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Activities of the relevant organs, organizations and bodies of the United Nations system in the field of new and renewable sources of energy

Addendum

Report submitted by the United Nations Industrial Development Organization*

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UNITED NATIONS INDUSTRIAL
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REPORT ON ENERGY-RELATED INDUSTRIAL DEVELOPMENT ACTIVITIES

With special attention to the development and to the utilization of new and renewable sources of energy in industry

Prepared for submission to the Preparatory Committee of the United Nations Conference on New and Renewable Sources of Energy according to Decision 7 (II), paragraph (e) adopted at the Second Session of the Committee, Geneva, 21 July-1 August 1980

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Explanatory notes

References to dollars ($) are to United States dollars, unless otherwise stated.

The following abbreviations are used in this publication:

ACC	Administrative Committee on Co-ordination
GDP	gross domestic product
ICPB	Investment Co-operative Programme Branch
INTIB	Industrial and Technological Information Bank
MBd	million barrels a day
MHG	mini hydroelectric generation units
MVA	manufacturing value added
NRSE	new and renewable sources of energy
OECD	Organisation for Economic Co-operation and Development
SAGE	Special Advisory Group on Energy
SIDA	Swedish International Development Authority
UNCSTD	United Nations Centre for Science and Technology for Development
WAES	Workshop on Alternative Energy Strategies
WEC	World Energy Conference

PREFACE

This Report, prepared in accordance with the recommendation of the Preparatory Committee for the United Nations Conference on New and Renewable Sources of Energy,[1/] presents the experience of UNIDO in energy-related industrial development activities and pays special attention to the development and the utilization of new and renewable sources of energy in this area.

Energy, technology (human resources) and finance are the three critical inputs for industrialization. The impact of the "energy emergency" on industrialization creates problems and opportunities for the developing countries. It is the view of UNIDO that the latter more than outweighs the former. New processes, new products and new energy solutions are already being developed and applied in the developing countries. The energy-related programme of UNIDO, in terms of studies, technical assistance, technological development and investment promotion, can be expected to expand in the next few years. It will be directed along three main guidelines proposed by the UNIDO secretariat, namely, "energy for industry", "industry for energy" and "energy management", as mentioned in the Report of the Secretary-General, to the General Assembly at its thirty-fifth session.[2/]

Although the scope of the forthcoming United Nations Conference is restricted to the development and use of new and renewable sources of energy, it is clear that the corresponding analyses and decisions cannot be carried out without taking the broader setting in which energy issues have to be considered into account. Accordingly, this Report focuses on the impact of development and use of NRSE in industry, but also presents information of interest for a proper understanding of the role of UNIDO.

The role and responsibilities of UNIDO in energy-related industrial development activities was implicit in the Lima Declaration and Plan of Action and were specifically referred to in the New Delhi Declaration and Plan of Action. The energy-related decisions and recommendations contained in the latter were subsequently discussed at the Industrial Development Board of UNIDO, which assigned special priority to energy-related activities. The main decisions and recommendations of the Lima and New Delhi General Conferences of UNIDO and of the Board

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1/ Report of the Preparatory Committee for the United Nations Conference on New and Renewable Sources of Energy, Second Session, Geneva, 21 July to 1 August 1980 (A/35/43), part II, part VII-B/7(II), para. 3.

2/ A/35/531, agenda item 61 (p), 15 October 1980.

are referred to in this comprehensive Report, together with the changes that were effected in the structure of UNIDO with a view to strengthening and expanding its programme of work in this vital area.

The energy-related industrial development activities carried out by the various divisions of UNIDO, with particular attention to new and renewable sources of energy, is presented in the Report. In addition, a review of the organization's arrangements and joint programmes in the energy sector that are currently being implemented in co-operation with governmental, non-governmental and various other bodies is included. The expansion of institutional co-operation in this area will receive increasing attention in the forthcoming years as the programme of work of UNIDO relating to the use of new and renewable sources of energy in industry is further strengthened and diversified. For a more complete view of the energy-related activities of UNIDO, other publications and documents should be consulted. The conceptual framework for development of an industrial energy programme, in particular, was reviewed in detail in the background paper prepared for the Ad-hoc Expert Group Meeting on Industrial Issues and Utilization in Transportation and other Allied Sectors.

This Report and the effort carried out so far represent an initial step taken by UNIDO to make a greater contribution towards achieving the Lima target through adequate analysis and action relating to the energy-industry interface.

CONTENTS

I. THE MANDATE OF UNIDO IN ENERGY-RELATED INDUSTRIAL DEVELOPMENT ACTIVITIES

The mandate of UNIDO in the energy-related aspects of industrialization, including especially new and renewable sources of energy (NRSE) has been established by the Second and Third General Conferences of UNIDO and has also been reflected in the Report of the Secretary-General to the General Assembly at its thirty-fifth session.

Lima Declaration and Plan of Action on Industrial Development and Co-operation

The Lima Declaration established what is known as the "Lima target", namely, that the developing countries' share in total world industrial production "... should be increased to the maximum possible extent and as far as possible to at least 25 per cent of total world industrial production by the year 2000, while making every endeavour to ensure that the industrial growth so achieved is distributed among the developing countries as evenly as possible. This implies that the developing countries should increase their industrial growth at a rate considerably higher than the 8 per cent recommended in the International Development Strategy for the Second United Nations Development Decade;"[1/]

This target already contains implicitly an energy target. Furthermore, in chapter III of the Plan of Action, paragraph 61 (d), the importance of energy is stressed:

> "61(d) Urgent consultations, taking into account appropriate information with respect to the development of demand and supply, availability of production factors and their costs, the possibilities and conditions of investment and the availability of appropriate equipment and technologies, with a view to facilitating, within a dynamic context and in accord with authorities available to Governments, the redeployment of certain productive capacities existing in developed countries and the creation of new industrial facilities in developing countries. These consultations should in particular relate to industries processing raw materials exported by developing countries or which consume vast quantities of energy, and should result in concrete proposals for inclusion in the development programmes of participating developing countries;"

The Third General Conference of UNIDO and the New Delhi Declaration and Plan of Action on Industrialization of Developing Countries and International Co-operation for their Industrial Development

To the Third General Conference of UNIDO, held at New Delhi from 21 January to 9 February 1980, UNIDO presented a paper entitled "The UNIDO programme for

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1/ "Report of the Second General Conference of the United Nations Industrial Development Organization" (ID/CONF.3/31), chapter IV, "The Lima Declaration and Plan of Action on Industrial Development and Co-operation", para. 28.

economic co-operation among developing countries" (ID/CONF. 4/15) that referred to energy as follows:

> "27. The vital importance of energy to the industrial development process is now widely recognized and UNIDO has tried to develop energy options and policy issues that could assist the industrialization of the developing countries. The economic position of developing countries that are not oil exporters is deteriorating with the continual rise in the price of oil and refined products, which constitute the main, and in many cases the only, energy supply for the developed part of their economies. There are equally severe, but less well known, problems in the sector of traditional fuels, where deforestation and soil erosion are the main indicators because reliable statistical evidence is lacking.
>
> "28. The urgency of the problem is underlined by the fact that the conventional fossil fuels (excluding non-conventional hydrocarbons such as tar sands and oil shales), the primary sources of harnessed energy today, do not exist in sufficient quantity to sustain the global industrial system for many more years to come. Prices will continue to rise as reserves are depleted and their unequal geopolitical distribution will continue to alter the world balance of power and the bargaining position of non-producing countries.
>
> "29. Most developing countries have some kind of indigenous energy resources that could be developed (at relatively little cost in terms of potential long-term benefits that would accrue) to help ease the strain of petroleum imports, but, with a few notable exceptions, little is being done to develop these resources. Many have relatively untested potential for conventional energy development; others possess non-conventional sources, for which the extraction technology exists, and whose exploitation is fast becoming economic, given the increased prices of conventional oil, but about which little or nothing is being done. The need for technical and economic co-operation among developing countries in the energy field is therefore acute. Development of these resources requires massive investment, which should be a matter of high priority in the case of conventional oil and gas, while other resources, such as oil shale and tar sands, should be studied and evaluated.
>
> "30. A pioneering project to assist the Government of Kenya to explore possibilities of energy production from biomass is in an advanced stage of implementation by UNIDO. If successful, it could form a nucleus for launching co-operation among developing countries that have similar resources to those of Kenya in terms of agricultural and animal products."

The Third General Conference of UNIDO adopted the New Delhi Declaration, which states in chapter II, paragraph 103, that:

> "The Conference recognizes the important role which energy can play in the industrialization of developing countries. In this context, it stresses the need for the use of alternative sources of energy and that attainment of the Lima target through the accelerated establishment of industrial capacities would require adequate availability of energy resources, inter alia, new and renewable sources such as geothermal energy, biomass, wind and solar power, development of conventional sources of energy, and the need for rationalization of the consumption of

energy, at the global level, particularly by developed countries. It also stresses the importance of the forthcoming United Nations Conference on New and Renewable Sources of Energy, to be held at Nairobi, Kenya, in 1981, and underlines the need for UNIDO to make an effective contribution to the work of the Conference."2/

Chapter IV refers specifically to energy and recommends action to be taken by the developing countries, the developed countries and by UNIDO. It is recommended that developing countries:

"200. Establish and strengthen national action programmes on energy availability and development, assuring adequate availability for industrialization and overall economic and social development.

"201. Enlarge the raw material base for the energy sector and more efficient utilization of all energy potential.

"202. Strengthen, and establish where necessary, medium- and long-term national action programmes on new and renewable sources of energy such as geothermal, biomass, wind, solar and hydraulic energy.

"203. Undertake research, development, and other measures for conservation of energy resources, their more efficient use, and recycling of materials in the energy sector.

"204. Make greater use of the significant potential of the peaceful uses of nuclear energy in meeting the energy needs of industrial development.

"205. Establish, among developing countries, multinational enterprises in energy and energy-related capital equipment.

"206. Promote co-operation among developing countries through regional and subregional energy plans and research centres for new techniques in energy.

"207. Intensify and enlarge the exchange of experience among developing countries in the energy sector through joint research and training, exchange of skills and information on standards and co-operation in production.

"208. Provide support to energy-related programmes in other developing countries."

It is recommended that developed countries:

"209. Rationalize the consumption of energy, in particular of non-renewable sources of energy, and intensify the research and use of non-conventional sources of energy, implementing effective national programmes including conservation measures, promoting more efficient use of energy in industry and industrial recycling.

2/ New Delhi Declaration and Plan of Action on Industrialization of Developing Countries and International Co-operation for their Industrial Development (PI/72), p. 23.

"210. Adapt energy-related technology and capital equipment to the needs of developing countries.

"211. Support financially, technologically and through other means the energy development activities of the developing countries.

"212. Make available to developing countries, on concessionary terms, the results of their research and development on industrial uses of energy, options on energy-saving measures, and on new, non-conventional and renewable energy sources.

"213. Assist the developing countries, at the request of the countries concerned, in the identification of alternative sources of energy.

"214. Rectify their export policies, removing arbitrary restrictions on the transfer of nuclear technology needed by developing countries for their industrialization.

"215. Promote bilateral programmes of development, testing and training co-operation between developed and developing countries with parallel testing centres in similar geophysical climatic conditions."

It is recommended that the UNIDO secretariat:

"216. Assign higher priority to the promotion of energy and energy-related technologies for industrial development in its technical assistance programmes, including training programmes.

"217. Prepare operational projects and programmes of direct relevance to developing countries in energy-related fields to be financed from the Fund set up by UNCSTD.

"218. Ensure that INTIB accords special attention to the collection and dissemination of information on alternative energy technologies of immediate relevance to developing countries.

"219. Prepare, in co-operation with the United Nations Centre on Transnational Corporations, and other competent United Nations bodies, a report on the practices of such corporations in the utilization of natural resources, particularly energy resources, of the developing countries, affecting their industrialization.

"220. Prepare, at all times, state-of-the-art reports and disseminate information on energy technologies such as geothermal, biomass, wind, solar and hydraulic energy.

"221. Make an effective contribution to the preparation and work of the forthcoming United Nations Conference on New and Renewable Sources of Energy.

"222. Strengthen its co-operation with other organs and agencies of the United Nations system and other concerned organizations on matters relating to energy.

"223. Prepare projections of the energy requirements of the developing countries, and in particular of the least developed countries, for achieving the Lima target."3/

Report of the Secretary-General to the General Assembly

The report of the Secretary-General to the General Assembly at its thirty-fifth session on development and international economic co-operation - "Ways in which the United Nations system can more effectively assist Member States in the area of new and renewable sources of energy", summarized the activities of UNIDO as follows:

"58. In line with the targets established at the second General Conference of UNIDO (Lima, 1975) and with subsequent decisions of the third General Conference and of the Industrial Development Board, which assigned high priority to activities relating to the energy/industry interface, the Executive Director of UNIDO has established within the secretariat a Special Advisory Group on Energy, to co-ordinate the organization's effort to strengthen its energy-related programme of work and to prepare its contribution to the forthcoming Conference.

"59. In this context, UNIDO will give special consideration to three essential aspects of the energy/industry interaction, with particular attention to the use of new and renewable sources of energy:

(a) The 'energy for industry' aspect, i.e., the development of an appropriate industrial pattern of processes and products on the basis of the pattern of locally available energy, especially from new and rewable sources;

(b) The 'industry for energy' aspect, i.e., the development of a local technological and industrial capability to do research, design, fabrication and servicing of the capital goods needed for development of the energy sector;

(c) The 'energy management' aspect, i.e., the optimization of energy use in industry through 'conservation', substitution and diversification as a means to increase the energy self-sufficiency of developing countries, especially through use of new and renewable energy sources.

"60. Accordingly, UNIDO will provide technical assistance in the following areas:

(a) Enhancement of the planning capabilities of developing countries, with identification of energy strategies appropriate to their industrial sectors;

(b) Promotion of research into energy-related industrial technologies to stimulate the development of novel processes and products best suited to the requirements and resources of developing countries;

3/ Ibid., pp. 37-39.

(c) Establishment or expansion of local capabilities to produce the capital goods needed for the energy sector;

(d) Efficient utilization of energy in industry encompassing effective energy management at the national, sectoral and plant levels;

(e) Expansion or establishment of technological institutions and related training schemes in order to develop the technical and managerial capabilities essential to the optimum utilization of energy in industry and to the production of related equipment;

(f) Industrial production of fuels and feed-stocks derived from biomass and hitherto unutilized raw materials such as shale and tar sands.

"61. These technical assistance activities will be complemented by the conduct of sudies on specific aspects of the energy/industry relationship. Particular attention will be devoted during the next biennia to the analysis of newly emerging patterns of industrial energy supply and to the projection of industrial demand for energy, in terms of types and quantities, so that the developing countries may have at their disposal the information they need to adapt to far-reaching changes in the pattern and pace of energy availability. These will also serve as a basis for the developing countries to seize the opportunity to establish or expand their industrial capacities with use of their great potential in new and/or renewable sources of energy.

"62. The organization has already published a number of guides to information sources, reports on industrial technology for various energy sources and is preparing a manual for mini-hydropower engineering It has also organized technical consultations among developing countries on large-scale biogas technology and study tours in the field of operation, manufacture and maintenance of medium- and small-scale power plants. A number of technical assistance projects in the field of new and renewable sources of energy are under implementation by UNIDO. Technical consultation and study tours are being organized at the interregional level.

"63. As for pipeline activities, UNIDO is considering implementation of a series of projects dealing with production of specialized equipment for and with the promotion of utilization of new and renewable sources of energy.

"64. In accordance with the UNIDO terms of reference, the organization will intensify its co-operation with United Nations agencies and national and international organizations in energy-related industrial problems and opportunities, especially in the areas of biomass, hydropower and other sources of new and renewable energy."4/

4/ Report of the Secretary-General, Thirty-fifth Session, agenda item 61 (p), document A/35/531.

II. SCOPE OF THE ENERGY-RELATED ACTIVITIES OF UNIDO AS REFLECTED IN THE DOCUMENTS PREPARED FOR AND THE DELIBERATIONS OF THE INDUSTRIAL DEVELOPMENT BOARD

In 1980, the UNIDO Industrial Development Board at its fourteenth session in the spring and its second special session in the fall devoted special attention to energy-related activities, as did its Permanent Committee at its thirteenth and fourteenth sessions. Relevant extracts from the documents prepared by the secretariat for these bodies and from the reports of the IDB are given below.

Report of the Industrial Development Board on the Work of its Fourteenth Session

"54. At its 281st meeting, on 19 May 1980, the Board, in considering item 7, agreed that in order to accelerate the industrialization of the developing countries, UNIDO's programme of work for 1981, and 1982-1983, should, taking fully into account the need for close co-operation with other relevant United Nations bodies, give priority to activities in the following areas with due regard to the need for appropriate institutional arrangements to effectively implement this programme: industrial technology, energy-related industrial technology, industrial production, development of human resources, and special measures for the least developed countries.a/ The Board agreed that priority should be given to the System of Consultations and agreed on the importance of industrial restructuring, including social aspects of industrialization. This area would be given careful consideration at the next regular session of the Board. The Board requested the Executive Director to communicate to the Secretary-General of the United Nations the above-mentioned priorities. The Board also requested the Executive Director to submit a work programme for 1981 reflecting those priorities, for consideration by the Permanent Committee at its fourteenth session in early October 1980 and the special session of the Board immediately thereafter. The Board further agreed that UNIDO's work programme for 1982-1983 should be further discussed at the fifteenth session of the Permanent Committee, and the Executive Director was requested to circulate his proposals in that regard, taking full account of the priority areas described above, for consideration by member States not later than six weeks before the beginning of that session of the Committee, if the Secretary-General's draft biennial programme budget for 1982-1983 were not available at that time.9/

"a/ The listing is without prejudice to the order of priorities.

"9/ For statements made subsequent to the adoption of the consensus conclusion, see chap. XVI, Adoption of the report of the fourteenth session, paras. 172 to 175, and ID/B/SR.281, paras. 121 to 128." (ID/B/248).

Revised Work Programme for 1981, C.3/99.
Report by the Executive Director

The Work Programme for 1981 starts with a reference to 1980 activities.

"18. The importance of energy and energy-related technologies to the industrial development of the developing countries and to the achievement of the industrialization target for the year 2000 set in the Lima Declaration and Plan of Action was reflected in the New Delhi Declaration and Plan of Action. Their significance was subsequently reaffirmed by the Board at its fourteenth session which attached priority to the effective implementation by UNIDO of a programme of work in the field of energy-related industrial technology when following up the decisions and recommendations of the Third General Conference.

"...

"20. In the course of the current year, [5/], and as a further step towards strengthening the capacity of UNIDO to fulfil its functions in connection with the priorities arising from the Third General Conference in the field of energy, a Special Advisory Group on Energy was established with the basic aim of defining and co-ordinating a new UNIDO energy programme which would extend into subsequent biennia.

"21. ... Steps have already been taken to co-ordinate appropriate activities; all programmes, for example, have contributed to the submission of five operational projects of direct relevance to developing countries - estimated at $5 million, to be financed from the Interim Fund for Science and Technology for Development (IFSTD) established by UNCSTD. At the same time, some 40 energy-related projects in the Industrial Operations Programme are being implemented in respect of such varied areas as coal conversion and the rational utilization of energy in the cane-sugar industry - at a total value of $6 million. Under that Programme, work has also been scheduled within the biennium on, for example, preparing guidelines for the standardization and selection of water turbines and generators for mini- and micro-hydropower plants, and assistance is being given in technical training related to the use of energy in industry. [These are detailed in a subsequent section of the report.]

"22. The schedule of studies of the Industrial Studies and Research Programme for the current biennium provides not only for the elaboration of an energy-specific typology for the developing countries and the assessment of demand for energy in those countries, but also for the elaboration of scenarios related to energy and studies on energy supply potentials and their implications for industrialization. As part of the studies conducted in respect of individual industrial branches, assessments are made of the current and projected energy requirements of those branches. This research, together with such studies as those on energy consumption in selected developing countries or the resource surveys of selected least developed countries, will contribute to the collection of data essential for a realistic assessment of the industrial energy requirements of the developing countries. This work is supplemented by an assessment of technological developments in the energy sector and their impact on industry."

5/ 1980.

These studies are also referred to in more detail in a subsequent section.

Regarding activities in 1981, the document contained, inter alia, the excerpts given below.

"23. Whereas every effort has been made, and will continue to be made, to utilize existing resources, it has to be recognized that the magnitude of the task calls for additional resources in the coming year so as to permit the definition and co-ordination of an integrated energy programme, with corresponding increases in the various subprogrammes in subsequent biennia. The main thrust of the energy programme will be upon the continued elaboration of a co-ordinated energy programme under the aegis of the Special Advisory Group on Energy, and increased attention will be paid to energy and energy-related industrial technologies in the technical assistance programme of UNIDO. These activities will be flanked by greater emphasis on the collection and dissemination through INTIB of information on alternative energy technologies of immediate relevance to developing countries and by the conduct of country surveys of the least developed, land-locked, island and most seriously affected developing countries so as to provide comprehensive inventories of their endogenous material resources - including alternative energy resources.

"24. In 1981, it is envisaged that the energy-related activities of UNIDO will involve the following programmes and subprogrammes:

(a) Executive Direction and Management. In re-directing, co-ordinating and monitoring the necessary expansion and strengthening of UNIDO activities concerned with the energy aspects of industrialization in the developing countries, the Special Advisory Group on Energy, which will co-operate with all programmes in UNIDO, will concentrate on:

The identification of problems and opportunities arising in connection with patterns of energy supply and industrialization in the developing countries;

The establishment of priorities in respect of the design, production, operation and maintenance of equipment used for energy generation, conversion and distribution;

The assessment of various sources of energy and their industrial applications - new and renewable, conventional and non-conventional;

The identification of training requirements for both technical and managerial personnel in energy questions in relation to industrial production;

The preparation of UNIDO inputs to energy-related meetings and conferences, such as the United Nations Conference on New and Renewable Sources of Energy to be held at Nairobi, Kenya, in 1981, as well as the organization of ad hoc expert group meetings such as that scheduled for 1981 on the patterns of energy supply and industrial development, which will contribute to the definition of the energy programme of UNIDO;

The strengthening of co-operation between UNIDO and other bodies in the United Nations system, other intergovernmental and non-governmental organizations, as well as appropriate national organizations, in matters relating to the utilization of energy in industry;

(b) Policy Co-ordination

Identification of new opportunities for the programming of technical assistance to the industry/energy sector;

(c) Industrial Studies and Research

Continuation of the assessment of energy requirements in the individual industrial branches, of the elaboration of an energy-specific typology as well as of the elaboration of standard scenarios, supplemented by special studies into energy supply potentials and energy consumption by industry, the latter for inclusion in the next issue of the Industrial Development Survey;

Expansion of country surveys of selected least developed, land-locked, island and most seriously affected developing countries, aimed at the preparation of comprehensive inventories of their endogenous material resources, particularly alternative energy sources;

Commencement - using data collected in previous studies supplemented by energy-specific research - of a preliminary study in preparation for the report on the practices of transnational corporations in the utilization of natural resources, particularly energy resources, to be prepared by UNIDO and other United Nations bodies, including the United Nations Centre on Transnational Corporations in the next biennium (1982-1983);

Preparation of state-of-the-art reports and dissemination of information on alternative energy technologies;

(d) Industrial Operations

Formulation and implementation of technical assistance projects related to energy to be funded not only from such sources as the United Nations Development Programme (UNDP), the Special Industrial Services programme (SIS), the United Nations Industrial Development Fund (UNIDF) and the regular programme of technical assistance, but also from the IFSTD;

Design of specialized training courses on energy and energy-related industrial technologies for nationals of developing countries, with a view to developing the managerial and technical capabilities needed to ensure optimum utilization and conservation of energy.

"25. Given the emphasis placed upon assigning higher priority to the promotion of energy and energy-related technologies for industrial development in the technical assistance programmes of UNIDO, a new programme element, 'Energy planning and management in industry', will be established to ensure a concerted approach to the provision of assistance in this area, which hitherto has been dealt with under a number of programme elements in the Industrial Operations Programme.

"26. In elaborating new projects in this sector with the aim of ensuring an optimum relationship between energy supply and industrial development, particular attention will be devoted to assisting the developing countries in identifying their energy requirements in relation to industry and in elaborating industrial development and energy supply plans that will ensure the most efficient utilization of energy in industry. Assistance will also be directed towards the production of energy-related feedstocks derived from such conventional and non-conventional resources as coal, cellulosic materials and animal waste; towards the development of alternative energy resources (e.g. hydro-electric and solar energy) in oil-importing developing countries, through such means as demonstration projects, and towards the promotion of new and renewable sources of energy through the establishment of regional and interregional technology centres. Emphasis will be placed on the conservation of energy, including the recycling of wastes and residues." (ID/B/C.3/99, pp. 11-17).

Addendum to the Revised Work Programme for 1981,
Note by the Executive Director

"8. The Third General Conference of UNIDO stressed the crucial importance of alternative sources of energy, particularly new and renewable sources, for achieving the industrialization target for the year 2000 set in the Lima Declaration and Plan of Action. Section IV of the New Delhi Declaration and Plan of Action specifies the action to be taken by the UNIDO secretariat, in addition to recommending action by developing and developed countries. A special Advisory Group on Energy has already been established within the Office of the Executive Director, by redeployment of existing resources, for the purpose of directing and co-ordinating the necessary expansion of UNIDO activities concerned with energy aspects of industrialization in the developing countries. It is the responsibility of the Group to develop and elaborate the programme with the maximum involvement of all relevant units of the UNIDO secretariat, which would subsequently be responsible for its implementation. It is envisaged that the allocation of additional resources to this Group would permit the formulation of the first phase of the new programme in this field to be largely completed in 1981.

"9. The energy programme needs to cover the following aspects, identifying the problems and opportunities and proposing priorities:

Patterns of energy supply in their relation to the industrialization of developing countries

Design, production, operation and maintenance of equipment used for energy generation, conversion and distribution

The application of various sources of energy - new and renewable, conventional and non-conventional - to industry, particularly in the developing countries

Requirements for the training in various aspects of the use of energy of technical and managerial personnel engaged in industrial production

Energy management (including conservation measures and reduction of waste by industrial users).

"10. The task of the Group is to stimulate and co-ordinate the efforts of the UNIDO secretariat in developing this programme, with the aid of expert technical advice. The enlarged Group would co-ordinate and to a large extent draft the UNIDO contribution to the preparations for and work of the United Nations Conference on New and Renewable Sources of Energy, to be held at Nairobi, Kenya, in 1981. It would likewise be responsible for the UNIDO contributions to other meetings on energy-related subjects, which would take the form of written papers, briefings and participation at such meetings." (ID/B/C.3/99/Add.1).

Follow-up of the decisions and recommendations of the Third General Conference of UNIDO

"1. The close interrelationship between patterns of industrial development and energy supply was fully recognized at the Third General Conference, at which it was stated that 'attainment of the Lima target through the accelerated establishment of industry would require adequate availability of energy resources.' 1/

"2. As the first step towards designing a programme for energy and energy-related technologies commensurate with the priority attached to the sector, UNIDO has established, through the redeployment of existing staff resources, a Special Advisory Group on Energy ...

"3. .... UNIDO will be concerned with developing a programme that will ensure the provision of the most appropriate technical assistance to the developing countries - assistance based on the reciprocity that exists within the energy-industry relationship. Seen in the most simple conceptual terms, this relationship can be expressed as 'energy for industry' in which energy is seen as an essential input into industry, and 'industry for energy' in which industry is seen as a supplier of capital goods to the energy sector. In the first instance, the need arises for analysis of the correlationship between the patterns of energy availability and industrial development in terms of structure, processes and products. In the second instance, the requirement is that of increasing the developing countries' capability to design, produce and service equipment for the generation, conversion and distribution of energy.

"4. The first correlation will call for an unprecedented thrust by the developing countries in the fields of planning, research, technology, finance and training to ensure that the industrial processes and products are best suited to their energy resources. The second correlation will necessitate the large-scale development of local technological and industrial capabilities not only to design and manufacture the equipment needed to exploit, generate, convert and distribute energy, but also to install, operate and maintain that equipment.

"5. These two aspects of the energy-industry interaction will determine to a great extent the approach to be adopted by UNIDO over the coming years. Assuming a catalytic role in its elaboration of a balanced and integrated energy programme, UNIDO will seek to provide technical assistance in the following areas:

(a) Enhancement of the planning capabilities of the developing countries, leading to the evolution of energy strategies appropriate to their industrial sectors;

(b) Promotion of research into energy-related industrial technologies to stimulate the development of processing and products best suited to the requirements of the developing countries;

(c) Establishment or expansion of a local capability to produce the capital goods needed for the energy sector;

(d) Efficient utilization of energy resources in industry, encompassing effective energy management at the national, sectoral and plant levels;

(e) Expansion or establishment of technological institutions and related training schemes in order to develop the technical and managerial capabilities essential to the optimum utilization of energy in industry and production of related equipment;

(f) Industrial production of fuels and feedstocks derived from conventional petroleum resources, coal, natural gas, biomass and hitherto unutilized cellulosic materials.

"6. These technical assistance activities will be matched by the conduct of studies on specific aspects of the energy-industry relationship. Particular attention will be devoted during the next biennia to the analysis of newly emerging patterns of energy supply and to the projection of industrial demand for energy, in terms of types and quantities, so that the developing countries may have at their disposal the information they need to adapt to far-reaching changes in the pattern and pace of energy availability, conventional and non-conventional. These studies will also serve as a basis for the developing countries to seize the opportunity to establish or expand their industrial capacities with the use of new and/or renewable sources of energy. They will also help them to decide on appropriate action in the face of shorter-term difficulties arising out of the current energy constraints.

"7. Thus, UNIDO will assume a dual catalytic function as a supplier of technical assistance and as a provider of information and analyses in an endeavour to ensure that the developing countries are assured the energy they require for their industrialization.

"1/ ID/CONF/4/22, p. 79, para. 103. The "Lima target", a 25 per cent share for the developing countries in total world industrial production by the end of the century, was established by the Second General Conference of UNIDO, which met in Lima in 1975." (ID/B/C.3/100/Add.2, p.3).

The Annual Report of the Executive Director 1980

The Annual Report of the Executive Director 1980, is in the final phase of preparation. It is expected that the text relating to energy and industrial development that is given below will appear.

"85. The importance of energy and energy-related technologies to the industrial development of the developing countries and to the achieve-

ment of the Lima target was reflected in the New Delhi Declaration and Plan of Action. This importance was subsequently reaffirmed by the Board at its fourteenth session when it attached priority to the effective implementation by UNIDO of a programme of work in that particular field.

"86. As early as 1977, the Executive Director had established a 'Task Force on Energy' with the purpose of reviewing the Organization's activities in the energy/industry interface and formulating suggestions for future action. An internal report was produced and discussed at UNIDO and, informally, with officers of certain other United Nations bodies. The final report of the Task Force, issued at the end of 1979, provided an up-to-date review of UNIDO activities at the time, and covered: basic assumptions on energy resources; problems of energy utilization in industry; production of equipment for the energy sector; production and use of fuels and feedstock; institutional implications; and co-ordination with other agencies.

"87. Many of the concepts developed by the Task Force were incorporated in the work programme of UNIDO. After the report became available, however, a number of events took place which broadened appreciably the scope, conceptual basis and medium-term goals of UNIDO efforts relating to the energy/industry interface: i.e., the Third General Conference and the fourteenth session of the Board, as well as the evolution of the energy/industry situation. Accordingly, as a further step towards designing a UNIDO energy-related programme commensurate with the priority assigned to the area, in April 1980, a Special Advisory Group on Energy (SAGE) was created, the main task of which would be to provide co-ordination and advice, at the Director level, in the particular area. Without duplicating the activities of other units of the Secretariat, the Group would co-operate with those units and advise the Executive Director on energy-related programmes and activities. Special attention would continue to be assigned to contacts with other United Nations bodies, to ensure maximum co-operation in related activities while minimizing overlap or duplication.

"88. In co-ordinating, monitoring and advising on UNIDO activities concerned with energy-related aspects of industrialization in the developing countries, SAGE would concentrate its attention on: (a) the opportunities open to developing countries as a consequence of the availability of new forms and sources of energy, and the related goals, strategies, methodologies and problems; (b) the impact of such new forms or sources on the industrialization process and on UNIDO efforts to assist the developing countries to reach the Lima target; and (c) the identification of action required to be taken in line with the three main aspects of UNIDO's energy-related programme, namely, 'energy for industry', 'industry for energy' and 'industrial energy management'.

"89. The 'energy for industry' aspect concerns the development of industrial patterns appropriate to the new and/or different patterns of energy supply confronting the developing countries; the 'industry for energy' aspect concerns the development of local capability to design and produce equipment for the energy sector; and the 'industrial energy management' aspect concerns the optimization of energy use by the industrial sector (through substitution, conservation, rationalization etc.).11/

"90. Insofar as energy sources are concerned, the basic assumptions contained in the report presented to the fourteenth session of the Permanent Committee were, in the interim, modified to take into account the comments made by delegations at that session.12/ Apart from the assumptions regarding sources, a conceptual framework for the formulation and co-ordination of an integrated and balanced UNIDO industrial energy programme was developed, based on the following:

(a) The five main or 'macro' sources of industrial energy needed by the developing countries to reach the Lima target are: fossil hydrocarbons; hydropower; coal; biomass; and nuclear power (other sources being highly location- or purpose-specific and limited in the total amount of energy they can contribute);

(b) In planning energy supplies for industrial purposes, it is important to distinguish between long-term requirements, in quantity and kind, on the one hand, and the problems created by the 'energy emergency' associated with the price and/or availability of hydrocarbons, on the other;

(c) In industrial planning, in order to cope with the 'energy emergency' two measures - apart from the development of resources - are necessary, namely improved energy management (rationalization, substitution, conservation, co-generation, optimization) and expanded manufacture for export, to gain the additional foreign currency with which to pay for energy imports.

"91. The 'energy dimensions' of the Lima target may be summarized as follows. The developing countries (including the centrally planned Asian countries) in 1980 had an estimated joint GDP of the order of $2,200 billion. Their total energy consumption was about 1,700 megatons, i.e. 34 MBd of oil equivalent. Their industrial output was of the order of $450 billion (MVA). For the year 2000, a projection consistent with the Lima target (assuming a 7.3 per cent growth rate) would indicate a joint GDP of $9,000 billion (1980 prices) with total energy consumption of the order of 6,500 megatons, i.e. 130 MBd of oil equivalent. Their industrial output expressed in MVA would be of the order of $2,300 billion. Up to the year 2000, the accumulated GDP of the developing countries could reach $90,000 billion (in 1980 prices), and it is estimated that about 5 per cent of that accumulated GDP would be required for meeting the additional energy-related investment for the period. From these figures, it may be concluded that the industrial energy requirements of the developing countries, and those countries' demands for energy-processing equipment, will call for an unprecedented effort in the areas of national planning and international co-operation.

"92. When the energy dimensions of the Lima target are considered together with the related assumptions and concepts mentioned above, it becomes clear that UNIDO will have to strengthen its programme of activities with respect to 'energy for industry', 'industry for energy' and 'industrial energy management'.

"93. In 1980, UNIDO continued its co-operation with the Secretariat of the United Nations Conference on New and Renewable Sources of Energy in the preparatory work for that Conference, to be held in Nairobi in August 1981. The Organization participated in two inter-agency meetings held in that connection in New York and Geneva, respectively; in the

first and second rounds of the preparatory Technical Panel Meetings (in particular in those meetings directly related to UNIDO's own activities); and in the Expert Group Meetings on 'Information flows' and 'Finance' in Geneva. In February 1980, UNIDO played host in Vienna to a technical panel meeting on hydropower and contributed a number of documents.

"94. At the request of the Conference secretariat, UNIDO submitted draft terms of reference for an ad hoc expert group meeting on 'industrial issues', scheduled to be held in Vienna, in January 1981, with UNIDO backstopping. Other contributions to the preparatory work for the Conference were submitted to its Secretariat or were under preparation in 1980. These included a background paper for the 'industrial issues' meeting and a comprehensive report requested by the preparatory committee at its second session. The participation of staff members in the Conference activities, and the preparation of written contributions, were the object of close in-house teamwork, involving the substantive divisions and programmes and co-ordinated by SAGE.

"95. UNIDO continued in 1980 to implement its diversified programme of energy-related activities, including the preparation of the technical assistance projects and studies mentioned elsewhere in this Report (chaps. II and IV). Towards the end of the year, an Industrial Energy Engineering Unit was established in the Office of the Director of the Division of Industrial Operations.13/ Within the framework of the UNIDO Energy Programme, co-ordinated by SAGE, and in accordance with requests from developing countries, the Unit will be responsible for the implementation of certain energy-related technical assistance projects falling outside the terms of reference of existing units of the Division of Industrial Operations and for the provision of substantive assistance to those units in the development and implementation of their energy-related projects.

"11/ Cf. ID/B/C.3/100/Add. 2, para. 2.

"12/ ID/B/249, paras. 46-50.

"13/ UNIDO/OED/B.180 - 3 November 1980."

III. ORGANIZATIONAL ARRANGEMENTS AT UNIDO FOR ENERGY-RELATED ACTIVITIES

Industrialization requires a number of inputs, among which energy stands out today, together with technology and finance, as an essential one requiring special attention and specific action.

As early as 1977, the Executive Director established a "Task Force on Energy" with the purpose of reviewing the organization's activities as they relate to energy and formulating suggestions for future action.

The Task Force prepared a report on UNIDO activities up to the end of 1979, including basic assumptions on energy resources, a review of the problems of energy utilization in industry, considerations regarding production of equipment for the energy sector, production and use of fuels and feedstock, institutional implications and co-ordination with other agencies.

Many of the concepts developed and the proposals made in the Task Force report have been or will be incorporated in the programme of work of UNIDO. It should be noted, however, that after the report became available, a number of important events took place that have broadened appreciably the scope, the conceptual basis and the medium-term goals of UNIDO energy-related activities. The Third General Conference of UNIDO, in particular, assigned special importance to these activities and made specific recommendations for action.

As a further step towards designing a UNIDO energy-related programme commensurate with the priority assigned to the problem, the Executive Director, taking into account the recommendations made at New Delhi and the energy situation, decided to create, in April 1980, a Special Advisory Group on Energy, under the authority of his Special Assistant. The Group's main task is to co-ordinate UNIDO programmes with those of other United Nations bodies, to ensure maximum co-operation in energy-related activities.

Concisely, the two main and immediate objectives of the activities of the Special Advisory Group on Energy are: to strengthen the energy-related programme of UNIDO and to ensure an effective contribution of UNIDO to the United Nations Conference on New and Renewable Sources of Energy. Accordingly, the Special Advisory Group on Energy will advise and assist the various UNIDO units in:

(a) Identifying problems and opportunities arising in connection with patterns of energy supply and industrialization in the developing countries:

(b) Establishing priorities in respect of the design, production, operation and maintenance of equipment used for energy generation, conversion and distribution;

(c) Assessing various sources of energy and their industrial applications - new and renewable, conventional and non-conventional;

(d) Identifying training requirements for both technical and managerial personnel in energy questions in relation to industrial production;

(e) Preparing UNIDO inputs to energy-related meetings and conferences, such as the United Nations Conference on New and Renewable Sources of Energy to be held at Nairobi, Kenya, in 1981, and the organization of ad hoc expert group meetings such as that scheduled for 1981 on the patterns of energy supply and industrial development, which will contribute to the definition of the energy programme of UNIDO;

(f) Strengthening co-operation between UNIDO and other bodies in the United Nations system, other intergovernmental and non-governmental organizations, and appropriate national organizations in matters relating to the utilization of energy in industry.

Since the role of SAGE is restricted to that of an advisory and co-ordinating unit in the Office of the Executive Director, and since the number and variety of technical assistance projects handled by the Division of Industrial Operations is increasing, it was also found necessary to establish a new operational technical assistance unit, the Industrial Energy Engineering Unit, in this Division. 6/ It will complement other existing units of the Division and its work will be carried out in harmony with the general co-ordinating and advisory activities of the SAGE.

6/ Executive Director's Bulletin, "Establishment of the Industrial Energy Engineering Unit (IEEU)" (UNIDO/OED/B.180). 3 November 1980.

IV. ENERGY-RELATED ACTIVITIES OF UNIDO UNITS

Technical assistance activities relating to the use of new and renewable sources of energy in industry

Since its inception, in 1967, UNIDO has identified, prepared and implemented many energy-related projects of technical assistance for industrial development, many of which have been concerned with NRSE.

At present, the Division of Industrial Operations is in charge of technical assistance. Recently completed and on-going projects of technical assistance in the area of NRSE are listed below. The number, of such projects is expected to increase appreciably in the near future, as well as their diversity and complexity.

To cope with project preparation, together with the Division of Policy Co-ordination, and with the implementation of new projects, a new implementation unit (Industrial Energy Engineering Unit) has been recently created in the Division.[7/] It will assist other units of the Division in carrying out energy-related projects and will implement directly certain projects not falling within the scope of existing units.

Recently completed and current projects concerned with the use of new and renewable sources of energy in industry are listed below.

Completed and current projects

Regional Africa: RP/RAF/77/014/B
Solar energy exploratory mission to Mali, Niger and Senegal (completed project)
$16,000

Benin: SI/BEN/79/805/B
Non-conventional sources of energy
$11,300

Gambia: SI/GAM/78/802/C
Emergency repair and maintenance assistance to the electric power station in Banjul (completed project)
$47,500

Mali: RP/MLI/78/001/B
Assistance to the laboratory for solar energy (completed project)
$68,000

Mali: RP/MLI/80/001/A
Assistance to the laboratory for solar energy, phase II
$15,960

Niger: SI/NER/79/803/B
Assistance to ONERSOL on alternative sources of energy
$5,950

7/ Ibid.

Afghanistan: SI/AFG/79/801/B
Utilization of solar energy
$10,000

Cook islands: SI/CKI/79/802/B
Evaluation of availability of non-conventional sources of energy
$8,750

Mongolia: DU/MON/75/006/B
Promotion of the rural development through the utilization of water, wind and solar energy (completed project)
$4,000

Thailand: SI/THA/79/801/D
Development of non-conventional sources of energy (project suspended by Government)
$50,000

Regional Latin America: SI/RLA/79/801/B
Assistance to OLADE on small hydro generating plants (completed project)
$19,000

Regional Latin America: SI/RLA/79/802/B
Development of small hydropower generating plants
$51,950

Cuba: SI/CUB/79/802/B
Exploratory mission on solar energy and other alternative sources of energy development (completed project)
$18,000

Cuba: SI/CUB/79/801/B
Preparatory assistance in manufacture of solar heaters
$20,500

Uruguay: SI/URU/79/806/B
Assistance in mini hydropower plants
$5,650

Interregional: US/INT/80/016/A
Group study tour in the field of medium- and small-scale hydropower plants, China and the Philippines (completed project)
$137,888

Interregional: US/INT/78/148
Study tour in the field of manufacture, operation and maintenance of medium- and small-scale hydropower plants, China (completed project)
$77,854

Interregional: UF/INT/78/167
Workshop on fermentation alcohol for use as fuel and chemical feedstock in developing countries
$17,110

Interregional: US/INT/78/167
Workshop on fermentation alcohol use as fuel and chemical feedstock in developing countries (completed project)
$71,930

Interregional: UC/INT/79/159
Technical consultation among developing countries on large-scale biogas technology in China (completed project)
$33,100

Interregional: UD/INT/79/159
Technical consultations among developing countries on large-scale biogas technology in China (completed project)
$64,500

Kenya: SI/KEN/79/803
Production of power alcohol from molasses (completed project)
$20,200

Panama: SI/PAN/79/804
Preliminary assistance for fermentation alcohol programme (completed project)
$12,300

Papua New Guinea: SI/PNG/79/806
Assistance in charcoal production (completed project)
$5,400

Philippines: SI/PHI/78/803
Assistance to indigenous energy resources development (completed project)
$72,081

Ethiopia: SI/ETH/79/803
Production of ethanol from molasses
$60,200

Ghana: DU/GHA/74/013
Charcoal production and utilization (phase II)
$16,500

Philippines: DP/PHI/78/022
Assistance to energy production from biomass waste materials
$404,300

Somalia: SI/SOM/78/803
Development of charcoal industry and establishment of demonstration plant for charcoal production and basic chemicals
$33,800

United Republic of Tanzania: UF/URT/77/056
Integrated biogas plant development in the United Republic of Tanzania and regional promotion in 10 least developed countries in Africa
$60,480

Upper Volta: UF/UPV/78/039
Demonstration of biogas technology
$65,100

Zambia: SI/ZAM/77/802
Processing of molasses - manufacture of ethyl alcohol and fodder yeast
$13,950

Energy-related industrial development studies

Several branches of the Division of Industrial Studies, namely, the Global and Conceptual Studies, the Sectoral Studies and the Country and Regional Studies Branches are engaged in energy-related studies. Many of these studies were completed before the end of 1980; others are either on-going or programmed, and a selection is reviewed below. Although some studies may appear from the

title to be concerned with conventional energy resources, they do indeed provide information relevant and even essential for proper consideration of the use of NRSE in industry. A selection of these studies is included in the list below.

Studies carried out or planned by the Global and Conceptual Studies Branch

Studies completed

"The dimensions of energy requirements and the Lima target", paper prepared for the Working Group of the Committee for Development Planning, December 1978.

In this first study, projections have been made to calculate the global primary energy requirements by the year 2000 if the Lima target is to be achieved. In comparison with other global projections (OECD, WAES) and a combination thereof, the projected energy requirements of nearly 17 billion tons of oil equivalent are roughly 18 per cent higher. The difference arises primarily from higher economic growth assumptions for meeting the Lima target scenario.

In view of these dimensions of energy requirements, whether the requisite amount of energy can be supplied is a crucial question. Supplies of oil will not be sufficient to meet world requirements in the medium and longer run. The likelihood of a future oil shortage is analysed in various scenarios. On the demand side three alternative levels of oil demand are postulated, corresponding to high, low and no-growth assumptions of the Lima target. On the supply side an optimistic assumption concerning future oil supplies (annual gross additions to reserves of 20 billion barrels and a reserve production ratio of 10:1) and a pessimistic one (gross additions of 10 billion barrels and a reserve production ratio of 15:1) are used. Even under the optimistic supply assumptions oil shortages will occur in 1995, 2005 and 2019 for the high growth, low-growth and no-growth Lima scenarios, respectively. The crucial differences resulting from different assumptions regarding the oil supply conditions can be seen by the fact that under pessimistic supply conditions the maximum periods for which the future oil demand can be sustained shorten drastically (e.g., in the low-growth scenario an oil shortage may come in 1992, instead of in 2005).

Even granting that large margins of error may occur in such an analysis, the real possibility of a global oil deficit before the year 2000, which would undoubtedly impede the achievement of the Lima target and other development goals, underscores the urgent need to search for alternative sources of energy.

"Energy intensity and industrial development strategy", Paper prepared by UNIDO for the ACC Task Force on Long-Term Development Objectives, New York, 22-28 May 1980

This paper examines and appraises some of the trends in the energy field that are relevant to the achievement of the Lima target.

Analysis of the primary energy requirements in both developed and developing countries shows that the future global imbalances of demand and supply are of such a magnitude that unless immediate and far-reaching measures are undertaken, the achievement of the Lima target will be impossible. Especially in the developing countries, the primary energy requirements will rise rapidly. If the Lima target is achieved by the year 2000, 4,300 million tons of oil equivalent (or 86 million barrels of oil equivalent) will be needed per day. 8/ A comparison of the projected primary energy requirements with the potential energy supplies reveals that by the year 2000 there will be a substantial primary energy gap, mainly a deficit of conventional crude oil; and, with the exception of the oil producing developing countries, all regions (developed and developing) will have a negative balance.

Examination of both cross-section and time-series data of the final energy demand by end-users reveals that the energy intensity of production tends to increase significantly in periods of social and economic transformation. 9/ A detailed examination of the energy use shows the importance of industry and especially a few energy-intensive industries in the final energy consumption. While in the highly industrialized countries the share of industry in energy consumption has tended to decrease in the last several years, in the developing countries industrial energy consumption has increased. Correspondingly, the energy intensity in industry tends to increase up to a certain stage of development. A review of two energy-intensive industries (iron and steel and the chemical and petrochemical industries) points to the increasing industrial energy intensity in developing countries in the future.

8/ Developing countries, excluding the centrally planned economies of Asia.

9/ The analysis of cross-section (country) data must be performed in terms of purchasing power parities, since the official rates tend to give a distorted picture.

Thus, the need to increase the efficiency of energy use is clear. This goal can be achieved through technology, specific conservation measures, and appropriate industrialization strategies regarding the industrial structure and the output mix.

While the first part of the paper (analysis of primary energy requirements deals with total energy (commercial and non-commercial energy), the second part (analysis of energy intensities) examines only commercial energy, and hence the role of new and renewable energy sources is not explicitly considered.

"New and renewable energy sources and industrialization"

This paper attempts to assess the potential role of new and renewable energy sources in the energy balances of the world as a whole and of the developing countries in particular. Furthermore, the impact of new and renewable energy sources on the industry and transportation sectors of the developing countries by the year 2000 is also discussed.

The assessment of the contribution of new and renewable energy sources in meeting the primary energy requirements of the world and particularly of the developing countries is based upon a synopsis of various projections of energy requirements. 10/ Different types of new and renewable resources are expected to have quite different development prospects.

By 2000, the share of new and renewable energy sources in the world's total primary energy supply may even decline slightly. Roughly similar tendencies are to be expected for the developing countries. (In the centrally planned economies of Asia the share of all kinds of new and renewable energy sources taken together will drop from a quarter to one eighth of primary energy requirements, while in the other developing countries it may fall to one third from nearly one half in 1976). Despite this decreasing relative importance, the use of new and renewable energy sources will rise in absolute figures. In view of the energy problems facing many developing countries, rational use of new and renewable energy sources will be of the utmost importance.

After analysing the future energy needs of the industry and transportation sectors of developing countries, the possible application of new and renewable energy sources in these economic sectors is discussed. In the transportation

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10/ For example, World Energy Conference 1977, World Energy Looking Ahead to 2020 and Other Related Materials; Workshop on Alternative Energy Strategies, Global Prospects 1985-2000, and J.R. Frisch, World Energy Conference 1980, Third World Energy Horizons 2000-2020.

sector, the production of alternative fuels from biomass (ethanol to be blended with gasoline in different proportions) seems to offer the most promising applications. In industry, new and renewable resources will be of importance either in special branches and/or applications (e.g., the pulp and paper industry, using wastes, the food industry using wastes and solar energy) or under special conditions (e.g., rural industry). But in general, at least in the near future, most new and renewable energies (with the exception of hydropower) will be better suited to the needs of other economic sectors (e.g., households, agriculture) that can apply energy of a lower quality. By contrast, in developing countries the energy-intensive industries, which are essential for rapid industrialization and dominate the industrial energy demand, may have to rely more heavily on conventional energy sources.

"UNIDO's contribution to the interagency study on the interrelationships between population, resources, environment and development," Report of the Secretary-General to the Second Regular Session of the Economic and Social Council in 1981, chap. V, "The energy dimension"

In this chapter the long-term energy perspectives until the year 2025 and after are analysed. The major conclusion is that most probably two periods of transition in global patterns of energy use are necessary. 11/

In the "medium" term until 2025, a transition to old and new sources of exhaustible energy sources (e.g., coal, but also non-conventional oil such as oil shale and tar sands) on the one hand and the development of nuclear energy on the other is necessary to meet the future primary energy requirements. On the basis of current estimates of reserves it can be demonstrated that in principle sufficient energy sources are available to permit such a strategy of "replacement" fuels for conventional oil, which is the backbone of the current energy supply of the world, but that the actual exploitation of these sources will remain a problem.

In the very long run a more stable energy supply system based primarily on renewable energy sources (especially solar) and advanced nuclear technologies (e.g., liquid metal fast breeder reactor) can be envisaged.

New and renewable energy sources play an important role in both periods of transition (new exhaustible sources in the first period and renewable sources especially in the second).

11/ The analysis rests primarily on the work of the last two World Energy Conferences (1977, 1980) and the IIASA Energy Project.

Activities planned for 1981

No specific programme is earmarked for energy activities in the Global and Conceptual Studies Branch in 1981. However, some aspects of energy problems in the developing countries will be studied. In particular, methodological issues relating to industrial energy demand will be thoroughly investigated with a view to developing an analytical framework for determining industrial energy requirements in the developing countries, and some work on the collection of industrial energy data for the developing countries which will be needed for empirical studies planned for the 1982-1983 biennium, will begin.

Studies carried out or planned by the Country and Regional Studies Branch

Past activities, 1980

Based on research work carried out for the Industrial Development Survey, a study entitled "Energy usage in industry: a survey of recent energy saving advances in industrial technology" was prepared and made available to the Expert Group Meeting on Industrial Issues held as part of the preparatory work for the United Nations Conference on New and Renewable Sources of Energy, 1981.

Planned 1981 and 1982-1983 activities

Within the context of country studies for the least developed countries a survey of potential energy resources for industry will be included. Subject to the availability of resources and the agreement of Governments, it is proposed to conduct 10 country studies in 1980-1981.

Studies on industrial energy carried out by the Sectoral Studies Branch

In carrying out studies on the present situation in each of the main branches of industry and making projections for the future, the Sectoral Studies Branch tackles the energy question by considering sectoral requirements, ways of saving energy and prospects of substituting other conventional and non-conventional energy sources for oil.

Studies already completed

Studies on the iron and steel industry, the leather and leather products industry, and in the agricultural machinery industry on a world-wide basis dealt with energy requirements.

Energy requirements in the iron and steel industry

The "Draft world-wide study of the iron and steel industry: 1975-2000" (UNIDO/ICIS.25)

This study indicates that the geographical distribution of the major natural resources essential to steel production will be central determinants in the future development of the global iron and steel trade. Four of these resources relate to energy - coal, natural gas, oil and hydroelectric energy - and the others relate to raw materials or are combined fuel and reductants - iron ore, coking coal, charcoal and manganese ore - as well as fluxes.

Those developing countries that are in a favourable position to establish an iron and steel industry because of their known mineral and energy reserves have been identified. It must be emphasized that this assessment has been made in the light of known reserves only. It is likely, however, that future exploration will reveal more resources in the developing countries.

The use of electricity to produce iron and steel throughout the world is constantly increasing, climbing from 7.2 per cent in 1950 to 17.4 per cent in 1974. The use of electricity will continue to increase as specific electric energy requirements per ton of steel gradually decline. It should be noted that some 1.425 GW, or 63 per cent of the world's total potential hydroelectric resources, are located in the developing countries, only 4.1 per cent of which, however, are being developed at a realistic average maximum flow capacity. At present, the developing countries account for only 20 per cent of the total world hydroelectric energy output, and much of their future energy requirements could be covered by the exploitation of hitherto unused water resources.

The use of charcoal as a furnace fuel should certainly be considered in countries rich in tropical forests and lacking in coal. Argentina, Brazil, India and Malaysia have long used charcoal in iron smelting; and certain African countries, such as Ghana and Kenya, are reportedly increasing the utilization of their forests for charcoal production on an experimental scale.

The second study, "The world iron and steel industry" (UNIDO/ICIS.89), issued in November 1978, deals with forecasting energy requirements in the iron and steel industry and with energy policies.

Energy requirements by different consumers and processes and by energy sources have been calculated. Trends in energy prices and energy policy have been analysed and cost of energy for the iron and steel industry and also potential energy savings estimated.

The energy issue in the tanning and leather industry

Various fuels are used in the leather industry, both directly and for internal production of electricity. At present, however, because of the lack of statistics, it is not possible to estimate the breakdown of energy consumption by fuel in this industry.

One of the major problems in studying the energy requirements in the leather industry is the large variation in technology and the degree of mechanization employed. These variations yield different energy requirements according to local circumstances and climatic conditions. The variations are innumerable and cannot be compressed within this study, but considering that energy costs represent at the most only 3-4 per cent of production costs, the economic effects of these variations within individual plants is insignificant.

Most developing countries have abundant sunshine. Thus, solar water heaters could supply all the necessary hot water for tanneries all year round. Solar water heater technology has already passed the phase of research and development and is reliable and well known.

The drying of hides and skins by solar energy is a very old practice that in recent years has been systematized and improved to the stage where it is possible also to use solar driers. Some tanneries are already using them.

In view of current fuel prices, solar energy could be increasingly used in tanneries as a substitute for traditional fuels, with a subsequently decrease in pollution levels.

Energy constraints in the study on agricultural machinery

Although agriculture is a minor consumer of energy, 12/ it depends, owing to the dominant (mechanical-chemical) model, on the use of non-renewable energy products, whose prices have skyrocketed since 1973. The rapid rise in costs of agricultural production (increases in the price of fertilizers, plastic materials, crop-protection supplies and equipment etc.) has, however, very different effects depending on the country, the farming system, and the category of equipment concerned.

The existence of farming systems that are highly differentiated in their use of various forms of human or motorized energy for agricultural work makes

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12/ In the industrialized countries direct and indirect expenditures by agriculture on energy represent only 9 per cent of the value of intermediate forms of energy consumption and between 3 and 6 per cent (depending on the country) of gross energy consumption.

one speculate about the impact of energy constraints on agricultural production. As regards agricultural equipment, the impact is more important, depending on whether or not there are technological alternatives. In the case of motorized mobile equipment, there are not many alternatives; there are more in the case of stationary equipment (methane, wind power, solar power etc.). More generally, energy constraints are felt very differently depending on the nature of the technical model adopted (mechanical-chemical model; biological model).

The policy of mechanization of a country must necessarily take this energy constraint on its economy into account.

Further energy-related studies planned

Energy availability, requirements, interdependence and substitution will be projected in the studies planned by the Sectoral Branch, mainly for the various chemical industries (petrochemicals, chemicals and fertilizers) and the capital goods industry.

The Industrial Technology Programme of UNIDO

Scope of the Technology Programme

The Technology Programme of UNIDO is carried out by the Development and Transfer of Technology Branch and the Industrial Information Section. Through the Development and Transfer of Technology Branch, UNIDO deals with technology development and transfer for the benefit of the developing countries, using as a major input the experience in this field UNIDO has accumulated since its inception. Since the development and application of NRSE depend greatly on technology, this programme has special relevance to the Conference's subject.

The part of the programme concerned with technology development and carried out by the Transfer of Technology Branch is designed:

(a) To assist the developing countries in improving the means of assessing, selecting and acquiring, on favourable terms, technologies suited to their industrial development requirements;

(b) To facilitate the adaption and utilization of appropriate industrial technology, after identifying and appraising technologies currently used in developing countries;

(c) To initiate and strengthen current, world-wide activities directed towards the development of technology especially designed to suit conditions in developing countries;

(d) To develop an analytical, evolutionary framework for policies on industrial technology and its linkage with general industrial development.

The Industrial Information Section operates the Industrial and Technological Information Bank (INTIB) and the Industrial Inquiry Service and issues a Newsletter, Guides to Information Sources and publications on transfer of technology. The information services are oriented to provide practical information to Governments and enterprises in developing countries, either by responding to inquiries or by compiling and disseminating technological information of direct relevance to industrial development.

Current and planned activities, including publications, related to NRSE

Seminar cum-Workshop on the Exchange of Experiences and Technology Transfer on Mini Hydroelectric Generation Units (MHG), Kathmandu, Nepal, 10-14 September 1979.

The seminar workshop attended by 41 participants from 23 developing countries and 27 participants from 10 developed countries. The objectives of the meeting were, inter alia, to discuss technological aspects of MHG systems and to exchange information on the availability of equipment and the possibilities of local manufacture of equipment in the developing countries. The meeting focused on the technology, economic policy and institutional aspects of promoting the application of MHG in the developing countries, particularly in the rural and remote areas. A draft final report of the meeting was presented to the first Hydropower Technical Panel of the United Nations Conference on New and Renewable Sources of Energy. The meeting adopted the Kathmandu Declaration for International Co-operation in the Field of MHG. Sixty-six papers that were presented at the meeting are available at UNIDO (ID/WG.305/1-66).

Second Seminar-Workshop/Study Tour in the Development and Application of Technology for Mini-Hydro Power Generation (MHG), Hangzhou, China, and Manila, Philippines, October/November 1980. The seminar-workshop was attended by 38 participants from 24 developing countries. The objectives of the meeting were, inter alia, to promote the exchange of experience in the planning, construction and application of MHG in developing countries; and particularly to make a comparative study of the method of planning and programme implementation in China and the Philippines. It further considered various ways of supporting the efforts of developing countries in applying MHG with specific emphasis

on local manufacture of equipment and schemes to reduce costs in MHG installations. The meeting requested UNIDO to compile a technological reference manual on the development and application of MHG systems for the benefit of planners and researchers and local manufacturers in the developing countries. A draft final report was presented to the Second Technical Panel on Hydropower of the United Nations Conference on New and Renewable Sources of Energy.

The meeting adopted the Hangzhou-Manila Declaration emphasizing the need to implement programmes for supplying cheap, reliable and renewable energy resources for rural industrialization. Fourty papers presented at the meeting are also available at UNIDO (ID/WG.329/1-40).

"MHG - a manual for decision makers" (in preparation). The main purpose of the manual is to serve as a working tool for decision makers in the developing countries, with emphasis being given to MHG development, policy, planning and programming, the engineering and technical requirements and potentialities, institutional organization and training. The manual covers, among other things, the advantages and limitations of MHG, comparison with alternative systems, development of technological capabilities and approaches to specific projects. The manual is expected to be one of the contributions of UNIDO to the United Nations Conference on New and Renewable Sources of Energy.

Technology for Solar Energy Utilization, Development and Transfer of Technology Series, No. 5 (United Nations publication, Sales No. E.78.II.B.6.).

In keeping with a recommendation of the Round-Table Ministerial Meeting on Industrial and Technological Co-operation among Developing Countries, held at New Delhi in 1977, it was considered useful to launch programmes of co-operation in applied research and development in the energy sector of industry, drawing upon the machinery and capabilities already available in the developing countries. This publication deals with the technology of exploitation of solar energy for the benefit of the developing countries. The first part discusses the utilization of solar energy in developing countries. The second part summarizes country and institutional programmes on solar energy. The third part discusses the technical aspects of converting solar energy for heating, cooling, distillation, drying and cooking, and the tranfer of technology.

Appropriate Industrial Technology for Energy for Rural Requirements, Monographs on Appropriate Industrial Technology, No. 5 (ID/232/5).

UNIDO organized the International Forum on Appropriate Industrial Technology, India, 1978, in which, inter alia, the question of energy for rural requirements was discussed. Since conventional energy systems based on centralized sources have failed to yield adequate electrical power in relation to the micro-economic needs in developing countries and usually have not met the specialized demands of agriculture or of rural and small-scale industries, the problem of rural energy supply calls for a new approach and a new planning strategy. The monograph contains the report of the Working Group on Energy for Rural Requirements and the papers presented to the Forum. It deals with appropriate technology for rural energy supply in developing countries, energy sources for rural requirements and planning for rural energy systems

Compilation and analysis of energy-related activities of industrial research institutions (in preparation)

The purpose of this work is to compile, analyse, identify and select the priority areas of energy-related research subjects for co-operative arrangements among research institutions.

Chinese experience in small hydropower generation (in preparation)

The study is to be based on many case-studies on MHG in China. The study focuses on policy and measures, economic considerations, exploitation and design of MHG, MHG machines and equipment, research and development and cost-reduction schemes etc. A brief preliminary study of this nature was presented at the UNIDO Second Seminar-Workshop/Study Tour at Hangshow and Manila. Cost: $4,000.

Philippines' experience on mini hydro generation

This study is useful not only to government planners and researches but also to local manufacturers in the developing countries. Output: The study was used as background material for the Second Mini-Hydro Generator Workshop in China and the Philippines. Cost: $1,000.

The Technology Programme also initiated a project for setting up a pilot plant in the Philippines for the production of ethanol through enzymatic hydrolysis of cellulosic wastes. The project is to consist of two parts, the first one being a techno-economic study with reference to Philippine conditions and the second the actual setting up of a pilot plant.

With regard to information on energy-related aspects dealt with under the Industrial Inquiry Services/INTIB, two guides to information sources have been published, one on non-conventional sources of energy and one on bioconversion of agricultural wastes.

Activities for 1981 and 1982

A Consultation on the Implications of Advances of Genetic Engineering for Developing Countries was held at Vienna, 4 to 6 February 1981. The Report of the meeting is expected to contain recommendations bearing on expanded use of NRSE.

In regard to future activities, work relating to technology for solar energy utilization, mini hydro projects and energy for rural requirements will be continued in 1981. A catalogue of solar-energy equipment will be prepared. The Industrial Inquiry Service and INTIB will continue to respond to energy-related inquiries. It may be recalled in this connection that the New Delhi Declaration and Plan of Action has recommended that INTIB disseminate information on energy-related technologies.

Through the monitoring of technological advances and their implications for developing countries, selected energy fields are expected to be taken up in addition to the advance in micro-biology and their implications for industrial development.

Technology profiles will be prepared and will cover in suitable cases energy technologies, specially those relating to NRSE.

Investment promotion of projects for development or utilization of new and renewable sources of energy in industry

Within the Division of Industrial Operations of UNIDO, the Investment Co-operative Programme Branch (ICPB) is already engaged in exploring opportunities for promoting investment co-operation between developed and developing countries in projects relating to the development of new and renewable sources for industrial application.

UNIDO, through ICPB, provides information on investment opportunities in developing countries to potential investors from developed countries, on an individual basis, or through investment promotion meetings. In 1979, information on 500 such opportunities was disseminated. 13/

13/ Annual Report of the Executive Director 1979 (ID/B/240), chap. III, p. 68, paras. 24 and 28.

In conjunction with the meeting in Kathmandu, Nepal, in 1979, organized by UNIDO through its Technology Group, preparations were initiated for an investment promotion meeting on mini hydropower plants. This was the first investment promotion activity specifically designed to help developing countries to build up their energy-generation facilities. In the coming years, it is anticipated extending such efforts to the manufacture of alcohol from biomass and the manufacture of solar energy equipment.[14/]

ICPB is at present looking into possibilities for promoting co-operation between industrialized and developing countries in industrial investments in equipment relating to energy generation. ICPB is planning an investment promotion programme for this purpose.

Consideration of new and renewable sources of energy in the Consultations of UNIDO

The Second General Conference of UNIDO requested UNIDO to establish a system of continuing Consultations that should relate in particular to "industries processing raw materials exported by developing countries or which consume vast quantities of energy".[15/] This request was endorsed by the General Assembly at its seventh special session in 1975.

The System of Consultations as recommended by the Third General Conference of UNIDO has been placed on a permanent basis. It is the instrument through which UNIDO serves as a forum for developed and developing countries in their contacts and consultations directed towards the industrialization of developing countries. It provides a framework for identifying problems associated with the industrialization of developing countries, for considering ways of accelerating their industrialization, and for contributing to closer industrial co-operation among member countries, in accordance with the Lima Declaration and Plan of Action. Participants of each member country should include officials of Governments as well as representatives of industry, labour, consumer groups and others, as deemed appropriate by each Government.

14/ Ibid.

15/ Lima Declaration and Plan of Action, op. cit., para. 61 (d).

Consultations at the sectoral level have already considered the problems of energy, notably in the iron and steel, petrochemicals and capital goods industries. Special attention is being paid to opportunities of utilizing new and renewable sources of energy in those and in other industries that will be covered by forthcoming Consultations.

The period 1980-2000 will be marked by a transition from the predominant use of petroleum and conventional sources of energy to an increased use of new and renewable sources of energy. Accordingly, the System of Consultations will continue to pay specific attention to energy-related issues in the future, to assess problems, to identify solutions, and to reach a consensus on the action to be taken.

V. ENERGY-RELATED CO-OPERATION AND AGREEMENTS BETWEEN UNIDO AND OTHER UNITED NATIONS ORGANIZATIONS, INTERGOVERNMENTAL ORGANIZATIONS, GOVERNMENTS OF DEVELOPING COUNTRIES, NON-GOVERNMENTAL ORGANIZATIONS AND WITH THE UNITED NATIONS CONFERENCE ON NEW AND RENEWABLE SOURCES OF ENERGY

Co-operation with the Food and Agriculture Organization

Agreements have been reached between the two organizations in the fields of biogas, compost, fermentation ethanol and charcoal so that their activities do not overlap but complement one another. The substance of these agreements is summarized below.

Biogas[16/]

The scale of operations is quite different for the two agencies. The FAO activities are aimed exclusively at the small farmer. FAO will not be involved with biogas plants of greater digester capacity than 10 m^3. UNIDO is more interested in plants of larger capacity having scope for utilizing the gas in generating electricity and operating machinery. For FAO the gas produced is merely a by-product and will be used only by farmers for cooking and lighting. Furthermore, whereas FAO is primarily interested in agricultural use of the effluents as manure, UNIDO is more concerned with the industrial application of the energy produced.

Compost[16/]

FAO is concerned only with small on-farm composting practices carried out by the farmer himself, whereas UNIDO is concerned with large-scale compost production. In the composting field, FAO is interested in the return of organic materials to the soil to improve its fertility, and UNIDO is concerned with the large-scale production of these materials.

With regard to the training programmes in organic recycling, FAO will provide courses for agriculturalists at the extension level; UNIDO will train technicians and engineers for large-scale production of organic materials for use as fertilizer.

16/ Working arrangement established on the basis of an exchange of letters between the two organizations in June 1979.

Further, the Chemical Industries Section of UNIDO has maintained a close and continuing contact with the FAO Soil Resources Development and Conservation Service. UNIDO has participated in the series of FAO/SIDA Workshops on Organic Materials as Fertilizers, e.g., the Workshops held at Bangkok and Alexandria in November 1976 and October 1978, respectively.

Another example of co-operation is in Indonesia and Nepal, where FAO has requested UNIDO to provide assistance in the composting of municipal solid waste in conjunction with its regional project on "Improving soil fertility through organic recycling".

Fermentation ethanol

Consultations between the two organizations have resulted in a joint programme outline on fermentation ethanol production and use in developing countries. This programme, described in detail below, was signed by the heads of the two organizations on 9 July 1969.

Objectives and justification

The Workshop on Fermentation Alcohol held at Vienna in March 1979 called upon UNIDO to assist developing countries in the production of fermentation alcohol for use as fuel and chemical feedstock and to seek the co-operation of FAO with regard to the agricultural aspects of fermentation alcohol production.

A similar recommendation was made at the First Consultation on the Petrochemical Industry held at Mexico City in March 1979.

The overall programme of UNIDO will consist of:

(a) Studies on the economics of fermentation alcohol production from different raw materials, e.g., cane juice, molasses, cassava;

(b) Studies on the economics of ethanol-based production of industrial chemicals;

(c) Technical assistance for improving existing distilleries and ethanol-based chemical plants;

(d) Fuel alcohol test programmes;

(e) Establishment of fermentation alcohol technology centres where appropriate;

(f) Planning and establishment of new capacities for production of fermentation alcohol in suitable interested developing countries.

The main merits of a fermentation alcohol programme, particularly for developing countries lacking petroleum resources, are:

Increased value added of agricultural products

Local development of ethanol-based industrial chemical production

Promotion of agro-based industrialization, bringing benefits to both agriculture and industry

Savings of foreign exchange currently used for petroleum imports and consequent improvement of their balance of payments

It is envisaged that a two-phased programme will be adopted in planning and implementing a fermentation alcohol programme in any given country. Phase I will be a short-term period of up to five years, and phase II will extend for a medium-term period after the completion of phase I.

Country programmes

Phase I - pilot programmes. Phase I will include project activities as outlined in (c), (d), (e) and (f) above to be carried out as appropriate to the needs of the individual country.

The main activity of phase I concerns the planning and establishment of new or additional manufacturing capacity for fermentation alcohol restricted to existing sugar-cane production. Countries considered for phase I planning are likely to be significant producers of sugar-cane already.

In phase I, a detailed feasibility study of the costs and benefits of alcohol production will be carried out. The main factors to be investigated are:

(a) The current level of output of cane and the potential for increasing the yield from existing plantations;

(b) The maximum volume of sugar-cane products that can be converted to alcohol from the existing plantations, bearing in mind other competing market outlets;

(c) The size, type and location of an alcohol plant or plants to be established in conjunction with existing sugar-mills. Due consideration should be given to the manufacture of other products, e.g., baker's yeast, fodder yeast, vinegar;

(d) The potential utilization of by-products (including carbon dioxide) and wastes from cane processing and alcohol production as animal feed, fertilizer and source of energy;

(e) The current and anticipated demand for alcohol for fuel, chemical feedstock and other uses;

(f) The capacity of local industry to fabricate some equipment items;

(g) Manpower and training requirements;

(h) The marketing and distribution arrangements for blended alcohol fuel.

The results of the cost-benefit study will be submitted to the Government and may be used in the formulation of appropriate pricing and investment policies.

Phase II - subsequent development programmes. Phase II is concerned with alcohol manufacture from a substantial expansion in the production of sugar-cane or the establishment of production capacity using other suitable fermentable crops. Accordingly, phase II involves a substantial amount of agricultural development in contrast to phase I. The objective of phase I is to establish the technology for alcohol manufacture and use rather than to meet the domestic demand for alcohol. Therefore, countries entering phase I must necessarily plan for phase II. However, some countries may enter phase I only to a limited extent owing to insufficient existing cane production. Hence agricultural development in phase II is required for countries either expanding alcohol production considerably or establishing fermentation alcohol production in the absence of an existing sugar industry.

To plan development in phase II, the following main factors will be assessed:

(a) All potential areas, in terms of capital investment required for land preparation, any recommended irrigation development, together with agricultural production costs;

(b) The effects of change in land use in relation to domestic food and animal feed requirements;

(c) The crops currently considered most suitable - cassava, sweet sorghum, maize, sago;

(d) Necessary expansion of the agricultural and communications infrastructure, including roads and transport facilities;

(e) The benefits arising from, and investments required for, related industries, e.g., downstream ethanol-based chemical production, local fabrication of equipment, animal feed manufacture, fertilizer manufacture;

(f) The time scale required for the realization of new agricultural production for alcohol manufacture.

Future joint co-operation

It is envisaged that the main contribution of FAO will be in planning and establishing new capacities for production of fermentation alcohol. This means that in phase I programmes, which are concerned with alcohol production from existing cane plantations, FAO expertise and experience will be used to assess such factors as:

Current cane output and potential yield increases obtainable

Competitive market outlets for sugar-cane products and the implications concerning raw material availability for alcohol production

Potential utilization of by-products and wastes for animal feed and fertilizers

FAO will be involved in all aspects of planning and implementing new agricultural development required for phase II programmes.

It is expected that, for phase I programmes, the inputs required from FAO will be restricted to readily available advice and information, together with occasional short-term services of a staff member or consultant. The costs of these services will be met from project funds by UNIDO.

The longer-term nature of phase II programmes will necessitate the establishment by FAO and UNIDO of separate but parallel projects with separate budgets. The two organizations may jointly seek common financing for their projects.

FAO and UNIDO should continue to exchange technical and statistical information on the subject of fermentation alcohol in general. Contact between the two organizations will be maintained through the focal points already established at the technical level.

Charcoal manufacture

An agreement between FAO and UNIDO for co-operation in the manufacture of charcoal was formulated at a meeting in Rome on 15-16 January 1979. It stipulates that:

(a) The production of charcoal from bagasse shall be the responsibility of UNIDO;

(b) The production of charcoal from wood and bark shall be the responsibility of FAO;

(c) Where wood-based charcoal is to be produced primarily for industrial uses and recovery of condensates and gases for production of saleable by-products may be considered, FAO will consult with UNIDO from the outset of such projects and invite UNIDO experts in chemical by-products to participate.

Two current projects are being jointly implemented by the two organizations:

(a) DU/GHA/74/013 - Charcoal production and utilization. UNIDO provides expert services ("11-03 Consultant in production of charcoal and by-products, 3 m/m"). Following the expert's mission from 8 April to 10 June 1980, it was decided to split the mission; the second part of the mission is now scheduled for the first half of 1981. In the meantime, some technical alterations of the existing kiln technology have to be made and additional laboratory equipment has to be acquired so that further research work can begin;

(b) SI/SOM/78/803 - Development of charcoal industry and establishment of a demonstration plant for charcoal production and by-products recovery. UNIDO provides expert services and equipment ("11-03 Expert in charcoal production, (6 m/m) in split missions.") The expert completed his first mission to Somalia, from 12 November to 12 February 1980, and has recommended that certain equipment items be purchased and delivered to Somalia before he undertakes the follow-up mission.

Co-operation with the United Nations Economic, Scientific and Cultural Organization

It was as early as July 1969 that UNIDO concluded a co-operation agreement with UNESCO. More recently, because of the close interdependency of education and scientific and technological research with industry, UNESCO and UNIDO signed another agreement in January 1979 to co-operate in the following four areas:

Development of science and technology policies

Scientific and technical research and the development of appropriate technologies

Development of proper liaison and co-operation between industry and the system of research and education in developing countries

Scientific and technological information

Energy will be one of the main elements to be tackled through co-operation between UNIDO and UNESCO in each of the areas mentioned above.

The "division of labour" between the two organizations in the area of energy-related scientific, technological and industrial information is currently under consideration.

Agreements and joint communiques between UNIDO and intergovernmental organizations

UNIDO has concluded several agreements with intergovernmental organizations covering the various aspects of development of the new and renewable sources of energy. Below is a list of agreements.

Name of organization	Region or group of countries the organization covers	Content of the agreement related to NRSE	Date of conclusion
Organization of African Unity (OAU)	Africa	Development of renewable sources of energy and programmes aimed at adding more value to fossil fuels through their conversion into chemical products	Mid-June 1978
Economic Community of West African States (ECOWAS)	West Africa	Pre-investment studies and implementation that will promote development of the member States of ECOWAS in energy-related industrial activities	Dec. 1980

Central African Customs and Economic Union (UDEAC)	Central Africa	Realization of a programme of industrial projects of interest to the region and permitting an upgrading of natural and human resources in member States	Mid-Sept. 1978
Arab League Educational Cultural and Scientific Organization (ALESCO)	Arab States (Middle East)	Development of renewable sources of energy and programmes aimed at adding more value to fossil fuels through their conversion into chemical products	April 1978
Central American Institute for Research and Technology (ICAITI)	Central America	Rational exploitation of the natural resources of Latin America	April 1980
Latin American Economic System (SELA)	Latin America	Co-operation related to the development of the capital goods industry with particular emphasis on energy related equipment	July 1980
Latin American Energy Organization (OLADE)	Latin America	A programme of collaboration agreed upon at an Expert Working Group held from 6 to 9 February 1980 at Quito, Ecuador. The programme includes support for the adaptation of energy conditions in the region as well as for the capital goods required by the energy sector	6 to 9 February 1980

Agreements between UNIDO and developing countries for the development of new and renewable sources of energy

A number of assistance agreements have been concluded between UNIDO and Governments of developing or other countries in the area of new and renewable sources of energy, covering technical assistance implementation, technical consultations, study tours, interregional seminars, technological studies and transfer involving information, documentation, studies, transfer and commercial application of related new or appropriate technology, with special reference to rural areas, to small and medium-size industries and to agro-industries. Below is a list of those agreements signed up to January 198

Region or country	Type of agreement and reference to NRSE	Date of signature
Africa		
Mauritania	Study, commercial upgrading and utilization of renewable resources	End October 1980
Mozambique	Co-operation in the field of energy for industry	November 1980
Sierra Leone	Identification and development of alternative sources of energy with special emphasis on hydro-power and use of solar energy for rural areas	March 1980
Sudan	Promotion of an energy industry to sustain industrial development	February 1978
Asia		
Bangladesh	Technical assistance to develop natural gas resources for accelerated industrial development	November 1978
China	Meetings for participants from developing countries: (a) Consultations and study tour on large-scale biogas technology held in 1980, in Beijing, China) (b) Interregional Seminar and Study tour on energy saving cement technology (held in 1980, in China)	April 1980

Nepal	Co-operation in the field of energy especially from new and renewable resources	October 1980
Central America		
Cuba	Joint assistance from UNIDO and UNDP in implementation of important projects concerning sugar-cane derivatives, which offer possibilities for Cuba and other developing countries	October 1980

Finally, Sweden has recently decided to consider assignment of priority in assisting developing countries, through UNIDO, to the development of new and renewable sources of energy for industrial development.

Co-operation of UNIDO with non-governmental organizations

Informal agreements, activities and contacts with non-governmental organizations in energy-related aspects of industrial development have been entered into in the last few years. Other informal and formal arrangements are under consideration and will be intensified in the near future.

As an instance, UNIDO will participate in the recently established World Energy Conference Ad hoc Committee on Energy Problems of Developing Countries.

Co-operation of UNIDO with United Nations Conference on New and Renewable Sources of Energy

UNIDO has co-operated closely with the secretariat of the United Nations Conference on New and Renewable Sources of Energy and with other United Nations organizations in preparations for that Conference, to be held at Nairobi in August 1981. UNIDO was represented at the Preparatory Committee of Conference and participated in two interagency meetings held in New York and Geneva, respectively. UNIDO also participated in or was represented at rounds of the preparatory technical panel meetings (in particular in those meetings

directly related to UNIDO activities) and in all expert group meetings.

In particular, in February 1980, UNIDO played host, in Vienna, to the first technical panel meeting on hydropower and contributed a number of documents. In 1980, at the request of the Conference secretariat, UNIDO submitted draft terms of reference for the Ad hoc Expert Group Meeting on Industrial Issues, held at Vienna, in January 1981, with UNIDO backstopping. Other contributions to the preparatory work for the Conference were submitted to its secretariat or were under preparation in 1980. These included a background paper for the industrial issues meeting and the comprehensive report requested by the Preparatory Committee at its second session. The participation of staff members in the Conference activities, and the preparation of written contributions, were the object of close in-house teamwork, involving the substantive divisions and programmes, and co-ordinated by the Special Advisory Group of Energy.

Annex

PUBLICATIONS AND STUDIES ISSUED BY UNIDO ON ENERGY-RELATED INDUSTRIAL DEVELOPMENT ACTIVITIES

Appropriate Industrial Technology for Energy for Rural Development, Monograph on Appropriate Industrial Technology No. 5 (ID/232/5).

Information Sources on Bioconversion of agricultural wastes, UNIDO Guides to Information Sources No. 33 (United Nations sales publication, ID/228).

Information Sources on Non-conventional Sources of Energy, UNIDO Guides to Information Sources No. 30 (United Nations sales publication, ID/210).

New Delhi Declaration and Plan of Action on Industrialization of Developing Countries and International Co-operation for their Industrial Development, chapter IV, "Energy" (PI/72).

See also ID/CONF.4/L.5/Add.2
ID/CONF.4/CRP/15
ID/CONF.4/CRP/16

Technology for Solar Utilization, Development and Transfer of Technology Series (United Nations publication, Sales No. E.78.II.B.6).

Seminar-Workshop on the Exchange of Experiences on Technology Transfer on Mini Hydro Electric Generation Units, Kathmandu, Nepal, 10-14 September 1979. ID/WG.305/1-ID/WG.305/47

Technical Consultations among Developing Countries on Large-Scale Biogas Technology in China, Beijing, China, 4-19 July 1980. ID/WG.321/1-ID/WG.321/11

Workshop on Fermentation Alcohol for Use as Fuel and Chemical Feedstock in Developing Countries, Vienna, Austria, 26-30 March 1979. ID/WG.293/1-ID/WG.293/47

"Charcoal ironmaking; A technical and economic review of Brazilian experience" (UNIDO/IOD.228/Rev.1).

"Agriculture, mechanization and energy problems: the Italian experience", Paper prepared for the Meeting on Exchange of Experiences and Co-operation among Developing Countries in the Development of Agricultural Machinery Industry, Beijing, China, 20-27 October 1980.

"Economic utilization of wood waste and its value for power generation in wood processing industries", Paper prepared for the Seminar on Wood Processing Industries, Cologne and Hannover, FRG, 16-30 May, 1979 (ID/WG.296/17/Rev.1)

"Methods of evaluation and prospects of utilization of waste and brown coal as fuel and raw materials in the cement industry", Paper prepared for the Inter-regional Seminar on Cement Technology, Beijing, China, 9-24 October 1980 (ID/WG.326/1)

"Small hydro in Sweden" (ID/WG.329/3), "UNIDO issue paper" (ID/WG.329/1), Papers prepared for the Second Seminar-Workshop/Study Tour in the Development and Application of Technology for Mini-Hydro Power Generation (MHG), Hangzhou, China, 17 October-1 November 1980.

"The role of UNIDO in industrial technology" (ID/WG.332/5), "Industrial technology manpower in Africa" (ID/WG.332/5), Papers prepared for the Joint OUA/UNIDO Symposium on Industrial Technology for Africa, Khartoum, Sudan, 5-11 November 1980.

"The solar-energy powered thermoregulation cushion: an original device for promoting the early maturity of melons and watermelons", Paper prepared for the Eighth International Congress on the Application of Plastics in Agriculture, Lisbon, Portugal, 6-11 October 1980 (ID/WG.327/3)