United Nations Educational, Scientific and Cultural Organization (UNESCO);
- (i) International Bank for Reconstruction and Development (IBRD);
- (j) World Meteorological Organization (WMO);
- (k) International Atomic Energy Agency (IAEA).

III. RECOMMENDATIONS

6. In view of the complexity and highly technical and political nature of the subject at hand and the divergency of opinion among the concerned elements of the United Nations system as to the optimal course of action, it is the view of the Secretary-General that it would be highly desirable to establish an ad hoc working group on energy resources research and development composed of recognized senior energy specialists nominated by Governments, who should serve in their individual capacities. The ad hoc working group should be geographically representative, composed of up to nine experts, and should convene in early 1977. The ad hoc working group, with the support of the United Nations Secretariat and in co-operation with the interested organizations and specialized agencies of the United Nations system, should prepare a comprehensive report regarding the desirability of establishing an international energy institute within the United Nations system ^{2/} and, if appropriate, outlining feasible alternative approaches for presentation to the General Assembly at its thirty-second session through the Economic and Social Council at its sixty-third session. The subject report might specify the activities to be undertaken under each alternative, the nature of the potential institutional arrangements that would be required and the costs and benefits associated with each approach, including a detailed presentation of financial implications.

7. Should the General Assembly endorse this approach, the Secretary-General is prepared to undertake immediately the necessary preparatory arrangements. Accordingly, the Secretary-General would make a supplemental request in his revised estimates for the 1976-1977 programme budget for the modest additional resources required for travel to permit critical consultations with the concerned agencies and organizations of the United Nations system, the regional commissions, and governmental and non-governmental institutes currently engaged in actual research and development activities in the energy field, which is essential for the preparation of a substantive background document for use by the ad hoc working group. It is estimated that \$6,000 would be required for this purpose. The financial resources required to cover travel to New York and subsistence for the nine governmental nominees for the two-week meeting of the ad hoc working group would amount to an estimated \$24,000. The cost of meeting services involving documentation (25 pages pre-session, 50 pages in-session and 25 pages post-session) is estimated at \$26,000, broken down as follows:

	\$
Interpretation	21,900
Translation, editing and typing	3,700
Reproduction and distribution	<u>400</u>
TOTAL	<u>26,000</u>

Total financial requirements for the ad hoc working group would therefore amount to \$56,000. It is envisaged that the Centre for Natural Resources, Energy and Transport of the Department of Economic and Social Affairs would serve as the secretariat for the ad hoc working group.

^{2/} In this connexion, it should be noted that at the Conference on International Economic Co-operation in Paris, a proposal is under review for the creation of an international energy institute that should establish close links with the United Nations system.

ANNEX

Submissions of organizations concerned summarizing
 their activities in the field of energy

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I. INTRODUCTION

1. At the ad hoc interagency meeting held at United Nations Headquarters on 2 and 3 August 1976 to discuss the Secretary-General's draft proposals on the possibility of establishing an international energy institute, the various bodies which were represented decided that an annex should be attached to the Secretary-General's report summarizing the activities of each organization in the field of energy. Each body was therefore asked to submit, in summary form, an account of its relevant activities in this area and the submissions of individual organizations in reply to this request are contained in the text that follows.

II. UNITED NATIONS SECRETARIAT

Department of Economic and Social Affairs

1. Centre for Natural Resources, Energy and Transport

2. The Centre for Natural Resources, Energy and Transport of the Department of Economic and Social Affairs is the central unit of the United Nations in energy matters on a global basis. All the conventional (for example, coal, oil, gas, hydropower) and non-conventional (for example, geothermal, solar, wind, oil shales, tar sands) energy sources are dealt with except nuclear power, which is the responsibility of the International Atomic Energy Agency (IAEA).

3. The Centre serves as the focal point of the Secretariat for the preparation of reports on energy matters to the General Assembly, the Economic and Social Council and its subsidiary bodies, such as the Committee on Natural Resources, as well as to United Nations conferences, such as those on population and environment. The Centre also maintains close contact with other United Nations bodies concerned with energy and co-operates closely with the regional commissions in the setting up of work programmes and in the organization of regional energy meetings.

4. In response to Economic and Social Council resolution 1954 (LIX) of 25 July 1975 on problems of availability and supply of natural resources, comprehensive reports are being prepared on the current situation and prospects of coal, oil shale and geothermal energy in developed and developing countries. Similarly in response to General Assembly resolution 3515 (XXX) of 15 December 1975, the Centre has participated, on behalf of the United Nations, in the meetings of the Energy Commission of the Conference on International Economic Co-operation, to which it has submitted a background paper on energy production and consumption trends.

5. The energy work programme of the Centre for 1976-1977 includes the preparation of studies on methodologies for the calculation of oil and gas reserves, energy-planning strategies and policies in developing countries, co-operation among developing countries in energy, financial aspects of energy exploration and

development, and trends in petroleum refining in developing countries. An interregional symposium on national oil companies in developing countries is planned for 1977.

6. In addition to the above activities, the Centre is responsible for substantive support to technical co-operation projects in energy executed by the United Nations. Technical co-operation projects which are under implementation reflect the particular needs of each of the developing countries in question and encompass practically all primary sources of energy as well as electrification and other energy-processing schemes. The average annual expenditure on these projects amounts to approximately \$US 10 million, including \$US 5 million representing the United Nations Development Programme (UNDP) contribution. These projects include energy surveys, involving the evaluation of indigenous energy resources and reserves and projections of energy demand; petroleum exploration projects, establishment of petroleum research centres in support of exploration efforts and strengthening of national petroleum organizations; electricity projects involving the evaluation of alternative sources of supply and projections of electricity demand at the country level; and geothermal exploration projects involving geological and geophysical as well as drilling activities.

7. As a result of the recent changes in the world energy situation and pressing problems in developing countries, the Centre has been called upon to provide increasing assistance in the formulation of energy policies, the organization and strengthening of national energy institutions and the preparation of appropriate energy legislation with particular reference to petroleum exploration and development agreements.

8. With regard to research and development (R and D), the Centre collects and analyses information on new energy technologies with the aim of introducing and applying such technologies to developing countries. This has been done with particular success in the case of geothermal energy and on an increasing scale with regard to other new sources of energy such as solar, wind and tidal by means of individual country projects and by organizing international meetings such as the Conference on New Sources of Energy (Rome, 1961) and two symposia on the development and use of geothermal resources (Pisa, 1970 and San Francisco, 1975).

9. Among R and D oriented projects executed by the Centre are the Indian Institute of Petroleum, the Petroleum Development Centre in Bolivia and the Petroleum Development Centre in Turkey, all of which have been established with United Nations/UNDP assistance with the aim of conducting applied research in all technical methods related to petroleum exploration for assisting the respective national oil organizations of these countries. Assistance has also been provided in setting up R and D programmes in secondary recovery of heavy oils, in the manufacture of lignite briquettes and in solar energy.

2. Office for Science and Technology

10. In accordance with its terms of reference, the Office for Science and Technology of the Department of Economic and Social Affairs collects and

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disseminates information on the activities of the United Nations system in science and technology, including energy research, in order to identify gaps and duplication in these activities, and delineates areas for co-operation between the specialized agencies and other organs of the United Nations system.

(a) Committee on Science and Technology for Development

11. The Committee on Science and Technology for Development, for which this Office provides substantive support, transmitted, at its third session, a draft resolution entitled "Research and development in non-conventional sources of energy" to the Economic and Social Council which the Council subsequently adopted as resolution 2031 (LXI) of 4 August 1976. In that resolution, the Council requested the Committee, *inter alia*, to keep the topic of research and development in non-conventional sources of energy on its agenda, with a view to submitting proposals for action for the benefit of developing countries.

12. Also in the resolution, the Council requested that surveys be prepared on ongoing research and development activities in the field of non-conventional sources of energy with a view to identifying gaps in the present activities within and outside the United Nations system. The Office, in co-operation with the Centre for Natural Resources, Energy and Transport and United Nations bodies concerned, is involved in the preparation of these surveys. These surveys will be considered by the Committee on Science and Technology at its next session.

(b) Advisory Committee on the Application of Science and Technology to Development

13. At present, the Office for Science and Technology is dealing with the scientific aspects of research and development programmes which are being implemented through the United Nations system. For example: the Office provides the Advisory Committee on the Application of Science and Technology to Development and its working groups with information on the current activities of UNDP and the United Nations Environment Programme (UNEP) in the field of non-conventional sources of energy (solar, wind, biogas).

III. ECONOMIC COMMISSION FOR EUROPE

14. The programmes of the Economic Commission for Europe (ECE) in the energy field comprise: projects in the fields of coal, gas and electric power dealt with by specialized committees; studies of innovations in energy technologies under the Senior Advisers to ECE Governments on Science and Technology; studies on long-term aspects of energy and basic materials under the Senior Economic Advisers to ECE Governments; and studies of the environmental impact of energy production and use, a major seminar on the desulphurization of fuels and combustion gases, and examination of energy conservation programmes under the Senior Advisers to ECE Governments on Environmental Problems. Other aspects of energy problems are also examined by other principal subsidiary bodies, such as transport, steel, chemicals, housing, building and planning.

15. ECE also adopted a programme of work on energy economy and efficiency in the ECE region. This programme includes the following projects: combined production of power and heat; new techniques for transformation of primary energy; improved insulation of houses and buildings; improved techniques for extraction and processing of primary forms of energy; recycling of energy-intensive industrial wastes and by-products as well as the use of municipal wastes for energy production; possibilities, methods and related problems of increasing energy productivity in selected economic branches (transport, chemical, steel and housing industries); long-term energy consumption perspectives and scenarios in the light of energy conservation programmes; environmental aspects of energy conservation measures.

16. The following are the major activities being carried out or proposed in the specialized energy committees:

(a) Coal Committee

Productivity in underground coal mining; open-cast mining; safety and health risks; new uses for coal such as gasification and liquefaction; use of solid fuels in the metallurgical and chemical industries; environmental measures such as desulphurization of coal, land reclamation, treatment of effluents from mines and preparation plants, and reduction of waste in the mining, processing, transport and use of coal;

(b) Committee on Electric Power

Selected problems arising with respect to classical thermal power stations and hydroelectric schemes; integration of nuclear power stations in electric power systems; distribution of electric power; interconnexion of electric power systems; rationalization of electricity use; selected problems in the relationship between electricity and the environment; combined production of heat and electricity;

(c) Committee on Gas

Economic and technical aspects of gas in various consumption sectors; investments in the gas industry and their financing possibilities; gas pipelines; gas storage facilities and transport systems; production and use of synthetic natural gas; optimization of the exploitation of natural gas; environmental problems in exploration, exploitation, transport, storage and distribution of gas.

17. The Senior Advisers to ECE Governments on Science and Technology continue to pay attention to the technical aspects of energy problems, dealing mainly with those matters which are not covered by other ECE bodies. These problems are as follows: environmental aspects of energy production and use, with particular reference to new technologies (in co-operation with the Senior Advisers to ECE Governments on Environmental Problems); policy development, resource allocation

and co-operation in the energy R and D field; improvements to existing energy technologies and research and development of new energy sources (technologies related to new energy sources, technologies connected with the utilization of low-calorific value fuels).

18. The Senior Economic Advisers to ECE Governments carry out a study of long-term problems in the field of basic products and energy as an important item in their programme of work. This project directs attention to the macro-economic impact on energy developments and in particular the following aspects: impact on balance of payments (trade deficit and interest paid on loans); impact on the volume of investment required for future growth; possible scenarios of interrelations between future growth of the region and energy developments; macro-economic impact of energy conservation policies.

IV. ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

A. Role of the energy programme within the Economic and Social Commission for Asia and the Pacific

19. The Economic and Social Commission for Asia and the Pacific (ESCAP) has undertaken activities in the energy field since 1951 when the Sub-Committee on Electric Power was established, which in 1967 was renamed the Sub-Committee on Energy Resources and Electric Power. The Sub-Committee held 12 sessions during the period 1951-1972. In 1974 the Sub-Committee was discontinued and responsibility for energy matters was transferred to the new Committee on Natural Resources, which is concerned with energy, minerals and water. Each of these topics is taken in rotation as the principal subject at annual meetings of the Committee, energy being the main subject in 1975. Following the Commission's declaration at the 1974 session that energy was one of ESCAP's priority fields, an integrated energy programme, entitled "Development, utilization and conservation of energy resources", was formulated, involving co-ordinated activities of various ESCAP divisions, and has two main components: (a) Exploration, extraction and production of energy, and (b) Utilization of energy.

B. Present energy-related activities with particular reference to research and development of energy resources of developing countries

20. The present energy programme is designed mainly to assist developing countries in development, management and conservation of energy resources, in identifying matters on which there is a particular need for research and development, and in arranging appropriate programmes, as far as possible within the region. Following are activities planned to be undertaken in 1976 and 1977:

(a) The main activity under the first component is to assist the countries in co-ordinated planning of the investigation, development and management of energy resources and the identification of priority projects (a team of experts is to be organized, tentatively in 1977). Further detailed advice on specific energy sectors and on management will be provided by specialist teams to be organized subsequently. Other activities include: technical advice on the exploitation of low-grade coal (by an adviser, tentatively in 1976); expert working group on the use of solar and wind energy (held in March 1976 and dealt with both research and development aspects; follow-up work is being continued); roving seminar on rural energy development, including topics of biogas, solar and wind energy and rural electrification (by 1977); assistance to countries in setting up prototype biogas plants (being continued); technical advice on biogas (by adviser in 1977); training workshop on biogas development (in Fiji in 1976); seminar and study tour on rural electrification (tentatively in USSR in 1977); seminar and study tour on electricity systems in large urban areas (in Japan in 1977); study on financing of rural electrification (1976-1977); and study on role of gas turbines and hydroelectric peaking stations of conventional storage and pumped-storage types (1976);

(b) Activities under the second component of the energy programme include: studies on problems of specific industrial sectors with specific reference to less-energy-intensive processes (1977); survey of the use of liquefied natural gas (1977); and studies on alternative technologies suited to energy resources endowments of developing countries and the transfer of such technologies among developing countries (1977).

V. ECONOMIC COMMISSION FOR LATIN AMERICA

A. The energy programme in the Economic Commission for Latin America

21. The Economic Commission for Latin America (ECLA) initiated its work in the field of energy in pursuance of resolution 38 (AC.16) of 14 February 1952. Since then, the energy programme has been a distinguished part of its activities both at ECLA headquarters in Santiago and at the Office in Mexico.

22. ECLA attached great importance to the energy sector in its work because the characteristics of this sector link it directly with the objectives of the Commission. For example:

(a) It is of vital importance for the economic and social development of the countries of the region;

(b) It is a key factor in trade and political relations;

(c) It requires heavy investments for its development;

(d) It is complex both in its technology and in its institutional organization.

23. Although only a small number of staff members are specialized in the energy sector at the ECLA secretariat, they form a critical mass which mobilizes consultants and experts for the execution of various projects.

B. Energy-related activities

1. Objectives

(a) Long-term

24. The long-term objectives are:

(a) To help raise levels of living in the countries of Latin America and the Caribbean through the rational use and supply of inanimate energy;

(b) To assist the countries in establishing an energy infrastructure which will make their over-all development plans viable and will be consistent with their natural, technological and financial resources while not having any serious adverse effects on the environment;

(c) To help further the progress of regional integration by encouraging projects of multinational interest in the field of energy.

(b) Immediate

25. The immediate objectives are:

(a) To help strengthen the Latin American Energy Organization (OLADE) by providing technical support for its activities;

(b) To enhance the awareness of the countries of the region regarding the importance of managing the energy sector on an integrated basis, formulating development policies and plans which simultaneously cover the various primary sources (hydrocarbons, carbon, hydroelectricity, radio-active minerals, geothermic resources etc.) and the needs of the various consumer sectors;

(c) To facilitate the exchange of information, experience and technical skills with a view to improving the economic efficiency of the management of energy, the utilization of the relevant natural resources and the protection of the environment.

2. Work plan (1976-1978)

26. This is a continuing task which includes a group of activities aimed at achieving the above-mentioned objectives and fulfilling resolutions of a binding nature for the secretariat of ECLA (General Assembly, Economic and Social Council, and regional commission resolutions).

(a) Activity 1. Contribution to multidisciplinary studies by the secretariat

27. Several multidisciplinary studies by ECLA require contributions on the development and prospects of the energy sector.

28. Among these studies may be mentioned: "Latin American development: appraisal and long-term prospects", "Regional appraisal of the International Development Strategy" and the annual Economic Survey.

29. The basic activity comprises: the collection of data, follow-up of the evolution of the sector's economy at the world level; analysis of its implications for the Latin American countries, and consideration of the relevant strategic options for countries which are importers and for those which are net exporters.

(b) Activity 2. Mutual co-operation with OLADE

30. The Executive Secretaries of ECLA and OLADE signed a co-operation agreement in compliance with higher mandates from their respective organizations (30 April 1976). On the basis of this agreement, priority studies will be selected to be worked upon jointly.

(c) Activity 3. Forecasting electric power requirements in Latin America

31. With the assistance of a developed country, a project is being planned on the above subject which will include a state-of-the-art survey with four in-depth country studies.

(d) Activity 4. Supporting activities

32. Supporting activities are as follows:

(a) Dissemination of technical and economic data connected with the utilization of energy resources;

(b) Co-operation with the Centre for Natural Resources, Energy and Transport of the Department of Economic and Social Affairs, United Nations Secretariat, in projects of world-wide scope.

(e) Activity 5. a/ Electricity interconnexion in Central America

33. A comparative evaluation will be made of the independent development of the electricity systems in the six countries and the development of an interconnected system. An optimization methodology using several mathematical models processed by electronic computer will be employed. This project is supported by UNDP and the Central American Economic Integration Bank (BCIE).

(f) Activity 6. a/ Energy development in Central America

34. Assistance will be given in the formulation of a Regional Energy Plan for the six countries. It involves the carrying out of several studies with UNDP assistance and the active participation of the Permanent Secretariat of the General Treaty on Central American Economic Integration (SIECA), ECLA and the countries themselves.

a/ To be carried out by the ECLA Office in Mexico.

VI. ECONOMIC COMMISSION FOR AFRICA

35. The aim of the energy programme of the Economic Commission for Africa (ECA) is to make an inventory of African energy resources, to encourage their exploration planning and development, to promote co-operation in exploitation and use, to co-ordinate energy development policies and rationalization of electrical energy development, to promote small-scale production and distribution of electrical energy in rural areas and to develop non-conventional sources of energy in Africa.

36. ECA's activities related to energy are focused on four main objectives, namely: (a) planning and optimum development of energy resources in Africa; (b) development of electrical energy; (c) rural electrification and development of energy equipment for rural use; and (d) development of non-conventional sources of energy.

37. Under these objectives and in the light of the adverse effects African economies have experienced as a result of the energy crisis, a project entitled "Inventory and development of energy resources in Africa" has been prepared and approved in principle by UNDP. As a first step of the energy resources inventory, preparation of an Energy Resources Atlas of Africa has been initiated. In addition, studies on petroleum developments in all African countries are being brought up to date and, following on the First African Conference on Petroleum Industry's recommendations, a study on the feasibility of establishing an African Petroleum Institute is being elaborated.

38. In order to appraise the current and future energy situation in Africa and its trends in supply and marketing and to consider development of African sources of energy, the secretariat is engaged at present in the preparation of the Second African Meeting on Energy which will be held between 8 and 19 November 1976 at Accra, Ghana.

39. Efforts are being made to promote multinational co-operation among African States in the field of energy development and utilization, to stimulate activities in the field of training of personnel and to assist African States in the formulation of their own energy policies. In this respect, the establishment of standing committees on energy in African subregions represents one of the main aims of ECA's activities in the energy field.

40. As far as development of electric energy in Africa is concerned, assistance is being given to African States in various fields such as linking up of power networks at national and international levels, modernization of existing facilities, utilization of local products for electricity generation, organization and management of public power authorities, and the training of staff.

41. Advisory services are being given to member States in developing small-scale production of electricity in low-capacity plants for use in rural areas.

42. In the development of non-conventional sources of energy, a project for inventory, development and utilization of solar, wind and biogas energy in experimental areas in West and East Africa has been elaborated and approved by a donor Government for funding. Within the framework of its objective to develop non-conventional sources of energy, the secretariat has sought to bring together other United Nations bodies in a common effort to develop and utilize solar energy in Sahelian countries. In this context, the secretariat participated in a UNDP interagency mission to the Sahelian countries to undertake an inventory of research and development of solar equipment carried out in the region and to advise on the modalities for establishing or strengthening subregional centres for solar energy research and development. The report of the mission is now with UNDP.

43. Under the same objective, the secretariat has also initiated discussions with UNDP on the need to regionalize some of the activities that are now being carried out on an individual country basis in the field of geothermal energy development.

VII. ECONOMIC COMMISSION FOR WESTERN ASIA

44. First, as to the role of the energy programme within the Economic Commission for Western Asia (ECWA), ECWA initiated for the first time an energy programme under the natural resources, science and technology work programmes which became effectively operational in the second half of 1975.

45. Secondly, as to energy-related activities of ECWA, they consist of the following:

(a) The preparatory work consisted of compiling an energy bibliography and cardex and developing sets of regional tables covering various aspects of petroleum statistics for the period 1960-1974, such as reserves, production, revenues, prices, refining capacity, etc.

(b) The following projects are under implementation for the ECWA region:

- (i) Strategy for action on alternative uses of oil;
- (ii) Basic energy statistics and review of development in the energy and oil sector;
- (iii) Medium- and long-term supply-and-demand projections for energy;
- (iv) Regional geological study specially orientated towards oil deposits and study of Arab oil reserves;
- (v) Support industries and services for oil production and assisted activities;

- (vi) Regional distribution arrangements for electrical energy;
 - (vii) Assessment of technical manpower requirements and training facilities in energy;
 - (viii) Structure and functions of energy institutions in West Asia;
- (c) Advisory services to Democratic Yemen and to Yemen in preparing two draft laws for the exploitation of oil resources in them;
- (d) Intensive consultation with secretaries of the Organization of Arab Oil Exporting Countries (OAPEC), the Organization of Petroleum Exporting Countries (OPEC), the Organisation for Economic Co-operation and Development (OECD) and IAEA, with a view to exploring the possibilities of co-operation between these organizations and ECWA in the field of energy.

VIII. UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

46. The secretariat of the United Nations Conference on Trade and Development (UNCTAD) keeps under constant review trade implications for developing countries of the world energy situation. Several activities of UNCTAD have a direct or indirect bearing upon energy including, for instance, those relating to production and investments, prices, restrictive business practices (particularly in the petrochemical industry) and shipping. Projections of energy supply, demand and trade are prepared as a part of over-all projections of world economic activity (see, for instance, "World economic outlook, 1976-1977," (TD/186), submitted to the fourth session of UNCTAD. Such projections are used in particular for assessment of trade prospects and capital needs of developing countries, which are regularly presented to the Conference and/or its subsidiary bodies (see, for instance, TD/B/C.3/134 and Add.1).

47. In order to help Governments in their consideration of various possible courses of action in this field, the UNCTAD secretariat is ready to continue and expand its analysis of relationships between energy problems on the one hand, and on the other hand those relating to economic development, patterns of trade and capital needs of the developing countries.

48. In the field of transfer of technology, a decision concerning the establishment of "subregional, regional and interregional centres by the developing countries in specific and critical sectors of particular interest to these countries" was contained in Conference resolution 87 (IV) (para. 5 (c)) under the broad heading "co-operation among developing countries". Such specific and critical sectors include mining, thereby broadly covering energy produced through mining operations (particularly coal, oil and gas). In addition, our current work on both fertilizers (including those produced through biogas plants) and petrochemicals, which is carried out in the context of our programme on transfer of technology, has a bearing on problems connected with the use of energy and energy-producing materials.

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49. In the context of its over-all research activities, the UNCTAD secretariat has undertaken work in the past few years on the price structure of crude and refined petroleum, earmarking the returns to producing countries and the returns to other parties, up to the final consumer price. Work has also been done on the impact of changes in energy prices upon the economies of developing countries in the context of trade and natural resources policies. Estimates have also been made of the current changes in trade involving the petroleum structure for individual developing countries.

50. In the context of a joint UNCTAD/UNEP project on the social evaluation and pricing of natural resources, the evaluation relating to energy resources will be dealt with along with other natural resources, taking account of environmental considerations, long-term limitations on resources and their impact upon trade and development, and will include consideration of alternative development strategies.

IX. UNITED NATIONS ENVIRONMENT PROGRAMME

51. Energy constitutes one of the areas of concentration of the United Nations Environment Programme (UNEP). The strategy of UNEP in this area is mainly related to the energy-environment context and consists of two main elements:

(a) Assessment of the impact of production and use of all sources of energy on the environment;

(b) Use of appropriate technology for the harnessing of renewable sources of energy for the improvement of the human environment in rural areas in developing countries.

52. To implement the first element of the strategy, UNEP has been undertaking a number of comprehensive studies on the environmental impacts of production, transportation, processing and use of fossil fuels, nuclear energy and renewable sources of energy (solar energy, wind energy, hydropower, geothermal energy, biogas, etc.). UNEP is also encouraging research work and technological development for the reclamation of coal strip-mined areas, for handling the environmental impacts of hydropower exploitation and of other non-traditional renewable sources of energy, and for the enhancement of the conservation of energy at the points of production and end use.

53. The second area of activity in the field of energy is mainly devoted to the application of appropriate technology to harness locally available renewable sources of energy in rural areas in developing countries with the main target of improving the human environment in such areas. Feasibility studies are being undertaken to establish two demonstration energy centres: one in Sri Lanka and the second in Senegal to illustrate sources of energy. In addition, technical assistance will be provided to developing countries for the development of their programmes and know-how for the exploitation of such energy sources.

X. UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

54. The Lima Declaration and Plan of Action for Economic Co-operation and Development (see A/10112, chap. IV) calls for the share of developing countries in world industrial input to increase to at least 25 per cent by the year 2000. At the same time, industrial development industry consumes, currently, approximately 30 per cent of total world energy. Therefore, if the Lima target is to be achieved it will require a considerable increase in the energy resources of developing countries. Achieving this increase is the underlying role of the energy programme in the over-all work programme of the United Nations Industrial Development Organization (UNIDO).

55. This programme is directed at assessing energy requirements of developing countries in the light of industrial programmes at a national level and at a factory level assessing individual energy requirements related to specific industrial projects. The programme places considerable emphasis on renewable sources of energy, solar, wind, biogas, solid wastes, photosynthesis, and waste gases. The programme also provides know-how for the manufacture and development of equipment suitable for specific energy systems and investigates alternative production methods which are less energy consuming or improve the efficiency of traditional technologies.

56. UNIDO's energy-related activities fall mainly into two categories. Those related to the study programme and those related to the technical assistance programme. Currently UNIDO's International Centre for Industrial Studies is undertaking four sectoral studies in 1976 and has eight planned for 1977. In 1976, the sectors to be studied are iron and steel, oil and fats, and agro-industries and fertilizers. Within these studies will be sections dealing with the energy requirements and utilization in these sectors. The findings of these studies will form a contribution towards UNIDO's system of consultations and negotiations between countries which are a fundamental element of the Lima Declaration and Plan of Action. UNIDO's technical assistance programme aims, inter alia, at providing practical assistance to developing countries in the creation (including R and D activities) of new sources of energy tailored to the industrial requirements of specific countries, evaluating the existing technology in such fields as solar and wind energy and assistance in establishing repair and maintenance services, for example electric power generating equipment. Examples of UNIDO's assistance in this field are as follows:

(a) (Solar energy) RP/SEN/75/001 Senegal - Evaluation of solar pump and feasibility of manufacturing within the country;

(b) IS/MLI/75/018 Mali - Studying of possibilities for creation of solar laboratory;

(c) (Wind power) IS/KEN/75/010 Kenya - Evaluation of prototype production and of low cost water development equipment (windmills);

(d) (Biogas) GLO/75/001 Global - Mobilization and evaluation of existing technologies for production of biogas in developing countries. Transfer of this technology to other developing countries on an integrated planned basis. Development of production capacity for appropriate equipment;

(e) (Natural gas) SM/RWA/71/805 Rwanda - Rehabilitation of plant for natural gas recovery, Cape Rubona;

(f) (Peat) IS/BDI/73/009 Burundi - Exploitation and industrial utilization of peat to replace use of wood in economy;

(g) IS/RWA/70/001 Rwanda - Industrial utilization of peat for replacing use of wood in economy;

(h) National project, Somalia - evaluation of two solar sea water distillation plants: 2,000 net evaporating square metres and 200 square metres respectively, supplying 10 solar stills of about one square metre each.

XI. UNITED NATIONS DEVELOPMENT PROGRAMME

57. Energy-related projects now being executed by the UNDP Office for Projects Execution are as follows:

(1) NEP/73/014 - Karnali River Basin Development

This project is a feasibility study for the development of a hydroelectric scheme at Chisapani on the Karnali River. The possible installed capacity is 1,800 MW, and most of the power is meant to be exported to India's electric grid.

(2) NEP/76/031 - Reconstruction of Phewa Dam

UNCDF has granted to the Government of Nepal the foreign exchange component of \$1,927,000 for the reconstruction of a small dam at Pokhara which collapsed in January 1975. The dam will allow operation of the existing hydroelectric plant of 1,000 kW and the irrigation of 320 hectares.

(3) MAR/73/007 - Quatre Soeurs Hydroelectric Scheme

This project includes the feasibility and design studies for the construction of a hydroelectric plant of 15 MW installed capacity at Quatre Soeurs.

(4) BRA/74/007 - URU/74/021 - Yaguaron River Irrigation Project

This project consists basically of the final engineering design for a dam forming a reservoir, with irrigation canals leading to approximately 10,000 ha for irrigation in Brazil and 12,500 ha in Uruguay. There is also a study required to determine the feasibility of a small 4 MW hydroelectric development using the surplus discharges not required for the irrigation system.

(5) BRA/74/028 - Integrated Development of the Paraguay River in Brazil

The purpose of the project is to plan the integrated development of water and land resources in the Paraguay River basin in Brazil. In the energy field, this will include the identification of demand for power and the preliminary location and evaluation of adequate sites for hydroelectric works.

(6) PAR/75/002 - Preparatory Assistance Missions in Paraguay for Renewable Energy Sources

This project involves sending a mission to the Chaco region of Paraguay in order to set up the terms of reference for a pilot project studying the feasibility of utilizing wind and solar energy for pumping water for irrigation and potabilization of water for human, animal and agricultural consumption.

(7) GUA/74/014 - Petroleum Development

This project consists of assisting the Government in preparing new petroleum legislation, training of officials for the Petroleum Organization and supervision of activities relating to petroleum exploration.

XII. UNITED NATIONS INSTITUTE FOR TRAINING AND RESEARCH

58. The United Nations Institute for Training and Research (UNITAR) has been active in the field of energy research and continues to be interested in the field. Its activities in the energy field have been principally carried out within the programme of the Project on the Future, under the direction of M. Philippe de Seynes, and have thus taken as their perspective future needs and problems, rather than the assessment of particular present day difficulties or assistance with specific problems.
59. Subject to severe financial limitations, the general purpose of the Project on the Future is to review existing and likely trends and to compare the implications of these trends with projected needs or desired goals. In the field of energy, this has meant a monitoring and evaluation of energy research and development and the dissemination of those research breakthroughs or technological developments that appear to offer promise for fulfilling the world's energy needs and, in particular, those of developing countries.
60. The first part of the programme concerns the dissemination of ideas and information, which has so far taken three primary forms: the sponsorship of public lectures (often in conjunction with the Department of Research), the publication of studies on energy problems and the issuance of a journal of comment and opinion - Important for the Future - of which energy is one of three major topics, the others being food and agriculture and the environment. In the lectures, studies and journal, UNITAR has not declined to promote unconventional or controversial ideas when it was felt that the ideas warranted attention, for it is believed that no person or country has a monopoly on creative knowledge and that alternatives not appropriate to some societies or contexts may be optimal for others.
61. The second part of the Project on the Future's energy programme consists of the organization of seminars and conferences on research and development efforts in the energy field. The aim of the seminars and conferences is threefold:
- (a) To assess the state of the art;
 - (b) To provide a forum for the international exchange of ideas and research results;
 - (c) To make more widely known the potential practical applications of research, knowledge of which is normally confined to national or specialized academic and industrial communities.

62. In pursuing these aims, UNITAR hopes to draw attention to the variety of alternative energy resources and policies that can be pursued in developing different resources. Examples of this type of programme are the Conference on the World's Future Supply of Petroleum and Natural Gas, organized with the International Institute for Applied Systems Analysis (IIASA) and held in July 1976, and the Seminar on Microbiological Energy Production, organized with the University of Göttingen and held in October 1976.

63. The Project on the Future also anticipates conducting short courses to acquaint educators, scientists and government officials in developing countries with the findings of the research and developments activities in energy that are being carried on in the universities, corporations and government agencies of the developed world.

XIII. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

A. Role of the energy programme within the Food and Agriculture Organization of the United Nations (FAO)

64. Agriculture is essentially an energy conversion process - the transformation of solar energy and other energy-based products into food and fibre for human consumption.

65. Traditional farming depends mainly upon solar energy conversion by photosynthesis and upon secondary (and renewable) energy sources such as organic waste and human and animal power for producing crops.

66. High productivity in food and fibre production has been achieved by applying high-yielding plant varieties, fertilizers, pesticides, farm machinery, improved irrigation and drainage methods, storage processing and distribution of agricultural products and improved farm management. Most of these inputs require energy for their manufacture, distribution and application. This "added" energy is to a large extent based upon fossil fuels.

67. "Added" energy can be defined as:

(a) Energy needed by industry for the manufacture of agricultural inputs, such as fertilizers, pesticides, farm machinery, building material etc.;

(b) Energy directly used at the farm level, for example for combustion engines, electric motors, heat generation etc.

68. In advanced countries it has been estimated that 12 to 16 per cent of the nation's energy is consumed in the food system of which about 3 per cent is for agricultural production.

69. The sharp increases in the price of crude oil has generated wide interest in the development of new and alternative sources of fossil fuel supplies. It also stimulated appraisal of areas in which savings in fossil fuel can be achieved without substantial loss of productivity.

70. From the foregoing general assessment of energy in agriculture, it is obvious that considerable number of activities in FAO are energy related, and that the appropriate use of all types of energy plays an important role in the increase of world food production and supplies.

B. Energy-related activities

71. Energy-related activities within FAO include:

(a) The monitoring of meetings and publications related to energy with particular reference to agriculture. Reference material on the use of energy in agriculture has been compiled;

(b) Preparation of publications on energy which includes a perspective on energy sources and utilization with particular reference to agriculture, as well as preparing a paper on the subject in the FAO SOFA (State Food and Agriculture) publication. Consideration is being given to bringing up to date past FAO publications on the use of solar, wind and biogas energy in agriculture. A paper relating to the subject, "Energy for agriculture in developing countries" has been published in the FAO Monthly Bulletin of Agricultural Economics and Statistics (February 1976);

(c) FAO's participation through its agricultural projects in developing countries in the efficient use of machinery, chemicals (fertilizers, pesticides and organic matter), irrigation systems etc.;

(d) The organization by FAO, together with UNEP, a programme on applying on a large-scale for various crops the symbiotic fixation of nitrogen from the air;

(e) The dissemination of information through fertilizer, pesticides and farm machinery statistics;

(f) Activities relevant to the subject of fuelwood plantations, efficient use of fuel wood and charcoal and the manufacture of charcoal;

(g) Preparation of publication entitled, "Rice husk as an energy source";

(h) FAO's involvement in the preparations for a seminar on residues utilization which aims at identifying priorities for using organic residues as an energy source;

(i) Complying with requests from Governments and individuals for advice on energy, including both traditional and alternative energy sources.

XIV. UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION

72. The role of the United Nations Educational, Scientific and Cultural Organization (UNESCO) in the world-wide energy programme is restricted to its terms of reference within the United Nations family and is therefore centred on education and research in the basic and engineering sciences related to the fundamental problems of resources, production, conversion, transmission, storage and utilization of energy, taking into account their environmental and social implications, with particular reference to developing countries.

73. The programme reflecting the above-mentioned philosophy covers the following main items:

(a) Identification of the basic scientific and technological energy problems requiring international co-operation, through the organization of periodic forums;

(b) Transfer of information to developing countries concerning appropriate technologies and procedures in the field of energy production, conversion, transport and utilization, through the organization of seminars and symposia, studies and publications;

(c) Assistance in training of personnel in technical disciplines appropriate to the needs of developing countries in the field of energy resources, development and utilization, through training courses, fellowships and UNDP projects;

(d) Assistance in the promotion of global and regional co-operation in energy resources research and development, through feasibility missions and support to global and regional activities.

74. UNESCO has been involved in the different aspects of energy problems, related to the advancement of science and technology, for the past 20 years. The programme started with the initiation of a project on solar energy utilization as part of the Arid Zone programme. Renewed interest for energy was experienced in 1970 when a consultative group, invited to advise the Director-General on engineering research programmes, recommended the initiation of an international co-operation programme in the field of heat and mass transfer which is the basic science for design and construction of installations for energy production, conversion and utilization for a wide range of different sources of energy. Consequently, UNESCO has co-sponsored and participated in several scientific seminars and summer schools in the field of heat and mass transfer. Such seminars and summer schools have now, in collaboration with the International Centre for Heat and Mass Transfer, become annual events.

75. In 1974 two working groups were organized in parallel with the Fifth International Heat and Mass Transfer Conference in Tokyo and the Ninth World Energy Conference in Detroit respectively. Both working groups recommended that the UNESCO programme should cover such topics as nuclear fission and fusion, geothermal, wave energy and ocean thermal gradients, and means of implementing this programme were

also suggested. The General Conference of UNESCO recommended, at its seventeenth and eighteenth sessions, the promotion of research in selected fields which may permit development of new sources of energy.

76. Consequently, negotiations were held with member States in Asia regarding support for the establishment of a regional centre for heat and mass transfer. Consultations with African experts and the Economic Commission for Africa were held on the feasibility of creating a regional research and training programme in science and technology applied to energy problems. Another feasibility study mission to Latin America was carried out with the aim of assisting in the development of regional research programmes in heat and mass transfer.

77. An International Forum on Fundamental Scientific and Technological Energy Problems was held at UNESCO headquarters in December 1975. The Forum drew up a list of the most important scientific and technological problems, crucial to energy development, requiring international co-operation for their solution.

78. The preparation of several publications is under way. Of these may be mentioned a study entitled, "Modern trends in energy development" and a book, to be published in 1976, entitled "Solar electricity, the coming energy source".

79. The continued programme in solar energy included activities such as: the award of post-graduate fellowships for scientists from developing countries for research and study at advanced centres; the establishment of a solar energy course at the Centre Universitaire of Perpignan, France; technical assistance, under the Participation Programme, to Cuba and Mexico; and the organization of a seminar entitled "Solar energy and its applications" in Africa, Niamey, Niger, in October 1972. These activities culminated in 1973 with UNESCO's participation and sponsorship of the International Congress entitled "The sun in the service of mankind" at UNESCO House from 2 to 6 July 1973, preceded by an International Working Party.

80. A UNDP mission, including a UNESCO consultant, was established in May 1975 in order to study possibilities regarding solar energy activities in the following African countries: Chad, Ivory Coast, Mali, Mauritania, Niger, Senegal, Upper Volta and the United Republic of Cameroon. A mission concerning a feasibility study on solar energy activities in Latin America is under preparation.

81. A panel of Arab experts was held at the UNESCO Regional Office in Cairo in October 1975. UNESCO is supporting international congresses in solar energy by offering travel grants to participants from developing countries. In 1975, contracts were established with the first "Latin American Congress on Solar Energy" in Buenos Aires and with the ISES meeting in Los Angeles. A UNESCO/WMO Solar Energy Symposium will be held in Geneva in August/September 1976. UNESCO is also organizing a European Solar Energy Working Group to be held at Genoa University, Italy, in October 1976.

82. The UNESCO draft Programme and Budget for 1977-1978 foresees an increase in the present activities related to energy and the draft Medium-term Plan for 1977-1982 recommends a gradual expansion of the programme of promotion of international co-operation and research and training in the basic and engineering sciences related to energy.

XV. WORLD BANK

General

83. Since its creation soon after the Second World War, the World Bank has been heavily involved in the financing of energy development, particularly electric-power systems expansions, but also in coal mining, oil and natural gas transportation and processing.

84. In line with general developmental policies, it has increasingly shifted its assistance to the lower income countries, and to the lower income groups in high and medium income developing countries. Its power projects have begun to show larger allocations of investments for rapidly increasing supply to the rural and urban poor.

85. The 1973-1974 increase in international oil prices has led the World Bank to a re-evaluation of its role in the fuel producing sectors of energy-importing developing countries. A gradually increasing involvement in this area may be foreseen.

86. The World Bank is also paying much greater attention to alternative energy sources which may play a significant role in solving problems. These include better management and utilization of non-commercial fuels (agricultural wastes, firewood, cow dung) as well as new decentralized technologies (for example solar water heaters, windmills etc.). Several small research projects are under way in co-operation with developing countries interested in these areas.

87. Finally, in the general framework of Bank economic and policy advice to developing countries, an increasing number of energy sector studies have been carried out and are planned to provide guidance on energy planning, institutions, pricing etc.

Lending

88. So far the World Bank has lent about \$9 billion for energy projects. This represents one fifth of all World Bank financing.

89. In the power sector, the World Bank has made 294 loans to 69 different countries and is by far the major source of financial support, accounting for more than the combined lending of all other official multilateral and bilateral banks.

90. In the fossil fuel sector, the World Bank has been involved in 14 projects for oil and natural gas and 4 for coal development.

Sector surveys. Technical assistance

91. In-depth energy sector studies have been carried out since 1974 in six countries with complex energy situations. More of these studies will be done in the future. The main object is to assist policy making, institution building and selection of projects.

Resources and technological studies

92. Studies have been carried out with the assistance of outside consultants to re-evaluate the petroleum, coal and geothermal potential of developing countries. Reviews of technological developments have been undertaken (for example biogas, solar heaters, solar cells, windmills). Feasibility studies regarding the use of these technologies under specific conditions are planned. A periodic evaluation of the status and possible role of nuclear power is carried out.

Analytical tools for energy system studies

93. A comprehensive review of analytical tools for better energy system analysis has been started with a view to their application in policy making in developing countries. A first report on energy demand forecasting methodologies has been drafted. The Bank has developed a model to simulate the relationships of economic and energy growth in developed countries members of OECD. A similar model for developing countries is under consideration. The Bank has also available for use other models for power system, transportation and energy sector studies.

International developing countries' energy studies

94. The Bank analyses and projects the probable behaviour of energy consumption, production and imports by developed and oil-importing developing countries; international energy and oil trade; and oil-export volumes of oil-exporting developing countries. It considers oil-export prices and receipts for major oil-exporting countries in the context of analysing the economic prospects for developing countries. These studies are of particular significance in the evaluation of the economic outlook of developing countries which the Bank carries out periodically.

XVI. WORLD METEOROLOGICAL ORGANIZATION

Role of the energy programme

95. In June 1976, the Executive Committee of the World Meteorological Organization (WMO) recognized the increasing importance of meteorology and operational hydrology in relation to energy problems and adopted resolution 15 (EC-XXVIII) approving a plan of action assigning responsibilities to the Commission for Hydrology, the Commission for Special Applications of Meteorology and Climatology, the Commission for Atmospheric Sciences, the Commission for Instruments and Methods of Observation and the Commission for Agricultural Meteorology.

96. A short description of energy-related activities is given below:

(a) Fields concerned with renewable energy sources, hydropower and solar and wind energy. In relation to hydropower problems, the responsibility of WMO for international operational hydrology covers networks of hydrological observing stations, methods of observation and standards of measurement. The study of the undeveloped potential for energy from water resources is another and very important part of the work on this aspect. Research into and methods of hydrological forecasting are also relevant. In the field of solar energy, WMO is responsible for international networks of stations for measuring solar radiation, for international methods of observation and standards for measurement including the comparison of reference instruments and publication of radiation data. Research activities aimed at the computation of radiative fluxes in the atmosphere come within this field. In the field of wind, WMO is responsible for the international networks of meteorological observing stations at which wind velocity is measured as well as for the international methods of observation and standards for measurement. Information from a selected number of stations is published in world weather records. Research aspects of the variation in wind velocity with height are covered by a working group on boundary layer conditions. In all three fields described above, technical publications have been issued and an enhanced programme is envisaged. Transfer of technology is also being covered through seminars symposia, technical conferences and training courses;

(b) WMO is also concerned with the international meteorological and operational hydrological aspects of energy conservation, transport, exploration and production; activities in these fields include building climatology, weather forecasting for oil tankers, ice forecasting for electrical transmission lines, and the planning and day-to-day forecast support for off-shore oil exploration and hydropower production;

(c) Problems concerned with the consumption of energy. WMO is highly involved in the pollution problems arising from energy consumption, including the large-scale anthropogenic heat and water vapour release into the atmosphere and heat release into water both of which may have the potential to alter local, regional and even global climate. Hydrocarbon pollution from either completely burned petroleum fuels or from combustions processes, natural and anthropogenic is also of importance and is being studied within WMO.

97. Again, transfer of technology in subjects (a) and (b) is undertaken through technical publications, seminars, symposia, technical conferences and training courses.

XVII. INTERNATIONAL ATOMIC ENERGY AGENCY

98. The responsibilities and functions of the International Atomic Energy Agency (IAEA) in the field of energy follow from article III of its statute which, among other functions, authorizes the Agency to:

(a) Encourage and assist research on the development and practical application of atomic energy for peaceful uses throughout the world;

(b) Make provision for materials, services, equipment and facilities for all peaceful applications of atomic energy including the production of electric power with due consideration for the needs of under-developed areas of the world. While IAEA has performed these functions from the beginning of its activities, they have received a special significance as a result of the recent sharp increases of fossil fuel prices which have made it essential for a series of developing countries to reassess the role of nuclear power within the general planning of their future energy supply and to initiate or expand nuclear power construction programmes.

99. In response to these needs the Agency has:

(a) Developed analytical methods and programmes to determine the costs and constraints of alternative plans for electric power expansion in order to ensure optimal integration of nuclear power. The application of these methods to individual developing countries requesting this service (to date, 17 countries) is carried out through field missions coupled with the training of engineers from the recipient countries at the Agency's headquarters;

(b) Begun the development of a general energy data base with special emphasis on nuclear fuels, their resources and costs, which is progressively extending to other energy sources as well as to estimate future primary and electric energy demand in individual developing countries;

(c) Initiated a wide programme of training in the field of planning, construction and operation of nuclear power plants involving, in particular, a series of three-month to four-month courses in the Federal Republic of Germany, France and the United States of America which are intended for participants from developing countries at various stages of nuclear power development;

(d) Focused its activities in the field of exchange of scientific and technical information on those areas of the nuclear power field which call for special and immediate attention and in particular on the nuclear fuel cycle and on nuclear power safety. In particular, a programme for establishing nuclear safety standards is under way;

(e) Placed special emphasis on assisting developing countries, with regard to research and development of energy resources, in uranium exploration through training, provision of equipment and large-scale UNDP-financed prospecting projects as, for instance, in Chile, Greece, Morocco, Pakistan and Turkey. The establishment of task forces consisting of consultants to assist member States with general assessments of their indigenous uranium resources and exploration policies may be initiated in 1977 in co-operation with OECD.

100. Because certain materials in the nuclear fuel cycle may be used for the manufacture of nuclear explosives, it is one of the Agency's principal statutory tasks to apply safeguards against such use. A large portion of the Agency's safeguards activities is undertaken pursuant to the Treaty on the Non-Proliferation of Nuclear Weapons (General Assembly resolution 2373 (XXII), annex) of 12 June 1968. In the performance of these general activities in the field of energy, the Agency has established a working liaison and co-operation with practically all international organizations active in the energy field and, in particular, with the United Nations and its regional commissions, IBRD, OECD, UNIDO, IIASA and the World Energy Conference.
