



General Assembly

Distr.  
GENERAL

A/CONF.100/PC/41/Add.1  
26 March 1981

ORIGINAL: ENGLISH

PREPARATORY COMMITTEE FOR THE  
UNITED NATIONS CONFERENCE ON NEW  
AND RENEWABLE SOURCES OF ENERGY  
Third session  
30 March - 17 April 1981  
Item 2 of the provisional agenda

UN LIBRARY

APR 3 1981

UN/SA COLLECTION

REPORT OF THE SYNTHESIS GROUP

Chapter V. Appendix

Recommendations made by the Technical Panels and the  
Ad Hoc Groups of Experts

Note by the Secretariat

## INTRODUCTION

I.	Report of the Technical Panel on Geothermal Energy on its second session (A/CONF. 100/PC/23)	2
II.	Report of the Technical Panel on Wind Energy on its second session (A/CONF. 100/PC/24)	7
III.	Report of the Technical Panel on Ocean Energy on its second session (A/CONF. 100/PC/25)	9
IV.	Final Report of the Technical Panel on Oil Shale and Tar Sands (A/CONF. 100/PC/26)	12
V.	Report of the Technical Panel on Solar Energy at its second session (A/CONF. 100/PC/27)	14
VI.	Report of the Technical Panel on Biomass Energy on its second session (A/CONF. 100/PC/28)	17
VII.	Report of the Technical Panel on Hydropower on its second session (A/CONF. 100/PC/30)	24
VIII.	Report of the Technical Panel on Fuel Wood and Charcoal on its second session (A/CONF. 100/PC/34)	28
IX.	Report on the use of peat for energy (A/CONF. 100/PC/32)	36
X.	Report of the <u>Ad Hoc</u> Working Group on Draught Animal Power (A/CONF. 100/PC/39)	44
XI.	Report of the <u>Ad Hoc</u> Expert Group on Financing of New and Renewable Sources of Energy (A/CONF. 100/PC/29)	49
XII.	Final Report of the <u>Ad Hoc</u> Expert Group on Information Flows (A/CONF. 100/PC/31)	56

XIII.	Report of the <u>Ad Hoc</u> Group of Experts on Research and Development and Transfer of Technology (A/CONF. 100/PC/37)	64
XIV.	Report of the <u>Ad Hoc</u> Expert Group on Education and Training (A/CONF. 100/PC/33)	73
XV.	Report of the <u>Ad Hoc</u> Expert Group on Rural Energy <b>including</b> the Utilization of Energy in Agriculture (A/CONF. 100/PC/38)	85
XVI.	Report of the <u>Ad Hoc</u> Expert Group on Industrial Issues <b>including</b> Utilization of Energy in Transportation and Allied Sectors (A/CONF. 100/PC/36)	96

## INTRODUCTION

1. During the meeting of the Synthesis Group, the Secretariat was requested to prepare an informal document which would bring together, without further analysis, all the recommendations contained in the reports of the technical panels and ad hoc groups of experts. Similar passages in the consultants' reports on peat and draught animal power would also be included. The Synthesis Group subsequently decided that the document should form an appendix to chapter V of the report of the Synthesis Group. This does not, however, imply endorsement by the Synthesis Group of any of the recommendations (see A/CONF.100/PC/41, para. 16).

2. The recommendations have been reproduced below and, for the convenience of the reader, the paragraph numbers from the original report have been retained.

I. Report of the Technical Panel on Geothermal  
Energy on its second session  
(A/CONF. 100/PC/23)

MEASURES THAT CAN BE TAKEN TO OVERCOME THE CONSTRAINTS  
LIMITING DEVELOPMENT OF GEOTHERMAL ENERGY

A. Education and Training

110. There are a number of training centres for the higher staff levels of the geothermal industry. Ideally, more students from a wider range of countries should be able to receive such training, with particular emphasis on technical training and the physical conduct of operations.

111. However, existing centres are often very far away from these students' native countries, and their environment is sometimes quite different from the conditions prevailing in the areas in which geothermal energy is to be introduced when the students have completed their training. It would, therefore, be useful to open new training centres in major regions which do not yet have one.

B. Flow of information

112. It is very important to ensure that all available raw geological and geophysical information concerning the subsoil which might affect geothermal energy stratigraphy, lithography, porosity, nature of the fluids and temperature - is accessible. Those who obtain such data should systematically transmit them to a specialized public body responsible for storing them, for making sure that they are communicated to qualified persons and for preserving the confidentiality of any information protected by law.

113. An international documentation centre on geothermal energy, for example, within the United Nations system, and having formal contacts with national data centres and other existing data banks, would be very useful. But only through the spread of geothermal energy leading to the issuing of specialized publications in several languages can this form of energy and the techniques it requires become a part of modern technology.

C. Research and development - applications and transfer of technology

114. Aid projects should encourage the transfer of the technologies necessary for the investigation and development of geothermal resources and the operation and maintenance of the subsequent installation to the fullest extent practicable. This would include transfer of equipment, and the necessary knowledge to operate and maintain it. Where applicable, local industry should be encouraged to supply an increasing proportion of the equipment and services.

115. However, considerable work can be undertaken outside the purely technical field. Making the population aware of the depletion of economically viable sources of conventional energy, familiarizing them with geothermal energy, identifying energy uses in which non-renewable conventional fuels which have no possible substitute for specific applications such as petrochemistry could be replaced by

geothermal energy, detailing instances in which geothermal energy could provide the solution to hitherto unmet needs - all this calls for interdisciplinary studies, to be conducted in conjunction with the administration, local communities, universities and industry.

116. Complex scientific and technical problems remain unresolved and require international efforts. For example, geothermal energy is often not competitive because of the high chemical activity of the fluids involved. In order to prevent unduly rapid corrosion and scaling, titanium exchangers sometimes have to be installed. Yet titanium cannot be considered for very large-scale applications if they are to be economic. New alloys which can perform satisfactorily in the special physical and chemical environment of geothermal energy must be developed.

#### D. Financial constraints

117. The initial geothermal exploration in developing countries, particularly energy-importing countries, requires external financial assistance by international financial institutions up to a stage when commercial investments are feasible.

118. Geothermal energy should be given a special status by energy-importing countries as a way of improving the balance in foreign trade. Investment incentives from outside the country in that area could be planned. They could take the form of loans at preferential rates, insurance for exploration, the assigning of priority for the supply of equipment available only in small quantities or special tax treatment.

119. In order to improve the capacity of repayment of initial capital investment by developing countries, it is vital to emphasize a multipurpose use of the geothermal resources. This will also maximize the efficiency of the electricity-generating plant so developed.

#### E. Infrastructure

120. When necessary, priority must be given to the inclusion of geothermal energy in the economic and social development plan from the earliest stages of plan preparation. A country's need for geothermal energy and the contribution that it can make to the national energy balance must be taken into account very early on, in order to ensure that development of geothermal energy is not hampered by infrastructure constraints.

121. Priority should be given to the encouragement of geothermal usage on the small scale. This can compensate for the lack of a geothermal infrastructure, while maximizing the benefits of geothermal energy and the conservation of non-renewable resources.

#### F. Institutions

122. It is desirable for every country to have a geothermal energy code governing the ownership of geothermal resources, conditions for their use, the charges payable by users and their fiscal régime. Otherwise, there is a danger that legal uncertainty will discourage development of geothermal exploration. A model legal framework could be drafted at the regional or international level. Such actions will greatly aid the development of the resource by reducing unnecessary restraints and/or difficulties, and efforts should be expanded to remove or avoid such restraints.

123. At the same time, for some countries the scope of State supervision of geothermal resources should be clarified. A sound course is to confer technical responsibility for monitoring the geothermal industry on a single technical ministry. This does not, of course, preclude other ministries, for example, Finance, Environment, Foreign Affairs and the like, from assuming their respective responsibilities.

# PROPOSED ACTION

124. The proposed measures have been set out in the table below according to the level - international, regional or national - at which they are to be taken. The figures refer to the 14 measures identified in chapter IV above in the order in which they are described therein.

	<u>International</u>	<u>Regional</u>	<u>National</u>
Education and training	(1)	(1) (2)	(2)
Flow of information	(4)	(4)	(3)
Research and development - applications and transfer of technology	(7)	(5) (7)	(5) (6)
Financial constraints	(8) (9) (10)	(8)	(8) (10)
Infrastructure	-	-	(11) (12)
Institutions	(13)	(13)	(13) (14)

## A. At the international and regional levels

125. At the international level, the proposed measures can be divided into three categories, depending on whether they relate to:

- (a) Financial constraints (8), (9), (10);
- (b) Organization of the geothermal industry (13);
- (c) Necessary know-how (1), (4), (7).

Existing institutions, both multilateral and bilateral, are believed equal to the task of dealing with the above problems. These measures must be taken as early as the exploration phase in the case of guarantees (10) and at the development phase in the case of financing (9).

126. On the other hand, there is at present no single institution capable of dealing with the other measures. A single international centre is highly desirable for data collection and dissemination (4) and conducting or commissioning studies on key areas of geothermal energy (7). Such a centre could be an aid in the all-important task of working out a general geothermal energy code (13).

127. The training of geothermal specialists (1) should receive the highest priority. The shortage is equally serious at the professional and technician levels. Co-ordination of professional training could be handled at the international and regional levels and technician training at the regional and national levels.

128. At the regional level, priority must be given to information (4) and training (2). This level is particularly useful because it is possible here to combine the

/...



efforts carried out by individual countries (5) while at the same time preserving a degree of unity as regards the types of problem encountered. Solutions worked out in this framework can probably be applied more easily and more rapidly to countries in the region than those worked out in a far broader framework embracing all possible situations. Regional bodies could put the finishing touches to the legal principles on geothermal energy drafted at the more general level by adding the clarifications and corrections warranted by each region's particular situation (13).

#### B. At the national level

129. The main effort must be concentrated on the national level because, in the final analysis, it is within that framework that geothermal resources are developed naturally. Moreover, it is at that level that most constraints are encountered.

130. National policies regarding training and education, (1) and (2) should, as well as developing national training facilities as rapidly as possible, encourage the fullest participation by their nationals in all available regional and international training schemes.

131. The constraints which must be removed first are those that prevent prospecting from being undertaken. Accordingly, the institutional measures [(13) and (14)] must be adopted first. Secondly, assistance for geothermal exploration leading to the defining of the national geothermal potential should be sought [(9) and (10)]. Thereafter, all due attention must be given to the inclusion of geothermal energy in the country's economic fabric. Infrastructural measures [(11) and (12)] are, therefore, equally pressing. Lastly, and this relates to measure (13), the dissemination of geological data (3) is a prerequisite for economic exploration.

132. The next priority goes to financial constraints. Tax-relief measures (8) may in some countries be a prerequisite for a speedy start in the development of geothermal resources.

133. These resources may be developed initially with external technical assistance, but efforts must be made as soon as possible to replace foreign capital goods and services gradually with locally produced equivalents. That is the aim of measures (5) and (6).

II. Report of the Technical Panel on Wind Energy  
on its second session  
(A/CONF. 100/PC/24)

RECOMMENDATIONS

1. Preliminary wind-resource assessment

83. A preliminary wind-resource inventory should be undertaken as soon as possible in all countries having some wind-energy prospects. This could normally be based on meteorological data, which should be improved as necessary and could be carried out by national staff assisted by the wind-energy technical note now under preparation by national staff assisted by the wind-energy technical note now under preparation by the World Meteorological Organization (WMO). If necessary, further international assistance could, in specific cases, be sought.

2. National wind-energy focal points

84. Countries having some prospects for wind energy should designate a national focal point for wind-energy policy-making, planning and implementation, within an appropriate department of Government (planning, finance, energy or rural development) or an agency nominated by the Government.

3. Wind pumping for rural development

85. Socio-economic systems studies indicate that small wind-powered water-pumping systems are quite appropriate to irrigation in small farms, even in comparison with other renewable energy sources. The panel strongly recommends inclusion of wind-powered pumps in rural development programmes wherever local conditions are favourable. An important positive aspect of small windmills is the likelihood of creation of additional employment in rural areas.

4. Wind energy centres

86. Because of the importance of creating national (and in certain cases subregional) centres for wind-energy technology, it is strongly recommended that international assistance, through the United Nations system and other agencies active in the field, be given to countries wishing to establish such centres. They should be tailored to suit the needs of the individual countries, taking account of those areas discussed in detail in paragraph 82, part B above (Constraints in research and development and transfer of technology).

5. Training of trainers

87. Because of the shortage of wind-energy specialists all over the world, it is recommended that training courses be established on a permanent basis at one or more suitable advanced wind-energy centres or other appropriate institutions.

## 6. Wind-energy information programmes

88. In view of the present initial use of wind power and the anticipated potential for rapidly expanded use, national focal points, wind-energy centres and appropriate international organizations should develop active information programmes to provide prompt, accurate and useful information and related materials on developments, techniques and experiences to potential users, decision makers and other interested parties.

## 7. Financing

89. The panel noted that wind-energy conversion systems (and most other renewable energy-conversion systems) are capital intensive (compared to conventional ones), even though they are cost-effective over a period of time. It is essential to devise suitable financial packages, including low-interest loans and subsidies to accelerate the pace of utilization of this energy resource.

## 8. Time scales

90. The panel takes note of the feasibility of using small windmills in large numbers in the rural areas of many developing countries and recommends that it is now time to make definite commitments backed up by adequate infrastructural facilities and financial support. Small-sized and medium-sized wind-powered electric-generation systems are expected to be economically viable on a significant scale within the next five years. In fact, many isolated communities can take advantage of this technology in the immediate future. The Panel also believes that supplying electric power from land-based wind turbines into power networks could become commercially viable in 5 to 10 years' time and from offshore systems by the turn of the century.

III. Report of the Technical Panel on Ocean Energy  
on its second session  
(A/CONF. 100/PC/25)

SUMMARY AND RECOMMENDATIONS

98. One of the major energy problems facing the world today is the rapidly increasing demand for and price of oil. Later on, the same problem will occur with other fossil fuels and with uranium. Hence, renewable sources of energy are of increasing importance. They are especially important for the developing countries, many of whose economies are suffering very badly from the adverse balance-of-payment effects of oil imports. Among the renewable sources, the ocean resource is substantial. The following ocean resources were considered by the technical Panel: OTEC, tides, waves, ocean currents and salinity gradients. Ocean wind and biomass are dealt with by other Panels. The size ranges of ocean energy plants, their requirements in terms of capital investment and their electricity costs, compared to those aspects of other energy systems, are shown in Figures IV, V, VI, prepared by EUROCEAN.

99. Of the ocean technologies, there is only one that is commercially established - namely, tidal energy. There are a few prime tidal sites in the world where the technology is probably economic now compared to the cost of fossil fuels (oil and coal). Other sites may become economic as energy prices rise. While tidal energy will make a useful contribution to world energy supplies over the next 20 years, it is not large by global standards and will not make a major impact on the energy problems of the developing countries. The conclusion on wave energy resources is somewhat similar, though for different reasons. It is larger in extractable form than tidal energy, but is of most interest beyond 30° N and 30° S. Hence, it is applicable to only a few of the developing countries. Even in such countries it is unlikely to find wide application in the present century because its unit costs are too high; more research is needed before its ultimate economics can be assessed. Neither ocean currents nor salinity gradients were thought to have any prospect of commercial application in the century.

100. The Panel focused primarily on OTEC, on the basis of projected conceptual viability, significance for developing countries in the next 10-15 years, and amenability to international action. Its advantages and the constraints on its early exploitation are summarized below.

A. Advantages of OTEC

101. On the basis of experimental trials on a small scale and of conceptual design studies on a much larger scale, the advantages of OTEC are clearly seen by technical experts. Those advantages were discussed in chapter II above, and relate to economics, technology, the environment, and resource and technological accessibility.

B. Constraints on OTEC development and exploitation

102. The idea of generating electrical energy from such small temperature differences and with such large structures somewhat strains the credibility of the non-specialist. Because it is not obvious that the process will work easily, lack of credibility is the first constraint to OTEC development. In fact, OTEC will not be fully credible to those responsible for purchasing and financing until its reliability has been demonstrated on a commercial scale.

103. There are also constraints involving OTEC technology and its potential. OTEC differs from conventional technologies; those likely to use it or invest in it do not fully take account of such factors as the effects of zero fuel-cost and of the maritime location on operating procedures and plant economics, or the need to develop an investment philosophy that credits the long-term benefits of those effects against the drawback of high capital charges. The resource, its management and its use are understood only in broad terms, inadequate for individual developing countries that may want to evaluate the full relevance of OTEC to their needs.

104. The Panel believes that OTEC is an emerging ocean technology of special potential significance for the developing world and that it should be given a high priority by the Conference. In order for OTEC to overcome the present constraints on its exploitation, the Panel makes the following recommendations:

(a) A demonstration project should be initiated in a developing country to demonstrate OTEC reliability and economics, under size and operating conditions appropriate to a commercial operation. It should be open to all who wish to participate. An international demonstration project under United Nations auspices would increase the understanding of OTEC and of the benefits of its application to developing countries.

(b) A special OTEC demonstration fund should be established to finance the project described in (a) above.

(c) An OTEC development fund should be established to support increased international awareness of OTEC and early projects in developing countries.

(d) An information, education and training programme should be established, with emphasis on resource and site assessment.

(e) Studies should be undertaken within existing United Nations programmes to address the following subjects:

- (i) Developing country markets;
- (ii) Research assessment and network integration;
- (iii) Long-term OTEC cost/benefit;
- (iv) Identification of manufacturing opportunities in developing countries;
- (v) Multiple-use concepts, including the "energy island" concept;
- (vi) International co-operative plantship projects;
- (vii) Refinement of guidelines for resource assessment and site evaluation.

(f) Any demonstration project arising out of recommendation (a) should be linked with activities arising out of recommendation (c). This should be done in such a way as to provide an over-all United Nations focus for the participation of all countries interested in OTEC, including information advice and studies aimed at applications and markets, and the establishment of fellowships to advance and train developing country specialists in OTEC technologies.

(g) On tidal power, activities should continue within existing United Nations programmes to help evaluate its prospects in individual developing countries interested in it.

(h) The position on wave power should be reviewed again in about two years.

IV. Final Report of the Technical Panel  
on Oil Shale and Tar Sands  
(A/CONF. 100/PC/26)

RECOMMENDATIONS

The Panel makes the following recommendations:

84. An oil-shale and tar-sands resource inventory should be undertaken as soon as possible. In order to assist developing countries, the geological and mineral exploration literature should be reviewed and possible occurrences indexed.
85. There is a need to standardize resource evaluation and measurement procedures. Geological evaluation and correlation data should also be treated in a standardized way. This calls for international collaboration.
86. Countries having some prospects for oil-shale/tar-sands development should designate a national focal point for policy-making, planning and implementation, within an appropriate department of government (planning, finance or energy) or an agency nominated by government.
87. Small-scale retorting of oil shale for domestic energy needs is technically and may be economically feasible in rural areas of some countries having a resource base. The attention of Governments is drawn to this possibility.
88. The Panel recommends that international assistance be made available for countries wishing to create national centres for oil shale and tar sands. The centres would perform in the following areas:
  - (a) Materials and know-how suppliers. The centre could identify the existing sources of equipment and services required to establish shale-oil and tar-sands industries. Through use of those sources and by utilizing personnel who have been properly trained and educated, the necessary facilities and installations can be constructed, operated and maintained.
  - (b) Information on technological requirements. The centre could assist in choosing a technology that would best accommodate the infrastructure of a developing country. For instance, an economic comparison of 10 technologies may show that for the United States a sophisticated, capital-equipment-intensive technology is superior to a simple, labour-intensive one. However, when the infrastructure and social requirements of a developing country are considered, a simple, labour-intensive system may be more suitable.
  - (c) Education and training. The centre should identify the institutions that are suitable for educating and training decision makers, managers, professionals and technicians who will be required to establish and to operate oil-shale and tar-sands industries. This should be followed by liaison activities to assure that the best training possible is being made available to the best qualified personnel. Inventories on the availability of scholarships might be exploited to facilitate this training.
  - (d) Research and development. In addition, the centre could assist in establishing co-operative research and development programmes. One example is the co-operative oil-shale research programme that is being carried out between the Laramie Energy Technology Center and Morocco.

(e) Resource evaluation seminars. The centre should sponsor seminars presenting resource evaluation procedures in detail to the people who will be conducting resource evaluations. This transfer of basic information and know-how to countries interested in initiating resource evaluation programmes could save developing countries invaluable time and much money. The seminars should be aimed primarily at geologists, mining, engineers, chemists, and technicians, but should on occasion include managers, in order to enhance understanding and support of the evaluation processes.

(f) Technology information pool. The centre should accumulate, index and maintain descriptions of available production technologies. They should include information on resource requirements and their performance variables, and cost estimates for operating the processes on suitable resources.

(g) Technology demonstration tours. Technology tours of ongoing commercial ventures, demonstration projects, pilot-plant experiments, and research and development facilities can be used to stimulate interest and educate all levels of personnel. They may also be used to arouse interest in development.

89. International financing organizations should be made aware of the favourable prospects for oil-shale and tar-sands developments, especially for small-scale oil-shale retorting to supply rural energy needs.

90. The Panel recognized the urgent needs of developing countries for technical assistance in all aspects of oil-shale/tar-sands development, and recommended that international arrangements for organizing and financing such assistance be strengthened.



V. Report of the Technical Panel on Solar Energy  
at its second session  
(A/CONF. 100/PC/27)

RECOMMENDATIONS

101. Solar energy technologies are currently passing through an exciting phase and are on the threshold of large-scale and extensive application in developing and developed nations alike. The following major recommendations are made in the interests of accelerating solar energy utilization.

A. Data

102. States should be encouraged to strengthen their national solar energy data collection systems, under the guidance of WMO, and to cover all their climatic zones, so that, using space and time correlation functions, it will be possible to extrapolate data to different places in a given zone.

103. National agencies should prepare solar energy maps, thus making it possible to improve solar radiation data over the globe.

104. The Conference should approve and encourage the preparation of such maps and the implementation of the above-mentioned measures.

B. Policy and institutions

105. All States should evolve a policy for new and renewable energies, including solar, within the framework of an over-all energy policy and should create the necessary infrastructure to pursue this policy.

106. The applications which are today technologically proven and economically viable should be introduced without further delay and, in addition, carefully planned demonstration programmes appropriate to the State should be undertaken.

C. Financing

107. States should, through various fiscal measures such as tax rebate, tax exemption, monetary incentive, leasing schemes, and State procurement, promote market penetration and, through the mechanism of financial assistance with higher depreciation rates, encourage the setting up of solar industry infrastructures.

108. Financial institutions should be encouraged to provide finance to solar industries on easy terms, since the initial investment in solar technology is relatively high and capital-scarce economies may find it increasingly difficult to find the necessary capital funds.

109. To ensure adequate funding for all the activities resulting from the recommendations made at the Conference, sufficient funds should be made available to appropriate international organizations and, when necessary, their working mandate should be extended.

D. Research and development

110. To accelerate the introduction of solar technologies and to make them more reliable and cost effective, research and development, especially in developing countries, should be increased several fold.

111. Greater emphasis should be placed on materials, construction and the adaption of technologies to locally available materials and skills.

112. Care should be taken to strengthen the various links in the innovation chain to ensure that the fruits of research and development go to the community.

E. Information flow

113. The information flow in relation to solar energy development and utilization should be considerably improved through a comprehensive information network at the global, regional and national levels. Carefully prepared documents giving the technical feasibility and economic viability of various solar energy applications should be prepared and made available to all groups, especially planners and decision makers.

F. Education

114. A massive programme for creating public awareness of the need for and possibilities of solar energy utilization and for providing appropriate information should be undertaken, using mass media such as radio, television, newspapers and periodicals.

115. Greater opportunities for the exchange of ideas, discussions between scientists, technologists and others need to be provided regionally and internationally through the organization of co-ordinated, well planned "action oriented" conferences, seminars and workshops.

116. Periodic state-of-the-art reports should be commissioned from groups of experts on various solar applications and should be made widely available.

G. Training

117. Intensive and appropriate training and education programmes in various solar applications at all educational levels, for schools, technicians, designers, urban and rural planners and decision makers, should be co-ordinated in various related technical and non-technical disciplines.

118. In the first instance, at least in developing countries, the major emphasis should be given to teacher training and continuing education.

H. Transfer of technology

119. It will be essential to evolve a methodology for generating solar technology by developed and developing nations working together in bilateral and multilateral programmes, so that not only will the complex question of technology transfer not arise but confidence will be felt by the scientists and technologists of developing nations in their own ability to contribute to indigenous technology if the appropriate local facilities are provided.

120. In order to ensure and increase design competence, manufacturing capacity, and the adaption of technology to local skills and materials, technology transfer should be considered the transfer of "know-why".

121. The Conference should be used as a vehicle for reinforcing the role of the United Nations system in the field of solar energy in ways which the Conference considers most appropriate.

VI. Report of the Technical Panel on Biomass Energy  
on its second session  
(A/CONF. 100/PC/28)

RECOMMENDATIONS OF THE PANEL

Recommendation I. Biomass energy implementation plan

155. It is recognized that there is considerable information and experience on biomass production and conversion available within the international community but there is a lack of practical experience of these systems in the developing countries where they are often most needed.

156. Through the international sharing of information and in the spirit of international co-operation, it is recommended that the United Nations, other international agencies, Governments and individuals should together promote the establishment of a global network of biomass energy projects to demonstrate appropriate technologies in realistic situations.

157. The global network should include existing organizations which are carrying out suitable biomass demonstration projects and would naturally act as information training centres.

158. Demonstrations of these technologies, both small and large-scale, will be useful only if they are well planned, carefully designed, well organized and integrated with local material and human resources, and objectively evaluated in terms of economics, technical characteristics, generation and demonstration potential and social and environmental costs and benefits.

159. A biomass energy working group should be constituted to assist in the planning of the demonstration and to review and assess the projects's progress and results and make the results available to all.

A. Biomethanation

160. The biomethanation of manures, agricultural residues and other organic materials is widely practised in some countries. The establishment of demonstration plants in other countries in different regions of the world would facilitate both the evaluation of the technology and the wider adoption of the technology. The integration of biomethanation with ethanol production appears to be a very attractive use of the technology to produce energy and to stabilize the effluent from the alcohol plant.

B. Small-scale gasifier and stationary engine for mechanical energy

161. The gasification of biomass to produce a fuel gas for combustion in engines is an existing technology. The operation, maintenance and life of these systems when used in large numbers has not been determined. The Panel recommended that a single region should be selected and a large number of units installed as a demonstration.

C. Electricity: small-scale system

162. The basic gasification technology can be used to run engines to generate electricity. It was recommended for domestic or industrial applications that a global demonstration at about 20 sites should be used to demonstrate the technology over a wide variety of conditions.

D. Electricity: large-scale system

163. Energy farms using short-rotation forestry have not been demonstrated except in a few selected sites in developed countries. The Panel recommended that a demonstration energy farm and a wood-fired electric generation or cogeneration facility should be set up in a developing country.

E. Methanol and/or synthetic fuel production

164. The gasification and indirect liquification of biomass to produce methanol and/or synthetic fuel has not been demonstrated. The Panel recommended that such a demonstration should be carried out.

F. Ethanol production from lignocellulosic biomass

165. Studies conducted on the bioconversion of lignocellulosic biomass into ethanol in the United States and India during the last decade have generated enough scientific and engineering knowledge and data to demonstrate the technical feasibility of production of this important form of bioenergy. These studies have moreover been based on lignocellulosic substrates widely available in most developing countries. The Panel recommended the establishment of a demonstration plant to produce 45,000-50,000 litres per day of 95 per cent ethanol.

Recommendation II. Incorporation of biomass energy into national energy programmes

166. The Panel was acutely aware of the constraint on the development and use of biomass energy systems created by the lack of national political commitment. Therefore, the Panel recommends that national policies should be adopted that give a high priority to biomass as a component in over-all national energy policies. These policies should incorporate descriptions of the mechanisms for implementing decisions in a manner that is appropriate to the interests, needs and social customs of local communities.

167. The Panel also recommends that Governments should be aware of the marketable and non-marketable energy share in their over-all energy supply and demand, and should duly consider in their energy planning the specific and potential contributions that biomass energy can make in the short, medium and long terms; such contributions should be given full consideration in the preparation of national energy assessments.

Recommendation III. Identification and distribution of energy plant species

168. The provision of an adequate supply of raw materials matched to specific biomass technology is a prerequisite for a successful biomass conversion programme. At present, many traditional crops are also used as energy crops (sugar-cane, eucalyptus etc.). However, insufficient attention has been paid to the identification and development of plant species specifically for energy. The Panel recognizes the work going on in this area and recommends that the United Nations and the specialized agencies should assist and encourage national and international institutions:

- (a) To establish an inventory of potential energy plant species;
- (b) To organize the exchange of living plant material (seeds, clones, cuttings etc.);
- (c) To establish a methodology, and support in conducting comparative studies of species and clones under local conditions.

169. Special attention should be given to local plant species, to plant species for semi-arid areas, and to multipurpose plant species particularly adapted for use in small-scale, decentralized rural energy systems.

170. This recommendation can be implemented by:

(a) Evaluating the national resources. Methods should be developed to evaluate the basic resources, which are residues from existing vegetation and potential biomass, both terrestrial and aquatic, and from energy farms. This evaluation needs to be done for the country as a whole and then in more detail for these specific sites that appear to be attractive for biomass energy use;

(b) Analysing the demand for various forms of energy today and in the future;

(c) Defining the systems for transforming natural biomass resources into usable forms. This includes technologies for harvesting residues, growing of energy feedstocks, conversion to intermediate and end forms of energy. Means to distribute the various energy forms throughout the systems should also be defined;

(d) Drawing up plans for national implementation of biomass energy as a part of the national energy programme. This plan should identify the resource, means to transport that resource to the conversion site, and the energy demand to be supplied. The plan should also include the cost, time, manpower needs, environmental impact (both positive and negative) etc.;

(e) Analysing the necessary financial, legal and organizational efforts for the biomass programme.

171. The means are the following:

(a) Encouraging and assisting Governments to set up national biomass energy centres which cover the basic "know-how", resources, information and suitable manpower;

(b) Organizing an international biomass energy evaluation and implementation office, preferably as part of an existing United Nations body, to assist the local governments in their efforts to achieve the above goals; this office could also, on its own initiative, encourage Governments to establish national bioenergy programmes;

(c) Establishing local biomass energy market organizations operating as an interface between the biomass resource and the users of various biomass forms; this is necessary to collect, transport and store various kinds of biomass and to transfer the upgraded feedstock to either single large users or several small users.

#### Recommendation IV. Decentralization

172. The Panel emphasized that biomass energy resources and technologies for their conversion to useful forms of energy, in common with other renewable energy systems, are particularly well suited to small-scale decentralized autonomous use. The Panel notes further that biomass-based systems are also well suited to matching energy resources and technologies for use with local needs. Therefore, the Panel:

(a) Calls for efforts to stabilize the participation of both rural and urban communities in mobilizing the resources for the production and use of biomass-based energy;

(b) Recommends that countries should include biomass energy as a major part of their energy planning, particularly for rural areas.

173. In addition, the Panel emphasized the particular need for countries to examine the potential of decentralized biomass-based systems when evaluating conventional rural-electrification schemes.

#### Recommendation V. Education and training

174. Any organized development of biomass resources and conversion techniques must be based on the availability of adequate training facilities and of trained manpower.

175. The Panel, therefore, recommends that the United Nations and the specialized agencies should strongly encourage and support national Governments in organizing and implementing regional, national and local training programmes for their professional and technical staffs, and for promotional, personnel and extension workers in the field of biomass energy production, management and conversion technologies.

176. Training needs to be done at the engineering, scientific, technical and extension levels (see paras. 88-92 above). International workshops and practical field courses (not symposia) should be instituted, aimed at training people at universities or other institutions who will act as professors or teachers in biomass programmes.

177. Popular education and extension programmes should be used to raise people's awareness and stimulate their capability to develop biomass resources for energy. Especially in rural areas, institutions can play a major role from the primary-school age forward.

178. The use of the mass media - television, radio and newspapers - should be promoted to familiarize the population with the advantages of these technologies.

179. Special importance should be attached to training and education in the social sciences to promote adequate integration of biomass technology for rural development.

#### Recommendation VI. Education and training: biotechnology

180. Any organized development of biomass resources and conversion processes pre-supposes the availability of institutional facilities for training manpower in biotechnology. The discipline is becoming more important in developing countries. If biotechnology is to have the proper, immediate and effective impact on the availability of knowledge of ecological conversion systems in a developing world, it is imperative that all developing countries should encourage the inclusion of biotechnology in the education and training of its sciences, incorporating disciplines like chemical engineering, microbiology and biology. One essential component of such a training system would be in situ practical exposure to the biomass energy systems in operation in the country or elsewhere. It is therefore recommended that all such countries lacking in such facilities should take active steps to achieve the objectives. United Nations agencies may be in a position to provide assistance to the developing countries as an immediate need.

#### Recommendation VII. Information flows

181. The Panel recommends that the United Nations and the specialized agencies should assist Governments to establish national biomass data in selected existing document centres, wherever possible, which will have the following functions:

- (a) To collect and distribute information on planning, evaluation, financing and operation of biomass techniques and technologies;
- (b) To promote the use of information throughout each country by organizing conferences, workshops etc.;
- (c) To promote standardization of equipment and techniques;



171. The means are the following:

(a) Encouraging and assisting Governments to set up national biomass energy centres which cover the basic "know-how", resources, information and suitable manpower;

(b) Organizing an international biomass energy evaluation and implementation office, preferably as part of an existing United Nations body, to assist the local governments in their efforts to achieve the above goals; this office could also, on its own initiative, encourage Governments to establish national bioenergy programmes;

(c) Establishing local biomass energy market organizations operating as an interface between the biomass resource and the users of various biomass forms; this is necessary to collect, transport and store various kinds of biomass and to transfer the upgraded feedstock to either single large users or several small users.

#### Recommendation IV. Decentralization

172. The Panel emphasized that biomass energy resources and technologies for their conversion to useful forms of energy, in common with other renewable energy systems, are particularly well suited to small-scale decentralized autonomous use. The Panel notes further that biomass-based systems are also well suited to matching energy resources and technologies for use with local needs. Therefore, the Panel:

(a) Calls for efforts to stabilize the participation of both rural and urban communities in mobilizing the resources for the production and use of biomass-based energy;

(b) Recommends that countries should include biomass energy as a major part of their energy planning, particularly for rural areas.

173. In addition, the Panel emphasized the particular need for countries to examine the potential of decentralized biomass-based systems when evaluating conventional rural-electrification schemes.

#### Recommendation V. Education and training

174. Any organized development of biomass resources and conversion techniques must be based on the availability of adequate training facilities and of trained manpower.

175. The Panel, therefore, recommends that the United Nations and the specialized agencies should strongly encourage and support national Governments in organizing and implementing regional, national and local training programmes for their professional and technical staffs, and for promotional, personnel and extension workers in the field of biomass energy production, management and conversion technologies.

176. Training needs to be done at the engineering, scientific, technical and extension levels (see paras. 88-92 above). International workshops and practical field courses (not symposia) should be instituted, aimed at training people at universities or other institutions who will act as professors or teachers in biomass programmes.

177. Popular education and extension programmes should be used to raise people's awareness and stimulate their capability to develop biomass resources for energy. Especially in rural areas, institutions can play a major role from the primary-school age forward.

178. The use of the mass media - television, radio and newspapers - should be promoted to familiarize the population with the advantages of these technologies.

179. Special importance should be attached to training and education in the social sciences to promote adequate integration of biomass technology for rural development.

#### Recommendation VI. Education and training: biotechnology

180. Any organized development of biomass resources and conversion processes pre-supposes the availability of institutional facilities for training manpower in biotechnology. The discipline is becoming more important in developing countries. If biotechnology is to have the proper, immediate and effective impact on the availability of knowledge of ecological conversion systems in a developing world, it is imperative that all developing countries should encourage the inclusion of biotechnology in the education and training of its sciences, incorporating disciplines like chemical engineering, microbiology and biology. One essential component of such a training system would be in situ practical exposure to the biomass energy systems in operation in the country or elsewhere. It is therefore recommended that all such countries lacking in such facilities should take active steps to achieve the objectives. United Nations agencies may be in a position to provide assistance to the developing countries as an immediate need.

#### Recommendation VII. Information flows

181. The Panel recommends that the United Nations and the specialized agencies should assist Governments to establish national biomass data in selected existing document centres, wherever possible, which will have the following functions:

(a) To collect and distribute information on planning, evaluation, financing and operation of biomass techniques and technologies;

(b) To promote the use of information throughout each country by organizing conferences, workshops etc.;

(c) To promote standardization of equipment and techniques;

(d) To co-operate with similar centres in other countries in sharing local experience, techniques etc.

182. The Panel recommends that the United Nations system should provide particular support and organize workshops for the adoption of standardized systems of units and terminology. In addition, the Panel recommends that developing countries with current involvement in biomass energy systems should organize a workshop to establish a common approach to the evaluation of the social, environmental and economic impact of such systems.

#### Recommendation VIII. Industrial issues

183. The use of biomass energy conversion technologies is restrained by low industrialization in developing countries to take maximum profit from the national resources available.

184. To overcome this situation, the Panel stressed the need for the encouragement and/or the promotion of participation by national industrial enterprises in the implementation of the conversion technologies of biomass.

185. For this purpose the United Nations system should provide assistance to all those countries which have potentialities to exploit biomass energy.

#### Recommendation IX. Research and development

186. The Panel recognizes (1) the diverse nature of conversion technologies, end uses and possible feedstocks for biomass energy production, (2) that over half the world's population, mostly living in rural areas, is now and will continue to be dependent on biomass energy resources for most of its energy and that efforts to promote bioenergy production should be for the benefit of the rural poor, (3) that research and development work should be aimed at more efficient utilization of current biomass resources, expansion of the resource base through introduction of new feedstocks or conversion technologies, and (4) that in the biomass energy field there are particularly good opportunities for combining the advanced technological capabilities of developed countries with the favourable geographic and climatic conditions of many developing countries.

187. The Panel therefore recommends:

(a) That the United Nations and other international organizations should assist Governments, universities and research institutes to promote co-operative research, development and demonstration programmes between developed and developing countries as well as among developing countries;

(b) That research and development centres should be established involving at least two, or possibly more, countries, with continuing international support in those developing countries where experience, expertise and infrastructure already exist, which are particularly suitable to each of these research and development needs;

(c) That scientific and technological information emerging from these programmes should be made freely available, particularly for the benefit of the rural poor.

188. Specifically, the Panel recommends the immediate establishment of international co-operation among research and development institutes and co-operative networks in the following areas of biomass-resource-based energy:

(a) Small-scale biomethanation from domestic wastes, manure and agricultural residues;

(b) Integrated biomass conversion systems incorporating ethanol and oil production, biomethanation processes and organic fertilizer evaluation;

(c) Thermochemical conversion of biomass on both small- and large-scales into gaseous and liquid fuels;

(d) Bioconversion of lignocellulosic biomass to ethanol.

#### Recommendation X. Rural energy

189. In rural areas, the seasonal character of the energy requirements at the farm and local community levels, and of various new energy sources, especially solar, must be taken into account. It is, therefore, necessary to examine the full range of problems concerning the production and utilization of biomass energy in close connexion also with the problems related to other new and renewable sources, especially within the framework of integrated energy systems. Networks of various types of farms and other enterprises should be established at regional levels in order to develop such systems.

#### Recommendation XI. Social and environmental

190. The Panel stresses the very close relationship which exists between most biomass technologies and rural communities and land-use systems. The Panel recommended that in designing, evaluating and developing biomass systems particular attention should be paid to direct and indirect socio-economic costs and benefits which may stimulate or constrain the system's insertion in rural areas and the active involvement of local communities. Social sciences should play an important role in the understanding of the social implications and constraints and in identifying ways and means to stimulate the participation of all community members and specifically women.

191. The Panel noted that, in contrast to fossil-fuel energy systems, properly managed biomass energy systems are characterized by their potential beneficial impact on the environment. This is particularly important in view of the potentially serious long-term climatic effects of increased atmospheric concentration of carbon dioxide resulting from accelerated use of fossil fuels.

192. The Panel recommended that in the design and evaluation of bioenergy projects systematic consideration should be given to the analysis of their impact on the environment, including agricultural productivity, livestock grazing, watershed management, soil erosion, and wildlife ecology, particularly as regards their implications for rural life and development prospects.

VII. Report of the Technical Panel on Hydropower  
on its second session  
(A/CONF. 100/PC/30)

GENERAL SUMMARY AND RECOMMENDATIONS

A. General Summary

174. Of all renewable sources of energy, hydropower is expected to make a significant contribution in the energy picture, in particular power systems of countries throughout the world during the next 20 to 25 years. Only a small portion of the economic potential of hydropower resources is utilized today. An immense unused hydropower potential is available in the developing countries.

175. Hydropower utilization technology is by now sufficiently well developed. Much experience has been amassed in the building and operating of hydroelectric power stations in various regions of the world and under different climatic, geological and geophysical conditions. The efficiency factor of hydroelectric power equipment now being manufactured in many countries is very high. The dissemination of accumulated experience in planning and building hydroelectric power stations to developing countries and the expansion of co-operation in the manufacture of hydroelectric equipment are essential conditions for a fuller utilization of hydropower potential.

176. The growing importance of hydropower in national economies and energy systems is reinforced by the fact that water resources are used in an integrated manner for the development of irrigation, water transport, and water supply to industry and population. It is also reinforced by the importance of flood control. The excellent flexibility of hydroelectric generating plant and its operational reliability mean that hydroelectric power plants can be used to regulate capacity in accordance with consumer requirements, thus creating favourable conditions for the operation of thermal and nuclear power plants.

177. Considerable successes in the utilization of water power provide the necessary conditions for the development of pumped storage and for the utilization of tidal energy. Better utilization of hydropower potential is achieved through re-use of water power with reversible generator sets and the construction of pumped storage plants on minor watercourses. Experience gained from the construction of the first tidal power stations has shown that it is technically feasible to use tidal energy. For the present, however, the development of such power stations in suitable locations is held back by the high construction cost of such plants.

178. The extensive use of hydropower is currently held back by the inadequacy of background hydrological, topographical, geological and economic data, especially in developing countries where most of the as yet unused hydropower potential is concentrated. Lack of skilled personnel and financial constraints in these countries also exercise a serious limiting effect. Considerable possibilities for hydropower development are available on international rivers, but their use for power generation is often rendered difficult by the absence of basic legal standards to govern the joint construction and operation of hydropower installations on such rivers. The above-mentioned constraints could, however, be largely eliminated in the near future by the adoption of appropriate measures.

## B. Recommendations

179. Having in mind the current availability of the established and widespread use of hydropower technology for the exploitation of the water resources of a country, the Panel makes the following recommendations to elaborate and enhance the use and value of this renewable resource:

### 1. General

180. Special attention should be drawn to the international professional organizations working in the field of water resources, water power, electricity systems and supply technologies. They should be encouraged to extend further their efforts to embrace developing countries in their activities to the extent possible. Developing countries not yet participating in such organizations should take steps to do so.

181. The international electrotechnical vocabularies published by the International Electrotechnical Commission (IEC) in several languages, with definitions for the hydraulic and electrotechnical field industries, e.g. water power and electrical supply system technologies, should be made full use of.

182. International standards covering various aspects of hydraulic and electrotechnical material for generation of electrical energy are issued by IEC. Application of such standards is recommended. They should be adopted as national standards also in countries where standards are not yet established.

### 2. At the national level

183. Proper institutions should be organized on local, national and international levels as appropriate to deal with hydraulic energy resources investigations and planning, construction and operation of hydropower plants and electricity supply systems, and other hydraulic installations associated therewith, and similarly on financing and legal matters.

184. In each country, subregional or regional institutions should be established to provide cartographic materials which are required for hydropower planning.

185. Hydropower potential should be examined in the context of a national natural resource development policy and stream gauging and other hydrological networks should be established to provide an adequate data bank for hydropower development.

186. The potential for rural application of small and micro-hydropower development should be examined and countrywide programmes for its development should be prepared where appropriate.

187. Because of limited availability of funds for hydropower development both at national and international levels, a priority list of hydropower development schemes should be established. Financing terms of such projects should reflect the long economic life of hydropower plants.

188. National research, development and demonstration programmes should be strengthened with appropriate bilateral assistance or through international organizations to make it possible to assess, select and adapt relevant hydropower technologies developed in the industrial countries.

189. Training programmes to meet trained manpower requirements and programmes of training of trainers should be established with appropriate bilateral and international assistance through either training centres or pilot projects in the field of planning, construction, maintenance and operation.

190. Special legislation on water rights should be established in countries where such legislation does not exist or is inadequate.

### 3. At the international level

191. Hydraulic resources of countries should be reviewed on a global basis. In this connexion the Panel draws attention to the work of the World Energy Conference (WEC) on such reviews and recommends that future United Nations activities and others in this field should be co-ordinated with those of WEC.

192. Standardization of hydropower equipment and of the "package plant" design of small-scale and even large hydropower plants should be accelerated through international collaboration.

193. A world-wide survey on the manufacturing of hydropower equipment, such as turbines, generators, regulators etc., should be undertaken with the help of appropriate international organizations. The information could form a basis for the promotion of international co-operation and local manufacturing of such equipment, particularly in developing countries.

194. Information systems should be strengthened with respect to manufacturers of hydropower equipment and types of equipment manufactured by them.

195. Programmes of technical assistance to developing countries should be intensified, through appropriate international organizations, in the field of development and utilization of their hydropower potential, especially for the purposes of industrial and agricultural development of these countries.

196. The design and production of hydropower equipment in developing countries should be an object of special technical and financial assistance so as to ensure development of their hydropower potential without complete dependence on imports.

197. Regional seminars and workshops should be organized to disseminate information related to development of hydropower resources.

198. A survey of experience of hydropower development in international rivers should be undertaken with the help of appropriate international organizations and a set of practical recommendations, designed to promote utilization of hydropower potential of such rivers, should be developed.

199. Collaboration of developing countries in development of large-scale hydropower projects should be promoted. Such a multinational approach to hydropower development would be efficient in promotion of regional and interregional co-operation. Interconnexion of intranational and, where applicable, national electric transmission networks should be recommended.



VIII. Report of the Technical Panel on Fuel Wood  
and Charcoal on its second session  
(A/CONF. 100/PC/34)

A. Programmes of Action

13. The Panel identified six major programmes of action. They - and the constraints to which they are subject - are described in some detail in chapter III below. All the programmes are based on technologies and techniques which are available and known: the major constraints to massive programmes are institutional, economic and social.

Intensifying the productivity of existing fuelwood resources

14. Substantial additional fuelwood supplies can be made available through intensive management of the available biomass in forests, woodlands, shrublands, and scattered tree resources in rural areas. Such a programme would require particular efforts in bringing all those resources under management for fuel production and in involving rural people in protecting and maintaining a sustained production. The main constraints are related to insufficient awareness of fuelwood needs and potential supplies, to lack of information on management possibilities of such supplies, to the low priority generally attached to fuelwood in forest policies, to insufficient perception of the need to involve local populations and, consequently, lack of an institutional framework to stimulate their active participation. Solutions to the constraints require a continuing effort in order to strengthen the institutional framework, adapt national policies, allocate necessary resources and stimulate the awareness and involvement of all concerned, particularly the local populations.

Creating new fuelwood resources

15. The establishment of new fuelwood plantations presents not serious technological problems but - rather - institutional, social and economic problems, apart from the possible competition for suitable land for other uses. Three different types of plantations can be envisaged: large-scale plantations for concentrated demand; community woodlots and farms; and individual planting. Agro-silvicultural or silvo-pastoral systems can also combine fuel production with other goods and services. The main constraints are the lack of effective support in national policies to tree-growing in rural areas, with insufficient awareness of tree-growing possibilities, the inadequacy of the institutional framework, the cost of such programmes, even if they can mostly be executed by calling upon locally available resources. The solutions would require a substantial strengthening of the institutional framework, particularly of the capability to stimulate and support tree-planting in rural areas, adapting as necessary land tenure and land-use systems, credit and incentive systems, the selection and diffusion of fast-growing multipurpose tree species and the use of non-conventional lands. The supporting infrastructure, nurseries and so on should be decentralized in order to meet local needs and potential. Of special importance should be social forestry programmes in which people actively participate in programmes to their own direct benefit. Substantial efforts are required to create new fuelwood resources which meet the needs of growing populations. The Panel recommended a fivefold increase, on average, in current levels of tree-planting for fuel. Additional fuelwood supplies should be established not only in the form of

fuelwood plantations, from individual to large scale, but also as an integral component in agriculture and rural development programmes.

#### Organizing the distribution of fuelwood

16. Distribution is one of the keys to ensuring access to continuous supplies of fuelwood from existing and new resources. In that context distinction must be made between urban and rural users. For rural users, distribution is mainly based on individual collection, whereas urban users rely on a distribution system. Major urban centres place heavy pressure on surrounding resources. In those areas the diversion of fuelwood from local use to urban markets affects the rural populations which suffer from the disappearance of trees. At the same time more distant supplies may remain untapped because of the cost of transportation and the lack of infrastructure. The constraints inherent to organizing the distribution more efficiently are the lack of storage facilities to ensure stable supplies, the lack of equipment required for large-scale distribution, the inadequate transport and communication facilities, and the disrupting impact of heavy, concentrated demand on local supplies for rural people. The solutions lie with a better control of distribution and pricing mechanisms, the establishment of storage facilities, and the improvement of transport facilities, especially from more distant sources.

#### Improving conversion technologies

17. Improvements to conversion technologies are of great importance since they represent a substantial potential for energy conservation by reducing the demand for wood. Such improvements range from the seasoning and pre-processing of fuels to the more efficient production of charcoal. Traditional charcoal-making can be improved through more efficient kiln and production techniques. The constraints to the programme are the relatively high cost of even intermediate technology, the socio-cultural, economic and organizational implications, and the lack of available information on improved technologies. Solutions for improving charcoal-making entail raising the level of technical know-how and equipment, promoting the grouping of producers, and organizing and controlling production and marketing, especially in areas of concentrated demand.

#### Wood-burning stoves

18. Traditional methods of using wood and charcoal for cooking and heating are generally wasteful of fuel, and the potential for improvement is substantial. The use of stoves and fuel is closely related to the local conditions of fuel availability, to cooking habits, and to traditional materials and skills. Improvements in stoves in order to save fuel are generally possible, but they should be developed locally in relation to specific local needs and possibilities. Stove efficiency can not be isolated from technologies for the harvesting, collection and transport of fuel and the qualities of that fuel. Combined efforts on the various aspects involved can result in a reduction in fuel consumption of some 30 per cent as compared to current levels. The constraints to the diffusion of improved stoves are lack of general solutions and of information on reliable proven designs, lack of extension service to stimulate a change in domestic end use to

more efficient stoves and fuel use, the inadequacy of local skills for making and maintaining improved stoves, and the insufficient awareness of the potential improvement among local populations. The solutions would require the involvement of local people - especially women - in the design, and manufacture of adapted efficient stoves, the training of extension workers for the diffusion of the stove technology and use, a continuing effort to improve stove designs and their adaptations further to local needs, the exchange of experience and dissemination of information on improved technologies, and political and financial support in line with the considerable scale of effort required.

#### Substitution possibilities

19. Substitution is the obvious alternative in some cases, either as a temporary measure - to alleviate the pressure in order to allow the restoration of supplies - or as a permanent way to replace exhausted supplies. Substitution by fossil fuels is a possibility limited by the cost both to the nation and to the individual user. It has a limited application in urban areas and among higher-income groups. The constraints involve the foreign-currency cost, the vulnerability to world energy situations, the lack of adequate supply and distribution facilities in rural areas, and the economic and social acceptability to the user. The possibilities for substitution by other renewable energy sources such as solar energy appear very limited because of the cost of equipment, the technical knowledge involved and the substantial social and consumption changes required. Substituting fuelwood in agricultural or rural industrial uses will have a more direct and faster impact. Agricultural residues are the substitute to which rural people naturally shift when fuelwood becomes scarce. The diversion of large quantities of vegetable and animal residues to fuel use decreases the availability of organic fertilizers and affects the soil productivity for future crops. However, certain amounts of selected agricultural and processing plant residues, such as ground-nut shells, coffee or rice husks, are available and can be used. Technologies do exist for agglomeration and densification which can improve the energy content to the level of fuelwood and facilitate the handling and transport. In fuelwood shortage situations, substitution should be organized at least as a temporary measure. Agricultural residues should be used selectively and, when possible, their fuel quality should be improved.

#### B. Recommendations

20. Massive and sustained programmes of action are urgently necessary in order to meet the minimal energy requirements of today and tomorrow. They can only be achieved through concerted political will and demonstrated governmental commitment. The urgency and dimension of the problems clearly indicate that Governments must attach the highest priority to those programmes, and that such a priority should recognize that adequate access to energy, particularly for cooking and heating, is of basic importance to survival and development and that fuelwood and charcoal play an essential role in solving the rural energy problem.

21. The accelerating degradation of the fuelwood situation implies that the earlier action is taken, the more effective it will be and the lower and therefore

the cheaper the total effort that is required. The time factor is critical: action should start immediately, without awaiting studies which could be part of action development. The scale of action is another critical factor, since only massive programmes of action are likely to have a sizeable impact. There is little risk of over-estimating the action needed, and under-estimating is not likely to halt the degradation of fuelwood resource supplies and its consequent impact on rural development potential.

22. Fuelwood and charcoal provide an essential source of energy for rural and village households. Decentralized systems and action rooted in people's participation are fundamental to the success of fuelwood and charcoal programmes. The importance of fuelwood and charcoal to the poor cannot be over-emphasized: benefits must accrue to them. Fuelwood programmes should fit local situations and they should therefore be based on flexible approaches which combine various elements of solutions in meeting local needs and possibilities. They should be closely integrated into rural development efforts and they should involve local populations through active and responsible participation.

23. The Panel analysed the constraints which generally affect the implementation of any sizeable fuelwood programme and, as a result, strongly recommended that the following lines of support to action be urgently pursued by Governments and the international community. They should all form integral parts of a global effort to remove the constraints, and they require the strongest concerted political commitment of all concerned.

#### Political infrastructure

24. Governments should develop a national policy and initiate national programmes which clearly demonstrate the high level of political priority and commitment attached to fuelwood and charcoal in meeting basic energy needs. Such a policy should raise the general awareness and commitment of all concerned - both institutions and people. It should encourage people to grow wood for fuel as an integral part of rural development efforts.

25. Governments should start, without delay, major action-oriented fuelwood programmes. The urgency and magnitude of the tasks require that such programmes should not be conditional on preparatory surveys and studies, which can be completed as part of programme development. Such programmes should reflect in each of the major aspects involved the importance and priority attached to fuelwood: institutions; manpower; finance; research and development. They should be built up as an integral part of rural development and national energy programmes and policy.

26. Governments should substantially intensify the efforts and resources devoted to fuelwood and charcoal on a scale which corresponds to the dimension and urgency of the problem. In particular, the institutions responsible for organizing and supporting the integration of fuelwood and charcoal into rural development, such as forest services, should be strengthened as well as those institutions which are already involved in, or could potentially contribute to, enhancing people's participation in those programmes.

27. Governments should ensure that national forest policy priorities include the production of fuelwood as a major objective, equal in importance to water and soil conservation or timber production. It should be part of integrated forest management systems.

28. Governments should review existing legislation with respect to land tenure, land use and forestry practice and licensing regulations which affect the access to fuelwood resources, and revise them as necessary.

29. Increased international assistance is urgently needed. Existing international organizations concerned with fuelwood and charcoal should reinforce their assistance capability in line with the scale of action required by the dimension and urgency of the problem. The Panel stressed the importance of making maximum use of the capability for assistance that has already been established in some international organizations.

30. International organizations should devote particular attention to strongly supporting efforts in developing countries for institution-building and strengthening as a basic requirement for massive action programmes.

31. International organizations should assist Governments in analysing national fuelwood situations, identifying and monitoring the evolution and implications of current or potential critical situations, and integrating fuelwood in the design of improved national energy sector planning and action programmes.

32. International organizations should promote an international declaration which recognizes energy for cooking and heating as a fundamental human need and stresses the basic role of fuelwood and charcoal in meeting that basic need in the developing world.

### Finance

33. The Panel stressed that a major financial effort is required in order to sustain the plan of action in each of its major areas. The Panel estimated that the financial effort required in order to realize the potential of fuelwood for meeting basic energy requirements by the year 2000 would amount to an average \$1,000 million per year over 20 years in the developing world. <sup>a/</sup> This is based on current 1980 costs of fuelwood programmes. An important contribution to the cost of such programmes could be made by mobilizing locally available resources such as labour, land etc. In most situations there is no risk of over-estimating the magnitude of the necessary efforts, which are likely to require gradual implementation because of existing constraints, mostly institutional and social.

---

<sup>a/</sup> The financial effort has been estimated for the year 2000 on the basis of the cost of establishing the plantations required to meet the fuelwood deficits; actually the cost would also cover the intensified management of existing resources and the efforts to be made in imposing the efficiency in use which would result in lower plantation requirements. The estimate is based on work carried out at FAO and at the World Bank. The cost of building up the necessary institutional framework and organizational infrastructure is not included and could double the total cost of fuelwood programmes during the initial 10-year period.

The average unit cost of fuelwood programmes will be higher in their launching phase owing to the cost of the required strengthening of the institutional framework and of the necessary infrastructure (roads, nurseries; once these have been established the cost should decrease).

34. Governments should clearly support the priority attached to fuelwood; credibility in those programmes will require a sizeable allocation of financial resources to get action on the ground initiated or strengthened. As a start it would require that priority in the use of forestry revenues be attached to fuelwood programmes. When necessary, additional financial resources may have to be mobilized from other sectors of the economy in order to sustain efforts on fuelwood as a source of energy for subsistence.

35. International organizations should substantially increase the amounts of funds available for sustaining massive action-oriented fuelwood programmes in all aspects involved, particularly when foreign exchange is a constraint. The current share of external funding to fuelwood programmes varies from an estimated 40-60 per cent of the total cost. Procedures of external aid negotiation for fuelwood projects should be streamlined in order to allow for a quick response to urgently needed action programmes.

36. International organizations should organize emergency funding mechanisms which meet the particular problem of countries in acute fuelwood shortage situations and which would ensure their access to the required supplies of energy for subsistence at least during their transition to new energy systems or for the time required for restoring fuelwood supplies.

#### Education and training

37. Governments should substantially intensify the training of the required forestry staff, since staff is already the limiting factor in current forestry programmes in many countries. On the basis of recent regional manpower projections for the forest sector, carried out by FAO, the Panel recommended that training programmes of forestry technicians and of extension staff should be increased by fourfold to sevenfold, according to the present situation in the country and the size of the fuelwood programmes. Training in communications and extension techniques is essential for stimulating social participation.

38. Governments should initiate or intensify popular education and extension programmes in order to raise people's awareness and to stimulate the capability of rural communities to develop, manage and efficiently use their fuelwood resources. Educational institutions should insist on basic training in fuelwood production and use in curricula from primary school onwards.

39. Both Governments and international organizations should make special efforts to involve women in actively participating in fuelwood programmes, particularly in those aspects related to their usual responsibilities of supply and use.

40. International organizations should promote and provide technical and financial

support to national and regional training programmes related to all aspects of fuelwood and charcoal production and use.

#### Research and development

41. Governments should intensify applied research programmes for the design and development of more efficient systems to grow and use wood for fuel. Programmes should investigate the socio-economic as well as the technical aspects of such systems on the basis of multidisciplinary approaches; they should follow practical orientations and should make use of the lessons of past and current experiences. The ultimate objective should be the identification and experimentation of solutions which meet the specific local conditions and of approaches which enhance the participation of local populations.

42. Governments should devote particular attention to applied research programmes on the selection and improved management of local fuelwood species, on the selection of fuelwood species for dry areas, on the development of information on low-cost tree-planting techniques, on seedling production, on combined agro-silvo-pastoral systems, and on appropriate technologies for harvesting, transportation and conversion of fuelwood.

43. International organizations should stimulate and assist national and regional applied research programmes on fuelwood production and use. Whenever possible, those programmes should be combined in networks for co-ordination of work, technical co-operation between developing countries and exchange of information and experience.

#### Information flows

44. Governments should further organize the co-ordination of, decentralization of and access to information and experience on current research efforts and programmes; the information should be disseminated under appropriate presentation to the various users.

45. International organizations should continue and intensify efforts to arrange and stimulate the exchange and diffusion of information and experience on all aspects related to fuelwood production and use; they should promote the access of all countries to available information on current developments.

46. International documentation centres should re-examine existing documentation with a view to cataloguing it from the point of view of fuelwood and biomass use for fuel.

47. Technical co-operation among developing countries should be fostered in order to accelerate the transfer of knowledge and experience on fuelwood programmes.

#### Rural infrastructure

48. Appropriate national institutions, such as forestry institutions, in addition

to fulfilling their direct responsibilities, should strengthen their capability of efficiently servicing, by means of infrastructure and technical support, the efforts being made by rural communities or other agencies involved in growing trees for fuel.

49. Governments should organize and monitor distribution and marketing in order to assure an adequate and stable access to supplies of fuelwood and charcoal to the groups of people most dependent on them. Major urban centres may require particular attention and specific approaches based on their particular needs and possibilities.

50. Action should be taken by Governments to identify and solve problems related to the lack of appropriate fuelwood and charcoal distribution systems, with the support and assistance of international organizations, as required.

51. In discussing the potential for improved production and use of fuelwood and charcoal, the Panel formulated an additional number of detailed recommendations on specific aspects and constraints: they are contained in chapter III of the present report and should be taken as integral parts of the proposed strategy adopted by the Panel for recommendation to the United Nations Conference on New and Renewable Sources of Energy.

52. Because of the importance of fuelwood as a source of energy for survival and of the urgency and size of efforts required, the Panel recommended that the strategy be widely and quickly disseminated to all concerned organizations, whether national or international, governmental or non-governmental. The Panel expressed the wish that FAO, because of its particular involvement in the fuelwood and charcoal area, in which it has the leading role in the United Nations system, should actively disseminate the results of the Panel's work.



IX. Report on the use of peat for energy  
(A/CONF. 100/PC/32)

MEASURES TO OVERCOME THE CONSTRAINTS OF THE USE  
OF PEAT AS AN ENERGY SOURCE

A. Potential constraints

Although peat seems to be a viable and indigenous alternative energy source in many developing countries, there are many constraints on the use of peat for energy.

The following are the most important:

- (a) Peat is at present used as a fuel in only a few countries, and in other countries there is a lack of information on peat as a possible alternative fuel;
- (b) In most developing countries adequate data on indigenous peat resources and their feasibility are not available;
- (c) There is no comprehensive international information system for peat;
- (d) As peat is neither a traditional fossil fuel nor a renewable energy source, it has not been explicitly included in the energy development programmes of international organizations;
- (e) National energy planning and programming is still at an early stage in many developing countries;
- (f) Developing countries have not generally had the time and resources to adapt foreign energy technology to their local conditions.

/...

The measures that must be taken to overcome the constraints lie in the following areas:

- Planning and programming;
- Research, development and demonstration;
- Transfer of technology;
- Dissemination of information;
- Education and training;
- Financing.

#### B. Planning and programming

One important task is to develop national energy plans that can provide a framework for including peat in the energy economy. The best alternative would be an over-all plan for peat utilization.

The main items to be included are:

- Estimation of resources;
- Prospects for peat demand;
- The feasibility of peat as a fuel on a national and regional basis;
- Alternative utilization of peat (for example, in agriculture);
- Selection of suitable peat production areas, taking into consideration the location of potential consumers and the available infrastructure;
- Assessment and selection criteria for appropriate technology for peat production, combustion and processing;
- Financial arrangements;
- Institutional arrangements.

Peat utilization can naturally begin without any systematic planning, but planning is necessary at later stages, when important budgetary or policy commitments are required.

#### Recommendations for promoting the planning of peat utilization

##### (a) Countries with unexploited peat resources

Include peat as a possible future energy source in the national energy programmes;

Initiate co-operation with international organizations and peat experts for the preparation of a peat utilization plan.

/...

(b) Peat-producing countries

Provide peat experts to assist other countries in planning the utilization of their peat resources, either through bilateral agreements or through international organizations.

C. Research, development and demonstration

Modern peat technology is based on existing knowledge and traditional methods of peat handling. It is developing through the close collaboration of experts from the various peat-producing countries and is supported either by government funds or by private industry. Because of the interdisciplinary nature of peat science and technology, research, development and demonstration is scattered among many different institutions and is partly unco-ordinated.

All countries that are starting to use their peat resources will, of course, make full use of the relevant knowledge already available in the world. But peat technology developed for a particular country is not directly applicable to other countries with different local conditions (resources, climate, infrastructure, social habits etc.).

The primary responsibility for the utilization of peat resources rests with the country itself. Indigenous scientific and technological activities are thus of essential importance for the continuing successful adoption of foreign technology. The major research, development and demonstration efforts should be directed towards resource estimation, the study of climatic conditions for peat production and small-scale appropriate technology.

Recommendations for promoting research, development and demonstration efforts

(a) Countries with unexploited peat resources

Assign to a specific organization the responsibility for obtaining the required peat expertise;

Motivate scientists from related disciplines to become specialists in peat production and processing;

Co-operate continuously with other peat-using countries.

(b) Peat-producing countries

Strengthen and co-ordinate peat research, development and demonstration efforts on the national and international levels;

Include items of potential value for developing countries in their peat research, development and demonstration programmes;

Co-operate with and assist developing countries in their peat research, development and demonstration efforts;

Encourage international organizations to include peat in their development programmes.

#### D. Transfer of technology

Small-scale and large-scale peat technology is well in hand and has been tested for decades. It originates in the main peat-producing countries, and is ready to be transferred to all countries that are beginning to use their peat resources.

The main alternatives are:

- (a) Technological assistance;
- (b) Consulting services;
- (c) Export/import of machinery and equipment;
- (d) Turnkey deliveries;
- (e) Licensing;
- (f) Direct investment.

The suitability of the alternative depends on the technology that is being transferred and the partners involved.

Technical assistance and consulting services are particularly necessary in the planning phase for the evaluation of the peat resources and production planning. The services can be provided through international organizations, for example, the United Nations system, and the international development banks or bilateral development assistance schemes.

Machinery imports, turnkey deliveries, licensing and direct investment are in general based on direct agreements between industrial firms or governmental bodies.

When the imported technology is capital-intensive, with a wide assessment of the whole country, for example, large-scale peat technology, the role of the Government is important. But the details of the transfer, for example, machinery and equipment, must be a matter of choice at the enterprise level.

Successful planning of the transfer process is, however, essential. Effective transfer calls for special efforts by both donor and recipient.

#### Recommendations for promoting the transfer of peat technology

##### (a) Countries with unexploited peat resources

Formulate a policy and improve conditions for the transfer and acquisition of technology. This should be supported by a legal framework (industrial property, foreign investment etc.);

Strengthen their capacity for evaluation, selection and assessment of peat technology through indigenous research, development and demonstration activities, technological production and international co-operation;

Co-operate and share their knowledge of peat with other developing countries.

(b) Peat-producing countries

Strengthen their bilateral peat development assistance;

Encourage and facilitate the transfer of technology for their peat-machinery industry (small and medium-sized) - this can be done, for example, through government-supported export drives;

Comply with the requests of developing countries for assistance, including experienced personnel.

E. Information flow

The flow of peat information is hindered by several specific obstacles:

(a) Science and technology pertaining to the utilization of peat as interdisciplinary: information must therefore be sought from many different fields (agriculture, forestry, geology, energy, transportation etc.), and the coverage of peat information in these sources is rather poor;

(b) There is no abstract journal or data base with international coverage of the whole peat field; there are, however, two recent important international projects; UNESCO has undertaken a study on an international information system related to new and renewable energy sources and the Organisation for Economic Co-operation and Development/International Energy Agency is starting an information system for biomass energy, which includes peat;

(c) There is no international, specialized peat journal that could act as an effective channel for scientific, technical and commercial information;

(d) Only a minor part of the information about peat is published in English; the essential technological knowledge originates in the leading peat-producing countries and is thus often published in Russian, Finnish, German or Swedish. The use of this information in other countries is thus hampered by language barriers;

(e) The obstacles to the systematic transfer of peat information are thus high, even in peat-producing countries. Personal contact is, at the moment, the most successful method. For developing countries with undeveloped information systems, this transfer is nearly impossible.

## Recommendations for promoting the flow of peat information

### (a) Countries with unexploited peat resources

Give the responsibility for following, collecting, disseminating and translating international peat information material to an organization (co-operation with other developing countries); the organization should maintain contacts with international information centres and systems in the field of peat utilization;

Promote and support membership in international organizations and participation in international conferences (for example, the International Peat Society) in order to improve and intensify the exchange of information through personal contacts;

Favour bilateral or multilateral agreements and co-operation with leading peat-producing countries;

Invite peat specialists from abroad to act as technical assistants or teachers;

Heighten the awareness of the general public, industry and other appropriate circles regarding the role of peat as an indigenous energy resource.

### (b) Peat-producing countries

Strengthen and co-ordinate the handling of peat information (for example, the activities of IPS);

Start an international peat journal covering all aspects of peat utilization;

Make information that is readily accessible to domestic users equally accessible to users from developing countries;

Publish general material on peat as an energy resource, such as booklets, films etc., for distribution in developing countries.

## F. Education and training

The utilization of peat requires much specialized knowledge, which is not directly included in other educational programmes. This is particularly true with respect to knowledge about the quality of peat and peat-lands, climatic effects and demands on peat production and the environmental aspects of peat utilization. Because of this, and the fact that special expertise is needed in large-scale utilization of peat and peat-lands, personnel training must be arranged simultaneously with other practical measures for the realization of peat development programmes.

Training programmes are necessary at all levels; for experts and management personnel as well as for peat workers, drivers, maintenance personnel etc. The programmes must be based on local conditions. In developing countries, manual production methods and household usage of peat must also be included. However,

external aid is necessary in many cases, especially at the starting stage of a peat development programme. The most critical is the training of people to evaluate the peat resources and planning of peat production. A small mistake at this stage can cause a great deal of harm and additional costs later.

The training must include both theoretical courses and practical work, for example, in experimental production. Essential aspects of the education and training of peat experts are international co-operation and participation in conferences and seminars.

## 1. Training programmes for the peat industry in Finland

Systematic training of peat workers was started in 1972, at a course centre where the drivers of heavy machines were trained. At present, there are three course centres in Finland for drivers and repair and maintenance personnel of peat enterprises. The maximum duration of the courses is 48 weeks. About 700 workers have so far received specialist training in peat production at these three course centres. Courses have also been arranged for peat briquette and peat-processing factory workers.

Field supervisors are the second largest group to require additional training. They are usually machine, agricultural or forest technicians whose basic education includes only a little knowledge to prepare them for work in peat-mining operations. For this group, 14-week courses have been arranged since 1975.

Various organizations have participated in the training of management personnel. The courses have been of shorter duration (2-3 days) and there have been 2-3 courses annually.

## 2. Recommendations for promoting education and training

### (a) Countries with unexploited peat resources

Investigate local education suitable for peat production and usage;

Investigate the total training requirements at an appropriate technological level;

Prepare a training programme based on local conditions.

### (b) Peat-producing countries

Assist developing countries with programmes, teachers and educational material for their training programmes;

Establish special training and exchange programmes for peat workers from other countries.

### G. Financing

Like any energy project, peat utilization can, in the starting phase, be economically burdensome. Without sufficient financial support, even for small-scale use, it is not possible to start production. As opposed to most of other "new" energy resources, peat technology is tried and tested and ready to use. The financing patterns are thus different.

In developing countries, where domestic financing capacities are probably insufficient, an essential part of the financing should come from international financing organizations (for example, the World Bank), noting the following:

Interest should not be high (less than 6 per cent).

Repayment time should be relatively long (15-20 years):

Because of the long bog-preparation time, loans should be free from repayments for the first three to five years.

In all countries the use of peat for energy should be promoted by special government measures (for example, loans, tax incentives).

#### Recommendations for promoting the financing of peat development

##### (a) International organizations and funds

Include peat energy projects in their short-term and medium-term lending programmes.

##### (b) Peat producing countries

Include peat projects in their bilateral development assistance schemes.



X. Report of the Ad Hoc Working Group on  
Draught Animal Power  
(A/CONF. 100/PC/30)

CONCLUSIONS AND RECOMMENDATIONS

150. Conclusions and recommendations were indicated alongside the description of the problems and situations. A few of the more important findings and recommendations have been taken out for enumeration in this final section, under the following categories:

(a) Immediate operative action by way of international assistance, and initiation of programmes and projects in order to create awareness, to develop expertise and infrastructure, to effect movements, to transfer technology, etc.;

(b) Socio-economic studies to identify problems and to formulate policies and action;

(c) Research and development plans for design improvements, testing, adaptation, comparative evaluation, field experiments, etc.

151. Energy is one of the main inputs for the development of agriculture. Unfortunately, for compelling reasons, many developing countries have to depend upon draught animal power for a long time to come, though maybe not for ever. Draught animal power need be considered possibly only as an interim phase; but it must complement other forms of energy and be encouraged only wherever it is inevitable or appropriate. Mechanization will continue to be even encouraged. Draught animal power does not compete with it.

152. Draught animal power is an excellent example of appropriate technology with great scope for mass level application and employment opportunities. But draught animal power will not take off unless there is deliberate intervention and assistance from the United Nations system and from the professionals in developed and developing countries. Finally, the Governments themselves will decide on the importance of draught animal power.

153. There is an urgent need to bring draught animal power, where it is suitable and appropriate, to the attention of the international development agencies as well as the national Governments of the developing countries themselves. In order to enable developing countries to equip themselves with the necessary knowledge and technical competence to develop and optimally utilize the full potential of draught animal power, it is recommended that those concerned with draught animal power, directly and indirectly, all over the world, should:

(a) Take immediate action on aspects where enough is known about problems and remedies;

(b) Take long-term measures by way of studies, and thereafter appropriate decisions and actions.

154. Some of the steps that Governments and international agencies could possibly take under appropriate situations are indicated below:

(a) To make the draught animal power system an integral part of agriculture, including forestry, and rural development structures and processes and include draught animal power in forums on energy and agricultural development;

(b) To consider draught animal power on a par with other agricultural inputs, such as fertilizer, water, diesel, etc. and to qualify it for subsidy as well as adequate resource allocation and institutional and infrastructural support;

(c) To interlink draught animal power with the milk-and-meat system by ensuring co-ordinated policy measures mutually reinforcing one another and benefiting all three systems with regard to resource allocation, breeding, feeding, health care, research and development, etc;

(d) To introduce draught animal power in appropriate development programmes for international technical and funding assistance.

#### United Nations co-ordinating arrangements

155. It is proposed that the United Nations should make arrangements for the initiation and co-ordination of projects related to draught animal power, and the collection of information on draught animal power through United Nations agencies (FAO, UNIDO, etc.).

#### Regional centres

156. It is recommended to set up five regional centres for draught animal power, two each in Asia and Africa and one in Latin America, to serve the respective regions in areas such as:

(a) Conducting socio-economic studies, research and development work, testing;

(b) Education, training, extension;

(c) Facilitating transfer of technology;

(d) Collection, evaluation and dissemination of appropriate or relevant information regarding draught animal power.

#### Workshops and conferences

157. In order to upgrade the draught animal power system to levels where it can be effective, it is proposed that national and regional seminars and workshops should be organized on specific problems (redesign of draught animal power equipment, information systems, research, infrastructure) of draught animal power development in the country or in the region.

#### Immediate action for modernization

158. On the basis of prevailing knowledge of economic evaluation of the different aspects and the current perceptions of the workers in the various fields, it is

recommended that suitable steps should be taken by national Governments to modernize the draught animal power system with international assistance where necessary. Some of the illustrative kinds of techniques and policies which can be transferred with advantage (after adaptation to local conditions) are:

- (a) Compilation and categorization for use in the developing countries, particularly of implements, carts and harnesses, of knowledge available in developed countries on draught cattle and horses; transfer of this technology and adaptation to local conditions;
- (b) Breeding and rearing of suitable draught animals wherever there is a shortage of draught animal power;
- (c) Increasing the number and improving the quality of donkeys, mules and horses for transportation and farm work;
- (d) Increasing the utilization of all draught animals and improving transport capability in agriculture during off-season and as specialized means of transport in rural and urban areas;
- (e) Introducing pneumatic tyres, smooth bearings, brakes and lighter platform, etc., in order to improve capacity of carts;
- (f) Replacing the neck yoke and head yoke systems by the double yoke system (back for vertical load and neck for hauling) for ploughing and carting; introducing collar-cum-hames yokes in place of neck and head yokes.

#### Infrastructure for draught animal power

159. It is recommended that the following kinds of action should be taken by countries, with appropriate international assistance where necessary, with a view to providing the requisite infrastructure for the development and management of draught animal power. Specifically it is recommended:

- (a) Developing countries, which have a large population of draught animals, should establish Animal Energy Boards as apex organizations with functions such as (i) recommending guidelines, standards, norms, for traffic safety; (ii) co-ordinating draught animal power programmes undertaken by other agencies or Governments; (iii) sponsoring draught animal power research projects and socio-economic studies; (iv) mobilizing financial support for draught animal power improvement; (v) formulating and monitoring draught animal power schemes and projects; and (vi) advising Governments on national draught animal power policies, etc.;
- (b) Developing countries should collect statistics on draught animal power on a regular basis;
- (c) Credit and insurance systems for draught animals should be organized and strengthened as has been done for milch cattle;

- (d) Appropriate farmers' organizations should be established;
- (e) Incentives should be given to individuals for breeding draught animals;
- (f) Laws defining working norms for draught animals should be introduced;
- (g) Measures should be taken for increasing feed availability for draught animals;
- (h) Appropriate veterinary services, including field-based and mobile facilities, should be established or strengthened;
- (i) Training and extension activities in draught animal power, including increased provision of training material, should be intensified.

#### DAP expertise

160. In order to develop expertise in draught animal power at all levels, the following are recommended:

- (a) Compilation of a bibliography of published and unpublished material classified according to the various components of the draught animal power system;
- (b) Preparation of a directory of institutions and individuals having expertise in (and interest in developing) draught animal power;
- (c) Assessment of future implications for draught animal power as a result of government policies and development targets, general economic and environmental trends within the country and outside, particularly relating to present and future energy costs;
- (d) Evaluation of the economic and social impact and implications of introducing (i) draught animal power in place of manual labour; (ii) petroleum-based power in place of draught animal power in the context of savings in petroleum and foreign exchange; (iii) appropriate combinations of manual, draught animal power and petroleum-based sources; (iv) the impact of draught animal power on the yield of crops and pressure on land.

#### Research and development studies

161. With a view to facilitating transfer of improved technology and practices as well as to developing new designs, it is recommended that countries with a significant interest in draught animal power should establish research and development centres, with help if required from the United Nations and other international agencies, to carry out design, development, testing and evaluation work on agricultural implements for draught animal power, animal-drawn vehicles, harnesses and hitching devices, logging techniques and devices, breeding programmes, and draught animal management, and to encourage research on fodder, range and pasture improvement.

Organization of co-ordinating bodies

162. Considering that immediate draught animal power development activities should be initiated, considering the need for international co-operation and co-ordination of such activities and the difficulty of establishing at this juncture a co-ordinating unit for this purpose, it is recommended that in the first place United Nations agencies, including FAO, should encourage and assist existing decentralized regional and/or national institutions to collect and diffuse appropriate information on draught animal power techniques and ongoing programmes and to initiate or promote studies and research as required; it is further recommended that meanwhile a co-ordinating mechanism should be envisaged and organized in an appropriate United Nations agency.

XI. Report of the Ad Hoc Expert Group on Financing  
of New and Renewable Sources of Energy  
(A/CONF. 100/PC/29)

RECOMMENDATIONS

62. The purpose of these recommendations is to call to the attention of the United Nations Conference on New and Renewable Sources of Energy, its Preparatory Committee and the international community at large a number of ideas, proposals and suggestions for the improvement of existing activities which, although incompletely explored and analysed, appear to warrant further attention. Some recommendations may be more relevant and more practical in the short term, others may be less immediately applicable, although they certainly may have a potential for action in the future. For focus and emphasis, some issues earlier discussed are re-emphasized below.
63. As has been indicated, the main thrust of the United Nations Conference on New and Renewable Sources of Energy is on promoting a shift from oil and gas to greater dependence on solid hydrocarbons (such as coal, oil shale and tar sands), nuclear fission, geothermal energy, and renewable forms of energy such as hydropower, solar energy, biomass including fuelwood, and wind energy.
64. Oil-importing developing countries should strengthen their energy planning, research, training, and project preparation capacity. They should also take measures to attract more external capital for financing investments in new and renewable sources of energy. Measures to this end could include maintaining their creditworthiness and providing a favourable investment climate which assures transparency and fair operating conditions for foreign investors, in accordance with the policies of the countries concerned. These countries should work closely with their partners in industrialized countries to remove absorptive capacity constraints so as to speed up assistance and disbursements.
65. The multilateral development finance institutions should continue to strengthen their capital base, both for their hard and soft windows. They should give a greater policy focus on strengthening external support for new and renewable sources of energy through technical and financial assistance, policy advice and stepped-up activities for project identification, preparation and execution. The institutions should expand their co-financing activities also in the new and renewable sources of energy sector, increasingly associating bilateral assistance and export credit funds as well as private bank finance with their operations.
66. The DAC countries, especially those whose performance falls short of the 0.7 per cent target, should make every effort to increase their ODA as rapidly as possible. This would provide incremental resources of which a larger share could be devoted to financing of new and renewable sources of energy.
67. Even within existing assistance programmes, a higher priority could be given to financing projects and programmes in the energy sector and in sectors with a significant energy component, with particular emphasis on new and renewable sources of energy.
68. Assistance should be increasingly concentrated on poorer developing countries whose needs are the greatest and which cannot attract (and service) significant amounts of non-concessional capital for their energy development.

/...

69. Support through technical assistance for training, planning, advice, institution building, and strengthening the technological capacity in developing countries should be increased and integrated into energy financing programmes.
70. DAC countries should use their guidelines for local and recurrent cost financing and for effective implementation to speed up disbursements.
71. More effective co-ordination among bilateral and multilateral activities and their integration into the energy strategies of developing countries would also be a welcome step towards making energy support more effective.
72. DAC countries should speed up procedures to make the capital increases and replenishments of multilateral development financing institutions effective. They should work within these institutions to improve their attractiveness for capital contributions from other sources and to strengthen their focus on energy financing, including new and renewable sources of energy. DAC countries should maintain liberal régimes for the borrowing of multilateral institutions on their capital markets.
73. DAC countries should use their official export credit facilities and guarantee mechanisms, as well as their investment insurance programmes, to provide additional incentives for energy financing. In this connexion, proposals to "multilateralize" national export credit guarantees and investment insurance programmes may also be relevant, as would the "Mexican proposal".
74. Most DAC countries have public development finance corporations which could extend and mobilize additional capital for energy support - both in loan and equity form.
75. ODA should also be used to strengthen non-concessional flows, for example by financing pre-investment and feasibility studies, research and training programmes, technology transfers and local costs.
76. The OPEC community should maintain the high level of aid extended and strengthen the policy focus on new and renewable sources of energy within these aid programmes. It should improve its administrative and operational capacity in order to expand bilateral lending programmes.
77. A resumption of large bond offerings in OPEC countries would enable the World Bank, regional and subregional institutions to expand their own activities.
78. Aside from those general measures which national Governments and multilateral institutions might consider taking to reduce or remove existing impediments to the availability of resources, whether of internal or external origin, two institutional routes for channelling the investment required to achieve the potential of renewable energy resources are, in principle, available. The first of these consists of transforming or extending the scope of existing institutions, and the second involves creating an entirely new and separate institution for the purpose of new and renewable energy development. Both routes should be considered. The exact measures to be taken will depend on the nature and desired timing of new and renewable energy development.

79. While the earlier analysis (see chapter I and annex I on matrix approach for estimating financial needs) emphasizes immense classification difficulties, the urgency of the energy problem suggests dealing with these difficulties in two parts. The first part relates to the urgent problems of the rural poor which should be assigned to the International Fund for Agricultural Development (IFAD). The second which includes a wider range of divergent income, activity and advanced technological considerations, including the application of new and renewable energy to the urban and industrial sectors, can more appropriately be administered by either the World Bank or by organizations of the United Nations development system, by the proposed energy affiliate of the World Bank or by the regional and subregional development banks.

80. The recommendation for the assignment to IFAD of that part of the task of developing new and renewable sources of energy in rural areas stems from several basic considerations. First, the problem is urgent. Second, the integrated nature of the purely agriculture-related energy development task involving fuelwood and alcohol implies a choice of allocating scarce land to alternative uses, for example, as between these and food production, and this constitutes the advantage of co-ordinating the issues of choice in relation to these areas within a single institution. Third, in so far as agricultural development is synonymous with rural development, the work of IFAD can be readily extended to encompass related energy dimensions - namely mini-hydropower, solar and wind energy. Fourth, since this extension implies planning for integrated rural development, the Fund's work can be harmonized at the level of rural programme development design with that of the World Bank. Finally, the proposed extension of the scope of IFAD into rural development related energy carries with it a major in-build political advantage. The voting structure of IFAD represents a half-way house between the "one-country, one-vote" principle of the United Nations and the weighted voting system in Bretton Woods institutions. This is an interesting representational arrangement.

81. The current position in respect to the replenishment of IFAD for its originally defined purpose of agricultural development is that its Governing Council has agreed upon an amount of \$1.27 billion which, together with resources already within IFAD, will support a total programme of \$1.5 billion for the period from 1981 to 1983. It is estimated that an additional provision for rural development related renewable energy purposes of \$500 million in 1981 will enable IFAD to develop a sufficient project portfolio with an emphasis on renewable energy within a two-year period. Its initial task of project development will permit the absorption of additional resources for energy-related rural development of the order of \$3 billion in the next replenishment cycle of IFAD. IFAD is already enabled within the terms of charter to borrow directly from Governments in endeavouring to raise amounts of this order. But, looking ahead to the time when a project portfolio for absorbing large amounts is developed, consideration could be given to amending the charter of IFAD so as to enable it to raise money in capital markets against supporting guarantees furnished by member Governments.

82. It must be remembered that the group of developing countries most dependent on oil - that is, those dependent on oil for more than 75 per cent of their energy needs, - and also most affected by the fuelwood problem comprises nearly 50 countries with a population of around 330 million, a substantial portion of which (82 per cent)

/...



live in rural areas. If countries somewhat less dependent on oil imports are added to the list, such as the bulk of the Indian subcontinent and certain other countries in Africa and Asia, the rural population to be served rises to 950 million. b/ The size of this task is immense and the human suffering involved requires speedy solutions.

83. It is recommended that the wider task of developing the technologies of new and renewable sources of energy should be undertaken by the entire range of United Nations institutions and agencies, in particular the World Bank, UNDP and UNIDO, as well as the regional and subregional development banks and the proposed energy affiliate of the World Bank. This should be done with due regard to the need for effective co-ordination among these organizations. Development of new and renewable sources of energy cannot occur without the industrial development necessary to produce the associated hardware and the equipment for using that energy. The investment required for this may be massive. In this context the proposal by UNIDO to channel funds on commercial terms from the world capital market for industrial development in the developing nations could be considered.

84. Expansion of the United Nations Revolving Fund for Natural Resources Exploration is another approach which could provide relatively rapid progress toward the utilization of new and renewable sources of energy. Its original mandate encompassed all energy sources but its current operation is confined to non-fuel mineral development. In view of the urgent need for progress in the field of new and renewable sources of energy, reactivation of its original mandate should be given consideration.

85. The energy affiliate of the World Bank which is under consideration could make a major contribution to the expansion of new and renewable sources of energy, particularly in the area of dissemination of information on renewables, development of a cadre of trained personnel in countries which could facilitate the spread of such technology, delineation of projects, as well as provisions of loans for these projects. Given its orientation, most such projects would be expected to be drawn from among those of the 14 renewables which lend themselves to large-scale developments. The Bank might draw on its expertise in hydroelectric generation to encourage smaller applications. Its experience in the fuelwood programme might be extended to biomass and biogas applications, particularly the larger scale operations. Private sector investments might be catalysed if the Bank were to expand its use of co-financing for renewables, both directly and through the International Finance Corporation. Even though the Bank currently envisions devoting almost \$2.5 billion during the 1981-1985 period for hydroelectric projects, if additional resources were available this level of financing could rise to nearly \$3.5 billion. In similar fashion the fuelwood programme currently envisioned at just over \$400 million for this period could be expanded to almost \$1.1 billion.

86. It is anticipated that the source and distribution of funding for the proposed World Bank energy affiliate might be different from that of the Bank itself.

---

b/ Afghanistan, Bangladesh, Botswana, Burundi, Ghana, India, Malawi, Mozambique, Pakistan, Rwanda, Zambia.

Its investment policy could also emerge from and be shaped by a decision-making process reflecting to a greater extent than is now the case the concerns of the oil-exporting and oil-importing developing countries. In the context of the proposal to augment the scope of IFAD operations to rural and small urban renewable energy development, the World Bank could logically assume greater importance in the development of renewable energy, particularly that requiring large-scale efforts.

87. Consideration might also be given to structuring the expansion of IFAD and the proposed World Bank energy affiliate in such a way as to encourage voluntary contributions, in part to break the log-jam which results from the difficulties of negotiating a scale of assessed contributions.

88. The financial resources required to realize the full potential of new and renewable sources of energy will be large. From examination of the World Bank estimates for the period 1981-1985 and other estimates it appears that this could amount to as much as \$12 billion for activities which could be undertaken by IFAD, with an additional \$4.5 billion for those which might be undertaken by the World Bank. These resources could be used to increase the Bank's fuelwood programme to the maximum feasible level and also to expand energy resource surveys in co-operation with UNDP. Requirements may, however, deviate from these indicative estimates. Some portion of this total may be expected to come from increased contributions from both the industrialized countries and those oil-exporting countries with financial surpluses.

89. However, it must be recognized that given the current (and immediately prospective) state of the world economy, substantially increased levels of official development assistance may be forthcoming relatively slowly. In these circumstances it would be desirable for all nations to re-examine their needs and priorities to determine whether, without adversely affecting current development activities in the developing countries, more assistance could be extended for encouragement of renewables.

## OPTIONS

90. Listed below are ideas and possible options for consideration at the appropriate time, without in any way prejudging their feasibility or their effectiveness.

91. New and renewable energy financing institution. In reactivating the original mandate of the United Nations Revolving Fund for Natural Resources Exploration consideration should be given to changing its terms of repayment.

92. Creation of a new institution focused specifically on financing, research, development, demonstration, and large-scale creation of new and renewable sources of energy might be considered as a comprehensive answer to the current fragmentation of approaches to this problem, as well as the current scarcity of funds. The creation of such an institution could incorporate or co-ordinate the activities now being undertaken by existing United Nations agencies and possibly sharply improve conditions and security for investors in new and renewable energy projects, thus increasing the level of such investment activity. While funding and decision making for such a new institution might follow the model already so successfully implemented in the International Fund for Agricultural Development, alternative criteria might be considered. These criteria might take account of changes in relative prices of imports and exports of all developing countries.

93. World Development Fund. As a result of its deliberations, the Brandt Commission proposed creation of a new international development finance institution to be called the "World Development Fund". The proposal stems from their judgement that "there is need for major additional multilateral finance to support mineral and energy exploration and development in developing countries. Some of this will come from existing institutions but we believe there is a case for a new facility for this purpose". The Commission came to this conclusion because it felt that the present reliance on short-term and medium-term credit for recycling surpluses to deficit countries (especially developing countries without access to the longer end of the market) gives rise to a precarious debt structure. It felt that the need to supply long-term capital to developing countries by official steps has been the principal *raison d'être* for the entire system of public development finance and that, however welcome the increased access to short-term bank borrowing that emerged in the 1970s, there is now a need for consolidation in the form of more long-term commitments. In addition to mobilizing additional funds for development, the Fund would also be aimed at altering those aspects of the international economic and financial system considered to be unsatisfactory by many, especially in the developing world.

94. Renewable energy window of the World Development Fund. Since the World Development Fund might consist of several components directed towards specific purposes, one such component could be structured to concentrate on lending for new and renewable energy resources. In this context creation of such a Fund could contribute significantly in the long term to increasing the levels of investment in new and renewable sources of energy.

95. Other financing mechanisms. A proposal for generating added funds for development purposes, put forward recently by a group of experts convened by the Commonwealth Secretariat ("The World Economic Crisis: A Commonwealth Perspective, 1980") might generate funds for renewable energy. The essence of this scheme was a two-stage transformation of the OPEC special fund into a full development institution. The first stage would bring together interested OPEC and other countries to set up a system of joint and several guarantees for the raising of funds in capital markets. Initial outlays would be small and would apply only for interest subsidy purposes. Later, if desired, these guarantees could be converted into the callable capital of a development institution concentrating in this instance on renewable energy sources. Under the scheme, each dollar of interest subsidy would permit raising in capital markets, under guarantee, four dollars (on average), and consequent on-lending on World Bank Third Window terms (4 per cent interest, a 10-year grace period and a 25-year maturity). Illustratively, SDR allocations accruing to developed countries alone in the last year of the current round of SDR allocations (\$3 billion) would be sufficient to subsidize the interest on borrowing for renewable energy purposes of \$12 billion.

96. The Brandt Commission proposed financing the World Development Fund through a tax on total world trade. Also mentioned in this connexion was the possibility of a tax on energy. Relating the development of new and renewable sources of energy to the depletion of the world's oil reserves raises the possibility of financing renewable energy investments through a tax on the crude oil portion of world trade.

XII. Final Report of the Ad Hoc Expert Group on Information Flows  
(A/CONF. 100/PC/31)

CONCLUSIONS AND RECOMMENDATIONS

A. Summary of the Discussion

99. The experts concluded that information is one of the essential ingredients for development planning. A realistic appreciation of the value of information is the sine qua non for the management of the scarce financial and human resources of developing countries and for the most efficient utilization of funds available for development. Therefore, information has special significance in the development of new and renewable energy sources and this should be acknowledged in relevant policy statements.

100. Although linked very closely to traditional energy sources, new and renewable sources of energy are very heterogeneous, encompassing sources as different as photovoltaic cells, wind and cow-dung. The scientific disciplines that underlie the application of renewable energy are varied as the sources themselves. In addition, valuable information on renewable energy sources has existed in the literature for many years but has remained unused because of the availability of low cost liquid fuel. Hence, it is not reasonable to force all the relevant information into a single new information system.

101. Clearly then, the mechanism to be developed for the transfer of information in such a highly heterogeneous field must be different in style and structure to those already established. Such a mechanism will be costly, requiring funds, human resources, organization, management skills and participation at the highest level. The group of experts recommended that funds be specifically allocated to support activities dedicated to making information readily accessible to users. They further recommended that a flexible network based on existing information facilities be established with the following features:

- (a) At global, regional and national levels with the national units forming the basis of regional and international networks;
- (b) Cost-effective involvement with all relevant existing systems - international, regional, national and commercial - thereby eliminating duplication;
- (c) Accessibility to well-organized information in the social, economic, political and environmental fields, relevant to the needs of government decision makers;
- (d) Information analysis units for each major field of new and renewable energy attached to centres of excellence;
- (e) Improved channels of communication among developing countries and between them and industrialized countries;
- (f) Networking, collaboration and mutual support among relevant information systems and services;
- (g) Provision of the whole spectrum of relevant information, that is, bibliographic, factual, numerical and referral.

102. Information users will often need to make comparisons across many energy sources, and it does not make sense to single out one particular subset for integrated action in the information field. Nevertheless, it is opportune to respond to the world-wide interest in new and renewable sources of energy and to establish an international programme that will promote a series of actions to ensure a better information service in respect of each of the significant separate energy sources that will be studied at the Conference.

103. Since the activities identified by the experts will be costly to both users and suppliers of information whether carried out by national or international organizations or by arrangement with other bodies, the member states are urged to formulate ways of financing these activities and establishing the financing mechanism to ensure that necessary resources are made available at the national, regional and global levels.

104. Therefore, a specified percentage of funds earmarked for developing new and renewable sources of energy should be allocated to information flows. This is particularly crucial in this field whose importance is just beginning to emerge and which is expected to increase with time.

105. The following is a summary of the recommendations made by experts for possible resolution at the Conference to be held at Nairobi. These recommendations are further elaborated below in paragraphs 111 to 120.

1. National level

106. A detailed analysis should be prepared of the national information resources infrastructures and their capabilities for supplying information on new and renewable sources of energy.

2. Regional level

107. A critical comprehensive review of current activities and institutions involved in information on new and renewable energy sources in the region should be undertaken, preferably by intergovernmental regional organizations with a view towards strengthening existing activities and establishing new information-supply facilities where gaps exist.

108. Funds required to promote effective information flows should be allocated within the budget of regional intergovernmental bodies, such as regional economic commissions, so that national and regional information activities would receive sufficient financial support.

3. Global level

109. International organizations entrusted with the responsibility of formulating and implementing the over-all programme of work for new and renewable sources of energy should in the first instance:

(a) Compile and maintain an inventory of currently available information systems and services on new and renewable sources of energy taking into consideration the compilations at regional and national levels;

(b) Convene consultative meetings at which representatives of organizations which are responsible for providing access to information on new and renewable sources of energy may devise ways and means of improving co-operation and rationalizing their separate responsibilities. In this connexion, a suggestion was made that UNESCO, which had already completed a preliminary study on the feasibility of an international information system on new and renewable energy sources, might convene a series of task forces, each composed of individuals from the key international, regional and national institutions that are already active in scientific and technical information work on a particular energy source;

(c) Undertake highly focused feasibility studies with the co-operation of the members of the task forces mentioned above for the creation of specialized information analysis centres in association with "centres of excellence" in specific fields within new and renewable sources of energy and develop a proposal for the better articulation of the relevant information service. Sufficient resources should be made available to one or more specialized-information-analysis centres located in "centres of excellence" for research, development and training in relation to a specific energy source. These specialized-information-analysis centres should eventually be linked to the network of national and regional institutions that will be responsible for disseminating information to the various levels and types of users.

#### B. Suggested lines of action

110. The following lines of action for improvement of access to information on new and renewable sources of energy to be taken at national, regional and global levels were adopted by the Expert Group based on the draft recommendations prepared by three subgroups. In reviewing these recommendations, the Group was mindful of both the needs of the forthcoming Conference on New and Renewable Sources of Energy, to be held at Nairobi in August 1981, and of the possible actions that may emerge from the Conference.

##### 1. National level

111. Based on the premise that the effective flows of information both at regional and global levels depend heavily upon the information handling capability at the national level, the experts agreed that efforts should be concentrated to provide support at this level. Therefore, it was suggested that a detailed analysis of the national information infrastructures and their capabilities be prepared. This analysis would then be used in preparing a development plan and an action programme on new and renewable sources of energy which take into account the following requirements:

(a) Development of national and specialized information centres either independent or attached to organizations engaged in research and development or technology transfer for new and renewable sources of energy and ensuring that they:

- (i) Identify indigenous information resources covering bibliographic, factual and numerical information on new and renewable sources of energy to be acquired, stored and disseminated in a co-ordinated manner by co-operating with indigenous institutions such as special libraries, technological institutions and engineering and other professional organizations;
  - (ii) Promote and provide appropriate local and national input to the regional and global centres and other agencies and services so as to actively co-operate and share resources;
  - (iii) Make effective use of the services, facilities and programmes of the regional and global centres and other sources and systems in providing information to its national clientele;
- (b) Strengthening of the basic components of the national information system by developing or modifying existing capabilities, or by establishing new information facilities or both in the following fields:
- (i) Analysis, evaluation and assessment of information by information-analysis centres;
  - (ii) Extension services, consulting services and similar person-to-person communication links acting as intermediaries and transmission facilities between information centres and end users;
- (c) Studies of the information requirements of user groups and their programmes in new and renewable sources of energy;
- (d) Planning and implementing an education and training programme for information personnel and users in the fields of new and renewable energy sources, for example:
- (i) Subject specialists engaged in information analysis, evaluation and assessment;
  - (ii) Information specialists in information repackaging and consolidation;
  - (iii) Information specialists in the methodology and technology of modern information handling; and
  - (iv) Engineers and other subject specialists as end users, university students as prospective end users in the uses of information and the application of information technology;
- (e) Organizing seminars, and meetings on information on new and renewable sources of energy for user groups in addition to the general public, including rural populations.



## 2. Regional level

112. In reviewing the suggested lines of action formulated by the subgroup on regional activities, the Expert Group noted the existence of a number of regional information-exchange mechanisms such as the Commonwealth Regional Renewable Energy Resources Information System (CRRERIS), Asian Institute of Technology (AIT) etc. which have been instituted through intergovernmental co-operation. The Expert Group recognized the fact that regional activity is possibly the only viable means of involving small developing countries which stand to benefit greatly from the introduction of new and renewable energy applications and which have technological resources below the threshold of effective or even viable national action.

113. The following specific measures suggested are expected to interface without much difficulty with global and national measures. Preferably, they should be carried out under an intergovernmental, regional organization:

(a) To ensure effective backward and forward linkages with national and global measures;

(b) To mobilize governmental will and funds behind the regional activities; and

(c) To effect follow-up mechanisms for monitoring implementation.

114. It is believed that whatever form of follow-up measures is recommended at the forthcoming Conference at Nairobi, regional activities have the capacity to respond quickly and effectively and interact constructively. Some of the suggested measures to be undertaken are:

(a) Allocation of special funds within the budget of regional commissions and other regional agencies for:

(i) Financing training programmes;

(ii) Intraregional visits among appropriate organizations;

(iii) Evaluation of information according to region-specific criteria;

(iv) Gathering, processing and exchange of information within and between candidate institutions in the region;

(v) Printing and publishing of periodicals, reports, proceedings, monographs and directories; and

(vi) Organization and servicing of meetings on new and renewable sources of energy;

(b) A critical, comprehensive review of activities relating to information on new and renewable energy sources in the region and the institutions involved. This would take into consideration previous surveys and studies and would identify the gaps and immediate needs in the region;

(c) Identification of candidate institutions or organizations, as focal points for specific sources of energy, or type of information activity, as well as focal points for programming and linking the candidate organizations;

(d) Elaborating a programme of action on the regional level based on the results of the above-mentioned review, the identified gaps, the resources required by the candidate institutions in phases according to the specific priorities and needs in the region. This would identify the material and human resources needed and provide the basis for financing these activities from regional and outside resources, thus rationalizing and optimizing the impact of external assistance from a variety of sources;

(e) Systematic compilation and dissemination of data specific to a region on physical phenomena and characteristics, socio-economic data relating to energy consumption and potential new sources of energy;

(f) Tackling regional language problems that are hindering easy flow of information particularly by preparing and disseminating standard terminologies on local languages, translation and the use of local languages in electronic data processing systems.

### 3. Global level

115. In considering the measures to be undertaken at the global level, the experts suggested that a programme be established for international organizations responsible for various aspects of new and renewable sources of energy to ensure that the activities enumerated below are carried out. The experts also recognized the importance of instituting effective co-ordination among these activities.

116. Because of the varied nature of the sources of new and renewable energy, experts recognized that activities may best be carried out separately for each type of energy - perhaps even in different institutions according to the availability of relevant substantive expertise, capabilities and support.

117. The majority of the more operational activities could also be carried out by arrangement with other institutions - regional or national. For example, by enlarging the circle of participating countries, existing specialized information services, such as the Biomass Conversion Technical Information Service which is presently provided by the Institute for Industrial Research and Standard in Dublin, Ireland, under the sponsorship of the International Energy Agency, could be strengthened and made the international information centre specializing in one or more sources of energy. Conversely, some of the proposed individual activities might best be carried out within systems whose subject coverage, while including new and renewable sources of energy, is in fact more broadly defined in scientific or technological areas.

118. The experts noted that the majority of the items recommended below figure in the programme adopted by the General Conference of UNESCO at its 1980 session held at Belgrade. They could also be implemented in association with the information-network programme recommended by the United Nations Conference on Science and Technology for Development held at Vienna in 1979. The current

programmes of several other international organizations (the United Nations Industrial Development Organization (UNIDO), the Food and Agriculture Organization of the United Nations (FAO) and the World Intellectual Property Organization (WIPO) etc.) also contain components that are relevant to the proposed activities and are in a position to strengthen them.

119. Among the activities suggested by the experts for information on new and renewable energy sources at the global level are:

(a) Creation of specialized information analysis centres in association with centres of excellence for research on selected topics;

(b) The convening of meetings at which representatives of ongoing information activities can consult together to define how they can better co-operate with each other and rationalize their separate responsibilities. Such meetings could also provide feedback for the over-all direction of their proposed programmes;

(c) The publication of a calendar of forthcoming conferences, seminars, exhibits and trade fairs;

(d) Locating and announcing the availability of statistical, engineering and other numerical data bases and providing access to them;

(e) The compilation and maintenance of an inventory of currently available information systems and services;

(f) The compilation and maintenance of a data base in specialized areas on ongoing research programmes and projects;

(g) The compilation and maintenance of a roster of consultant firms and of individual experts not only for the purpose of identifying and engaging where appropriate but also for assessing their capacities and suitabilities for specific tasks;

(h) The compilation and maintenance of bibliographic data bases, and the provision of associated document-delivery services, particularly for non-conventional literature;

(i) The compilation and maintenance of a register of technical co-operation activities, both bilateral and international;

(j) The compilation and maintenance of common indexing tools for retrieving information from the files described in (d), (e), (f), (g), (h) and (i) above;

(k) Training and promotion in the use of all the services enumerated above, particularly by extension services and the provision of materials that will support efforts to ensure awareness by the general public.

120. The experts recognized that some users of the proposed services may, when they request information on new and renewable sources of energy, also want to have comprehensive information on other energy resources, including new and renewable sources of energy and their applications. Therefore, it was suggested that care should be taken to ensure compatibility with information on other forms of energy and their applications.

### C. Conclusion

121. The subject of "new and renewable energy sources" is heterogeneous: it encompasses sources as different as photovoltaic cells, the winds and cow-dung. The scientific disciplines that underlie the application of these energy sources are varied as the sources themselves. Hence, it is not reasonable to force them together into a single new information system or service. Furthermore, they cannot logically be distanced from other alternative sources including non-renewable sources. Information users will often need to make comparisons across many energy sources, and it does not make sense to single out one particular subset for integrated action in the information field.

122. Nevertheless, it is opportune to respond to the world-wide interest in new and renewable resources and to establish an international programme that will promote a series of actions to ensure a better information service in respect of each of the significant separate energy sources that will be studied at the Conference.

123. It would be advisable to proceed, initially, on a sectoral basis, taking each energy source in turn. A series of task forces should be convened, each composed of individuals from the key international, regional or national institutions that are already active in information work on a particular energy source. Each member of a task force should come with at least some power to commit his institution to adjust its own programme to co-ordinate with those of other institutions and to expand its services to a larger constituency, particularly the constituency in developing countries.

124. Each task force would conduct a highly focused feasibility study and develop a proposal for the better articulation of information services on the source of energy with which it is concerned. Undoubtedly, each plan will have financial implications, but it is expected that the central item would be to ensure that sufficient resources be made available to one or more specialized information analysis centres located in "centres of excellence" for research, development and training in relation to a specific energy source. Other components will involve linking the specialized information analysis centres to the network of regional and national institutions that will be responsible for carrying output information to the various levels and types of users.

125. The United Nations Educational, Scientific and Cultural Organization has already established such a programme, which it plans to carry out in association with other international organizations and donor agencies that are active in this field. Progress will now be best served by channelling interest and support to this programme and by not promoting competing efforts at the international level.

XIII. Report of the Ad Hoc Group of Experts on Research and  
Development and Transfer of Technology  
(A/CONF. 100/PC/37)

MEASURES FOR CONSIDERATION

52. It is important that the developing countries assume a major role in applied research, development and demonstration for renewable energy technologies, particularly in:

- (a) Generating detailed identification and analysis of specific needs in developing countries and the engineering of the entire systems involved in meeting those needs;
- (b) Testing the technical and economical viability and assessing the social and environmental impact of such systems;
- (c) Assisting local manufacture;
- (d) Adopting systems designed to increase the quantum of in-country manufacture and to facilitate local operation and maintenance, which is especially important for renewable energies with their relatively high initial investment;
- (e) Research and action programmes to overcome social or cultural barriers.

53. Most research, development and demonstration will be undertaken at the national level, albeit often with financial and technical support from bilateral and multilateral assistance organizations. The Technical Panels indicated, however, that there were several research, development and demonstration initiatives which could be better addressed at the regional and international levels. The following reasons were given:

- (a) By reducing the amount of duplication in the more widespread/identical research, development and demonstration activities, developing countries can direct their scarce resources to programmes of special relevance to their individual needs;
- (b) The objectives, methodologies and procedures of some research, development and demonstration programmes must be agreed at the international level and consequently require international co-ordination (for example, in establishing performance standards, testing methodologies and the like);
- (c) Such research, development and demonstration is primarily non-proprietary, has a relatively long pay-back time and is applicable on a regional or world-wide basis;

(d) Conducting research, development and demonstration activities at the regional and international level would help to co-ordinate and rationalize the input of resources to new and renewable sources of energy by national Governments and various bilateral and multilateral assistance organizations;

(e) Demonstration is intended primarily to generate information for facilitating decision making and to provide information to end-users on a national or international basis and therefore requires strong co-ordination at that level.

54. There are a number of research, development and demonstration initiatives in many specific technologies which could be considered for regional and/or international action. Five broadly defined initiatives which appeared to be consistent with the above guide-lines and consistent with the recommendation of one or more of the technical panels are:

- (a) Energy assessment and planning;
- (b) Regional centres for technology transfer;
- (c) International biomass development programme;
- (d) Long-term testing of systems;
- (e) Development of technologies for meeting special needs.

55. An important issue relating to transfer of new and renewable energy technologies to developing countries concerns the appropriation of technologies developed by the public research and development institutions. It is recommended therefore that:

(a) New and renewable energy technologies resulting from public research and development institutions should be made freely available to all countries, taking into account different national policies;

(b) Developed countries should provide incentives to encourage their institutions and firms to undertake research and development for the creation of technologies especially suited to the needs of developing countries.

#### A. National energy assessment and planning

##### Recommendation

56. In view of the overriding importance of obtaining the results of those assessments in adequate detail as soon as possible, it is recommended that a task force should be set up immediately under United Nations auspices and through United Nations funding. Within a period of 6 to 12 months, the task force would report on:

(a) The energy assessments that are in progress or will begin during the next three years on a global, regional or national level;

(b) The adequacy of such efforts, in terms of their scope, depth of coverage, scheduling and constraints;

(c) The additional work to be done, including proposals for the co-ordination and mobilization of resources, with a view to formulating a programme of action.

### Background

57. Several of the technical panels stressed the fact that discussions of the potential role of new and renewable sources of energy had to be qualitative at this time owing to a general lack of government planning in the energy area. The resultant lack of information on the potential market for different technology options makes it difficult to assign research, development and demonstration priorities to new and renewable sources of energy. In particular, it is difficult for national Governments and the various multilateral and bilateral assistance organizations to determine the technology options with potentially the greatest beneficial impact and thereby to specify research, development and demonstration programmes which will most effectively utilize the available financial and technical resources.

58. The proper role of renewable energy sources in meeting the needs of developing countries can only be determined in the context of national energy planning. An essential input into such planning are national energy assessments. Through such assessments, the role of various new and renewable sources of energy can be better quantified, the types of systems required to satisfy key end-use functions identified and assessments made of research, development and demonstration needs, institutional arrangements and financial and manpower commitments from Governments.

59. Specifically, such assessments should include:

(a) The analysis of present energy-use patterns in all important sectors, including rural and urban, commercial, industrial, agricultural and transportation sectors;

(b) The projection of future energy-use requirements if development goals are to be achieved and the identification of energy-related constraints;

(c) The identification and assessment of indigenous sources of energy - both conventional and new and renewable - which can be used to satisfy present and future energy requirements;

(d) The critical examination of the relative costs of developing the various energy options and of their capital requirements, taking into consideration such factors as the potential for increasing the manufacture of systems, with attendant beneficial foreign exchange and industrial development implications;

(e) The formulation, on the above basis, of strategies for satisfying present and future energy needs using both conventional and new and renewable sources of energy and defining the policy implications of each strategy.

60. A number of national, regional and international agencies are providing assistance to interested countries wishing to undertake national energy assessments. The World Bank, with assistance from the United Nations Development Programme (UNDP), has begun a programme under which assessments will be made in approximately 60 countries during the next three years. These assessments will focus on the identification of major energy-strategy options, their policy implications and requirements for strengthening national planning and other institutional capabilities for the formulation and implementation of energy plans.

61. In evaluating the existing programme and in recommending any complementary action, it will be necessary to ensure that:

(a) The analysis of the present role and future potential of new and renewable sources of energy is given high priority in the energy assessment programmes and is fully integrated into the resulting national energy plans;

(b) Sufficient efforts are made to assess the research, development and demonstration requirements for the exploitation of new and renewable sources of energy and the measures necessary to strengthen national, scientific and technical capabilities for this purpose;

(c) Emphasis is placed on strengthening capabilities within the countries to maintain continuity in the energy assessment and planning processes and to establish the infrastructure required to collect and evaluate the necessary data;

(d) Attention is paid to the preparation of a number of energy assessment methodologies appropriate to a range of developing country needs, which will help ensure some degree of consistency between assessments made in different countries.

#### B. Regional centres for technology transfer

##### Recommendation

62. It is recommended that the United Nations regional commissions should continue to play an important role in establishing regional centres for technology transfer and in obtaining support from international organizations and developed countries.

63. In order to assess the need for assistance to existing regional centres for technology transfer and determine the need for establishing new centres, possibly devoted to specific areas of new and renewable sources of energy, the immediate establishment of a task force under United Nations auspices is recommended. Within a period of 6 to 12 months this task force will report on the need for financial, physical and human resources for the proposed new and/or existing regional centres and will propose a priority financing scheme, taking into account the financial resources already available, as well as possible means for obtaining additional funding.



## Background

64. During the past four years, regional centres for technology transfer were established in the regions represented in the Economic and Social Commission for Asia and the Pacific, the Economic Commission for Latin America and the Economic Commission for Africa. Centres in other regions are planned. The functions of the regional centres for technology transfer should be to:

(a) Promote implementation of co-operation and joint research, development and demonstration programmes and increase transfer of technology flows in the area of new and renewable sources of energy;

(b) Promote prototype projects and the establishment of pilot plants and demonstration units;

(c) Help establish, where needed, special centres to carry out research, development and demonstration in specific areas in the field of new and renewable sources of energy;

(d) Augment facilities in existing institutions of excellence to do research development and demonstration work, to carry out testing and standardization of equipment and materials in the field of new and renewable sources of energy;

(e) Promote exchange of experience, information and personnel among developing countries, in order to accelerate technical co-operation among developing countries;

(f) Provide support, as required, for professional and semi-professional training in the field of new and renewable sources of energy;

(g) Organize conferences, seminars, panel discussions and workshops for the exchange of experience.

65. Through the activities listed above the following objectives will be reached:

(a) Stimulation of joint research, development and demonstration programmes among the countries of the region in order to optimize the use of manpower and financial and institutional resources;

(b) Establishment of regional research, development and demonstration networks;

(c) Provision of assistance to:

(i) Small enterprises;

(ii) Potential end users;

(iii) Government policy makers;

(d) Assistance to decision makers in developing countries when negotiating for and indigenizing imported technologies;

(e) The active promotion of technical co-operation among developing countries for accelerating research, development and demonstration of technology in the area of new and renewable sources of energy;

(f) Assistance to countries in training the required specialists, by employing staff from all the countries in a particular region, which is particularly important in terms of training cadres for national institutions.

### C. International biomass development programme

#### Recommendation

66. In view of the numerous gaps in the present research effort in the areas of special interest to developing countries, it is recommended that an internationally funded and co-ordinated programme of research and development on biomass energy systems should be established, taking the following into consideration:

(a) The biomass energy systems identified by the Technical Panel on Biomass Energy and the Ad Hoc Group on Research and Development and Transfer of Technology should be implemented. To that end, a special task force of experts on biomass energy should be assembled to perform the following functions:

- (i) Assessment of scientific and technological capabilities;
- (ii) Diagnosis of requirements in human resources and physical facilities;
- (iii) Diagnosis of needs for technical and financial assistance;
- (iv) Regional priority programmes drawn up on the basis of the above and presented to the international body responsible for further implementation.

The task force projects must complement national and regional programmes already under way. The task force should be created immediately in order to have the programme under way by 1981.

(b) The project should be funded through the United Nations (see the report of the Ad Hoc Expert Group on Financing New and Renewable Sources of Energy (A/CONF.100/PC/29)).

(c) Those responsible for the project must also be delegated to the group made responsible for implementing the recommendation of the Conference.

(d) The direction of the projects should be undertaken with assistance from a group of internationally recognized biomass energy experts. This group must be involved in the final design, construction, operation and final evaluation of the research, development and demonstration projects.

## Background

67. It is recognized that biomass could be an increasingly significant source of renewable energy. Specifically, developing countries could benefit greatly from this source. Even though considerable information and experience on biomass production and conversion are already available in many parts of the world, further research, development and demonstration is required in order to utilize biomass on a much larger scale.

### Biomass conversion and production-conversion systems

68. Several systems are identified in the report of the Technical Panel on Biomass Energy that require attention. These include the following:

- (a) Biomethanation;
- (b) Gasification of biomass to produce fuel gas;
- (c) Energy farming and conversion to electricity;
- (d) The gasification and indirect liquification of biomass;
- (e) Ethanol from lignocellulosic biomass.

### Identification and distribution of energy plant species

69. The provision of an adequate supply of raw materials matched to specific biomass technology is a prerequisite for a successful biomass conversion programme. At present, many traditional crops are also used as energy crops (sugar-cane, eucalyptus and the like). However, insufficient attention has been given to the identification and development of plant species specifically for energy.

## D. Long-term testing of systems

### Recommendation

70. A group of international experts should be formed to undertake the following tasks, in order that a programme for long-term testing of systems for new and renewable sources of energy utilization on a world-wide basis may be undertaken within 18 months. The task will be executed in two phases as follows:

#### Phase I

71. Establishment, within six months, of a test programme comprising technical specifications, cost forecast and organizational structure (based on a survey of existing national and regional competence).

#### Phase II

72. Formulation, within a further 12 months, of a detailed plan which should also have been discussed with, and agreed by, concerned organizations for:

- (a) Funding;
- (b) Programme implementation and supervision.

#### Background

73. Long-term system testing means testing of the installed components of the system under actual operating conditions for a period of several years. Until 1980 nearly no long-term testing of equipment for new and renewable sources of energy had been done either in developing or in developed countries. This has produced several undesirable consequences:

- (a) It discourages large investments in systems for new and renewable sources of energy and inhibits market expansion;
- (b) No guarantee can be given for the appropriate design choice with regard to local production, operation and maintenance of the system;
- (c) The technology may not be adapted to specific climatic and social conditions;
- (d) It becomes difficult to evaluate the world-wide results of research, development and demonstration.

74. In response to this situation it is necessary to establish a long-term system-testing programme, which takes the following questions into account:

- (a) What technologies are to be covered by this programme;
- (b) What existing standards are adaptable;
- (c) What different climatic conditions are to be considered;
- (d) How will testing be defined, supervised and reported;
- (e) Will existing institutions (for example, regional centres for the transfer of technology) be assigned this task or will a new arrangement be needed;
- (f) How can the collaboration of users and producers be assured from the beginning.

#### E. Development of technologies for meeting special needs

#### Recommendation

75. It is recommended that two task forces should be set up to determine the modalities for ensuring that, within the next five years, technologies will be developed for using new and renewable sources of energy to meet the following needs:

- (a) Stand-alone power sources capable of delivering between 5kW and 50kW of either mechanical or electrical power;
- (b) Domestic cookers.

Such task forces should report back within six months and propose viable technical and financial strategies.

Background

76. Viable strategies for the utilization of stand-alone power sources are needed to meet the following needs:

- (a) Power sources for rural industries;
- (b) Pumping water for agriculture and drinking purposes;
- (c) Electricity for educational television in rural areas;
- (d) Refrigeration, when necessary, of agricultural and medical products.

77. Cookers are needed for meeting three basic types of cooking: high-temperature short-duration, medium-temperature medium-duration and low-temperature long-duration.

78. It is clear that if there is no escalation in the level of current efforts, it is extremely unlikely that the above needs will be met in the next five years. Perhaps large companies will develop photovoltaic technologies for those purposes. But because no feasible alternatives are foreseeable, it is desirable to build in a calculated degree of redundancy in the effort deployed to ensure that viable alternatives will be developed over the next five years.

XIV. Report of the Ad Hoc Expert Group  
on Education and Training  
(A/CONF. 100/PC/33)

RECOMMENDATIONS

79. Although the recommendations by the group of experts set out below are, as far as possible, self-contained and self-explanatory, two general points should be kept in mind. First, the sequence of recommendations is arranged so that what is required generally precedes proposals on the mechanisms through which this may be achieved; the earlier recommendations are concerned primarily with the content of education and training programmes, the later recommendations with the process of implementing them, especially the role of international bodies such as the United Nations. Secondly, the limitation noted in paragraph 5 above needs to be repeated at this point: the recommendations are addressed only to those education and training needs that are specific to new and renewable sources of energy; they do not encompass the wider problem of the lack of trained personnel in many developing countries, that was a principal concern in the Vienna Plan of Action on Science and Technology for Development, <sup>10/</sup> adopted by the United Nations Conference on Science and Technology for Development in 1979.

Recommendation 1

The establishment or strengthening of appropriate national structures for science and technology is recommended as an imperative need in social and economic development, so as to give adequate recognition to the significance of new and renewable sources of energy.

The need to strengthen the science and technology capacities of developing countries has been recognized in section I of the Vienna Plan of Action on Science and Technology for Development. <sup>10/</sup> In the context of new and renewable sources of energy, the recommendations contained in the Plan of Action have particular force, because of the scientific and technological character of the various forms of new and renewable sources of energy and because of the vital role that energy plays in the development process. Despite the renewed attention given to new and renewable sources of energy in recent years, there is a danger that developing countries may neglect the potential contribution that such sources of energy can make to development, or fail to provide within the country adequate scientific and technological capacity for their development. New and renewable sources of energy should be given high priority in the planning and activities of national structures established for science and technology.

---

<sup>10/</sup> Report of the United Nations Conference on Science and Technology for Development, Vienna, 20-31 August 1979 (United Nations publication, Sales No. E.79.I.21 and corrigenda), chap. VII.

#### Recommendation 2

The establishment of national energy policies is recommended, incorporating short-term, medium-term and long-term elements, that give full recognition to the potential role of new and renewable sources of energy and that include explicit strategies for implementing the policies.

Traditional energy policies have usually been concerned with ensuring supplies of conventional fuels, and their use through centralized energy distribution systems. The inclusion of new and renewable sources of energy in revised policies will entail the adoption of new concepts and attitudes on the part of energy planners, which may need to be achieved through special training programmes on new and renewable sources of energy and through other similar mechanisms.

#### Recommendation 3

It is recommended that a comprehensive assessment be undertaken, at the national level, of the current situation in regard to energy supply and use, including social, economic and environmental considerations.

Energy budgeting in many countries at the present time is confined to commercial energy produced and distributed through centralized systems; this ignores, for example, the vital and often dominant role played by fuel-wood and similar fuels in meeting the energy needs of the majority of the population in many developing countries. The methodologies and models available for comprehensive assessments are not well-developed or universally accepted; each country must shape the assessment according to its own characteristics and the key personnel will probably require special training in order to accomplish the task.

#### Recommendation 4

It is recommended that education and training be provided to enable adequate energy resource inventories to be made for each country.

For effective assessments of energy needs and options, many more data are required, especially in developing countries. There is little quantitative information on existing levels and systems of use of new and renewable sources of energy (for example, number and depths of wells for drinking water and irrigation systems) and even fewer reliable data on the character and scale of under-utilized resources (for example, solar and geothermal resources and oil shales). What are required are improved systems for data collection and qualified people to conduct the surveys, maintain data collection systems, and analyse the results. Some of the data requirements may be difficult to meet (for example, geothermal resources need to be proved by drilling) but other needs (for example, some of those related to solar and wind energy) may be met by relatively minor modifications to existing climatological and similar data collection systems. Similarly, some forms of training in making inventory assessment of new and renewable sources of energy can be provided in most countries, and should preferably always be organized on a

national basis. However, some forms of training (especially in connexion with the inventory of resources that have not been utilized in the country on a significant scale in the past) may require access to appropriate training programmes organized on a regional or international basis.

#### Recommendation 5

The establishment is recommended, initially using international and regional facilities, of courses for policy-makers on the role that energy plays in social and economic development, giving adequate attention to the present and potential future role of new and renewable sources of energy.

The courses might have the following characteristics:

- (a) Intended participants: senior advisers and administrators working in national governments, organizations for regional co-operation and similar bodies, who are charged with the responsibility for formulating and advising on major aspects of policies for social and economic development;
- (b) Scope: to provide participants with an appreciation of the role of energy in the development process and the contribution that new and renewable sources of energy might make to development (including indirect contributions through employment generation, etc.);
- (c) Format: short courses or seminars, led by experts familiar with the needs and constraints of policy-making at the macro level, for a limited number of participants (15-20 per course);
- (d) Method of organization: initially using international or regional centres of excellence if necessary, but subsequently becoming a national responsibility as facilities and expertise become available;
- (e) Institutions to be used: universities with appropriate staff and expertise; institutes for public policy development and analysis;
- (f) Duration: probably limited to one to three weeks, because of constraints on participants;
- (g) Examples of existing courses: United States of America, State University of New York (Stony Brook); France, Sophia-Antipolis; Institute for Energy Policy, short courses and seminars on energy systems, energy planning and energy economics.



#### Recommendation 6

It is recommended that, using international or regional institutions where national capacity is not yet adequate, courses be established for energy planners on the application and potential contribution of new and renewable sources of energy and on the over-all assessment of energy needs and supply mechanisms.

The courses might have the following characteristics:

- (a) Intended participants: senior administrators and managers involved in energy planning and supply at the national level or for large subnational units;
- (b) Scope: to provide energy planners with the extra dimensions of new and renewable sources of energy, and to enable them to undertake over-all assessments of energy supply and use, including decentralized and non-commercial sources. Existing energy planning courses should be revised and strengthened in order to give adequate attention to new and renewable sources of energy;
- (c) Format: short or medium-length courses initially, with longer courses added to or incorporated in the training of the next generation of energy planners;
- (d) Method of organization: some countries, including several developing countries, already possess the capacity to provide such courses at the national level; others may need, for some time to come, to participate in courses offered by regional or international centres of excellence;
- (e) Institutions to be used: universities with appropriate engineering, economic and related expertise; international or regional centres of training and research;
- (f) Duration: initially, the courses may need to be limited to short periods (about one month) but the nature of the task ideally requires a more prolonged training, which should be provided for the next generation of energy planners;
- (g) Examples of existing courses: United States of America, Brookhaven National Laboratory. Argentina, Bariloche: Instituto de Economía Energética. France, Sophia-Antipolis: Institute for Energy Policy, short courses and seminars on solar energy and buildings, and biomass use, including industrial implications. Norway, University of Oslo: international summer school on energy planning and the environment.

#### Recommendation 7

It is recommended that the knowledge and expertise of scientists and other professionals be strengthened and extended through the provision of training programmes in specific technologies for new and renewable sources of energy.

- (a) Intended participants: those who have already acquired a professional or scientific training in fields where significant opportunities exist for using new and renewable sources of energy;

(b) Scope: provision of detailed information on the state of the art in specific areas of new and renewable sources of energy. Among the many topics that might be touched upon or considered in some detail are: available technologies and products, system design, current research and development needs, simulation techniques etc. - since the intended participants will be drawn from widely differing backgrounds, specific courses will be needed for different groups;

(c) Format: courses of medium to long duration, to ensure that participants acquire the necessary knowledge and skills;

(d) Method of organization: through nationally organized programmes where possible; otherwise through courses held on a regional basis;

(e) Institutions to be used: universities and research centres in individual countries; regional centres for specialized training;

(f) Duration: from a few weeks to one year;

(g) Examples of existing courses: Norway, Trondheim: Royal Norwegian College of Technology, one-year international course on hydroelectric design, technology and practice. Latin America, Latin American Energy Organization, (OLADE), seminars and courses on geothermal energy, biogas and energy balance assessment. France, Perpignan: one-year course on geothermal energy. United States of America, University of Florida: 15-week course on solar energy.

#### Recommendation 8

It is recommended that the knowledge and capability of teachers and trainers be extended in regard to the scope, opportunities and problems of new and renewable sources of energy, including techniques of utilization.

(a) Intended participants: teachers and trainers, particularly, but not limited to those who are involved in vocational training in fields related to energy supply and use;

(b) Scope: the scope will vary greatly according to the character of the participants. Consequently a wide range of courses will need to be provided to cater for different needs - for example, teachers in elementary schools will have very different needs to those involved in vocational training. Examples of the courses that may be included under this heading are:

(i) Short courses for elementary school teachers, on basic energy principles;

(ii) Courses for teachers in vocational schools or training centres, on the knowledge and skills in specific technologies of new and renewable sources of energy;

(iii) Courses or seminars for university, college and school teachers, to review existing curricula or course content, or to define new degrees and diploma courses and new career-training opportunities related to new and renewable sources of energy;

(iv) Courses or workshops for extension service workers;

(c) Format: courses of varying duration: short in the case of participants involved in general education; longer for those who are directly involved in vocational training related to new and renewable sources of energy;

(d) Method of organization: courses (especially with a high technical content) may need to be organized initially at the regional level, but should be transferred to a national framework as soon as possible;

(e) Institutions to be used: regional training centres, technical colleges, polytechnics and universities; there are also many opportunities for co-operation between industrial establishments and educational institutions in the provision of specific courses; the school and training systems from which the participants will be drawn can also play a significant role, especially in defining the needs that specific courses should be designed to meet;

(f) Duration: A few weeks to a few months, depending on technical content;

(g) Examples of existing courses: Italy, Turin: ILO International Centre for Advanced Professional and Technical Training.

#### Recommendation 9

It is recommended that training programmes for technicians and skilled labour in specific technologies of new and renewable sources of energy be established or strengthened.

(a) Intended participants: those who will find employment in projects and operations for new and renewable sources of energy. The requirements for such technicians and skilled labour should be determined as part of the national energy planning process, and provision for recruitment and training made accordingly. Participants may already possess general technical or other skills, but require further training specific to a particular technology of new and renewable sources of energy;

(b) Scope: specific to and defined by the new and renewable sources of energy technology concerned; generally, the training should include:

(i) The basic principles of the particular new and renewable sources of energy;

(ii) Operation of production machines;

(iii) Manufacture of components and assembly;

(iv) Installation and operation;

(v) Trouble-shooting and maintenance;

(vi) Environmental implications;

(c) Format: several options exist, including both special courses and regular training provided by:

(i) Vocational schools (at secondary education level);

(ii) Polytechnics and technical colleges (post-secondary);

(iii) Research institutes and universities;

(iv) Industrial establishments active in new and renewable sources of energy;

(d) Method of organization: although training at this general level (though not normally at present in new and renewable sources of energy) is well-established in most countries, the role of local industry may play an essential role also: assistance in developing and operating courses may be required from regional or other centres of expertise and finance, and legal and economic incentives to assist training may be included in measures to promote industrial development of new and renewable sources of energy;

(e) Institutions to be used: as noted above, this training will normally make use of the existing framework for technical training, with substantial industry involvement and external assistance where available and needed; training opportunities provided by demonstration projects supported by United Nations bodies should be used;

(f) Duration of courses: variable, depending on course content;

(g) Examples of existing courses: Senegal, Dakar: University Institute of Technology and Research Centre on Renewable Energy.

#### Recommendation 10

The development is recommended of curricula, teaching aids, performance recognition awards and other materials required to implement the training programmes called for in recommendations 5-9.

In developing curricula and providing the other materials required, national educational bodies and other relevant organizations would be greatly assisted by the creation or adaptation of activities by international bodies (such as UNESCO), by bilateral assistance and by technical co-operation among countries with similar needs.

#### Recommendation 11

It is recommended that national programmes and materials be established for general public education on new and renewable sources of energy and the optimization of energy use.

At the present time, in practically all countries, such programmes are required to educate the general public in the opportunities that exist for using new and renewable sources of energy, especially in small-scale, centralized applications, and in the necessary techniques. At a later stage, much of this effort should be accomplished through the basic educational system, and additional programmes would be developed to extend and support such education. Each country, working where appropriate in co-operation with international organizations, regional training centres and similar bodies, should identify the main groups in the population to which information on new and renewable sources of energy should be addressed, and the best means of reaching them. For example, special efforts should be made in most developing countries to reach women and young people, especially in rural areas; the available means include the mass media (television, radio, press), films, cartoons, posters and other audio-visual means, and exhibits and demonstration projects in individual communities. Voluntary non-governmental organizations have a vital role to play in communication.

#### Recommendation 12

It is recommended that a report be prepared based on a sample survey of a small number of industrialized and developing countries, on the attention that is given to the optimal use of energy resources, including new and renewable sources of energy, in the content of systems of general and specialized education, with recommendations for the future.

It seems probable that detailed study of a relatively small number of countries will allow general conclusions and recommendations to be formulated that will assist all countries in making desirable changes in educational systems. The survey should include consideration of both the present extent, form and content of specific courses on new and renewable sources of energy, and the extent to which characteristics of new and renewable sources of energy are, or should become, an integral part of general education for all and of specialized courses for architects, engineers and other experts.

#### Recommendation 13

It is recommended that appropriate model curricula, teaching aids and other activities be developed for use in national education systems that familiarise students with the potential for and problems involved in the utilization of new and renewable sources of energy.

The approach should be both general (oriented towards making the use of new and renewable sources of energy a normal element of daily life) and specific

(ensuring, for example, that techniques relating to new and renewable sources of energy are included in educational systems for all experts who can use them in their professional work). Vocational courses, adult education and refresher courses should be taken into consideration. Special attention should be given to the particular advantages of new and renewable sources of energy for improving the life of women, especially in rural areas. As with the development of curricula etc. for the special courses proposed in recommendation 10, the task facing national Governments and educational bodies can be eased through relevant activities of international organizations and through other co-operative activities. The report called for in recommendation 12 should provide guidance that will be found useful in a large number of countries.

#### Recommendation 14

It is recommended that the exchange of information on educational systems, training programmes and technical experience related to new and renewable sources of energy among countries with common interests be facilitated.

Education and training to promote new and renewable sources of energy offer significant opportunities for technical co-operation among countries, especially among developing countries. For example, many of the techniques for utilizing new and renewable sources of energy have already been adopted in many parts of the world, and in some cases form part of long-established patterns of urban and rural life. Exchange of this experience can contribute to an understanding of the social and economic context needed for successful use of new and renewable sources of energy and a more optimal approach to energy use in general. Within the United Nations system, this aspect of technical co-operation among developing countries may be facilitated by seminars, study tours and other initiatives taken by the regional commissions and other bodies.

#### Recommendation 15

A review, is recommended using the appropriate existing interagency co-ordination mechanisms, of the extent to which greater and more effective use of new and renewable sources of energy would contribute to the success of existing programmes and objectives of United Nations bodies and specialized agencies, and the contribution that these bodies can make towards meeting the related education and training needs.

Some United Nations bodies and specialized agencies are already directly involved in activities related to education and training in the field of new and renewable sources of energy (for example, UNESCO and the United Nations University (UNU)). Other United Nations bodies and agencies have substantial programme activities to which the increased use of new and renewable sources of energy could make a significant contribution. These include the International Labour Organisation (ILO) (use of simple systems of new and renewable sources of energy in rural development country projects), the Food and Agriculture Organization of the United Nations (FAO) (use of undervalued land resources to produce biomass for

energy, and the use of new and renewable sources of energy in irrigation pumping), the World Health Organization (WHO) (pumping and purifying drinking water), the United Nations Environmental Programme (UNEP) (reduction in forest loss through better management and use of fuel-wood resources), the United Nations Industrial Development Organization (UNIDO) (development and application of mini-hydro projects), and several others.

Such a review should be completed within 12 months of the adoption by the General Assembly of the recommendations of the Conference.

#### Recommendation 16

The strengthening and expansion of fellowship programmes within the United Nations system are recommended to ensure adequate training of personnel from developing countries in selected aspects of new and renewable sources of energy and the optimal use of energy.

Although some fellowships are already offered by UNESCO, UNDP and UNU, more are needed to meet the analytical and training needs identified in preceding recommendations. In particular, the fellowships would facilitate the advanced training of appropriately qualified persons from developing countries at regional centres such as those proposed in recommendation 17 or at international centres of excellence.

#### Recommendation 17

It is recommended that regional centres be established for specialized training in energy assessment, planning and policy development and in technologies of new and renewable sources of energy.

Appropriate United Nations bodies could participate in the designation and support of about six regional centres. Existing centres could also be recognized and strengthened to perform the required functions. These functions would include:

(a) The provision of specialized training for policy makers, planners, professionals and scientists on the methodologies of energy surveys, assessments, planning and policy development related to new and renewable sources of energy and conventional energy; this training would be offered through seminars, panel discussions, workshops and short courses. The object should be to strengthen the ability of participants to formulate and implement national energy policy, plans and programmes that would form an integrated part of national social and economic plans and would take into account short-range and long-range implications for research and development, education and training, local industries, optimization of energy use, scientific and technological infrastructure and public services, and the appropriate organizational structures involved;

(b) Provision of training for technicians and skilled manpower in the various technologies of new and renewable sources of energy relevant to the region. Training may include:

- (i) Technical aspects of new and renewable sources of energy;
- (ii) Methods of data collection and measurements related to new and renewable sources of energy;
- (iii) Manufacturing and production methods for equipment for new and renewable sources of energy;
- (iv) Installation and maintenance of equipment;

(c) Provision of training for professionals and scientists in various aspects of new and renewable sources of energy, such as:

- (i) The scientific and technical principles involved;
- (ii) Design criteria for equipment and systems design;
- (iii) Testing methods, specifications and codes related to the design, manufacture and use of equipment and systems for new and renewable sources of energy;

(d) Assistance to Governments in the region in the design of programmes and materials for general and specialized public education in new and renewable sources of energy and optimal energy use;

(e) Assistance in establishing curricula and educational materials related to new and renewable sources of energy.

Each centre would, in the implementation of these functions, co-operate with and utilize existing facilities and expertise in the region; other regional centres; institutions and centres outside the region; international organizations; and regional and other industries relevant to new and renewable sources of energy.

The permanent staff of the centre should be kept at a minimum. Small display equipment could be obtained free in the form of donations from manufacturers within the region and elsewhere. Larger display units would be purchased.

#### Recommendation 18

The inclusion of a significant education and training component for new and renewable sources of energy is recommended in the terms of reference of any possible United Nations centre of responsibility for energy.

In the event that a centre of responsibility for new and renewable sources of energy is established in the UN system, this body should contain a unit for the initiation, funding and organizing of activities to meet education and training



needs in regard to new and renewable sources of energy in developing countries. Such a unit could also facilitate the implementation of several of the previous recommendations, including: courses for government policy-makers (recommendation 5), energy planners (recommendation 6) and professionals and scientists (recommendation 7); survey of new and renewable sources of energy in present education systems (recommendation 12) and development and introduction of appropriate curricula (recommendations 10 and 13); the exchange of technical information and experience (recommendation 14); fellowship programme (recommendation 16); and the development of regional capability (recommendation 17). It would also make possible the periodic review of the adequacy of education and training facilities, especially those designed to meet the needs of developing countries.

#### Recommendation 19

It is recommended that assistance be provided for the work undertaken by international and national nongovernmental organizations in promoting the development and utilization of new and renewable sources of energy.

Non-governmental organizations have already indicated their willingness and demonstrated their effectiveness in several successful activities. Some organizations have played a valuable role in developing new techniques for utilizing new and renewable sources of energy, especially for use on a self-help, non-commercial basis, but the main contribution likely to be made by non-governmental bodies is in communicating the opportunities and techniques of new and renewable sources of energy to large numbers of people, and by providing organizational mechanisms through which projects can be initiated, constructed and maintained. Assistance to non-governmental organizations with the requisite skills, interest and membership is likely to be very cost-effective when compared with other forms of education and training.

XV. Report of the Ad Hoc Expert Group on Rural Energy including  
the Utilization of Energy in Agriculture  
(A/CONF. 100/PC/38)

MAJOR CONSTRAINTS AND PROBLEMS

56. There are a multiplicity of problems and constraints associated with the development, supply and utilization of new and renewable sources of energy in the rural areas. These include, inter alia:

(a) Unavailability of policies and strategies for the development and use of new energy technologies and systems in rural areas;

(b) Infrastructural issues in rural areas, such as transport, storage, maintenance (both labour and parts);

(c) Institutions; skilled manpower to manage and operate the systems; access to funds;

(d) Terms for loans and investments in rural areas;

(e) Affordable cost to the consumer and productive enterprise;

(f) Inadequate research, development and demonstration of new technologies and systems;

(g) Available information on the kind of data required, resource base and proven technologies and systems.

57. There are also such other factors as:

(a) Poverty, remoteness and dispersed patterns of rural settlements;

(b) Difficulties in achieving technical and other changes in rural areas;

(c) Lack of political will in identifying and solving the problem.

58. Many of these issues are discussed at length in the section below on recommendations.

59. Suffice it to say, in resolving the problems and overcoming the constraints, the following must be borne in mind:

(a) Effective development and management of rural energy use and production can be best achieved within the framework of rural energy systems. This calls for a better understanding of the energy flows in local rural economic and social units, such as villages or small market towns and their environs. It also calls for those who deal with the individual components of the system to take into consideration the totality of inter-relationships when proposing changes.

(b) While most rural energy technologies have reached sufficient maturity, additional effort is required to optimize their performance.

(c) There are certain inadequacies and drawbacks in the use of new energy technologies in rural areas; these become more serious with increases in complexity and intensity of use.

(d) There is a need to further elaborate the integrated rural energy concept. It looks at the farm and the rural community as an energy system capable of producing its own energy requirements to meet total related energy demand through time and in terms of quality of energy required, by appropriately mixing or combining renewable and conventional feedstocks and technologies.

60. The concept of an integrated rural energy system is obviously not new. But comprehensive research and development, which would start from the logic of the concept and work out the implications of a complete system, including its operational aspects, by means of testing and demonstration activities, is practically non-existent.

61. In a wider perspective, energy planning for rural areas must be integrated with over-all agricultural planning. The first step in this direction will be the further development of methodologies for the analysis and management of rural energy systems. These will have to provide links to both agricultural development planning and to national energy planning. They will also have to be tested in practical planning situations and their widespread implementation ensured by training people in their use.

#### RECOMMENDATIONS

62. The PRINCIPAL RECOMMENDATION of the Ad Hoc Expert Group is that national Governments, the United Nations system, and other regional and international agencies should commit themselves to strengthening the position of rural people in their access to sufficient supplies of energy given the current circumstances of increased competition for scarce supplies of useful energy. This is necessary both to prevent the further deterioration of the currently inadequate levels of rural subsistence and to allow genuine rural development in future.

63. This recommendation is based on the view that:

(a) Although rural people constitute the majority of the world's population, they have traditionally been disadvantaged;

(b) Rural people are nearest to the margins of subsistence and consequently their adjustment to increasing energy scarcities will be particularly painful; furthermore much of the burden of this adjustment is likely to fall on women and children;

(c) Adequate access to energy for rural development, and in particular for cooking and heating, is of basic importance to survival; adequate supplies of energy are also fundamental in ensuring food security for both rural and urban populations;

(d) Growing demand for traditional fuels and food has accelerated the process of excessive deforestation and threatens the environmental stability of large areas of developing countries.

64. However, the Group recognizes that there are formidable constraints to implementing such a recommendation. These include:

(a) The poverty, remoteness and dispersed pattern of settlement of rural people;

(b) The increasing debt burden of developing countries and the world-wide recession;

(c) Political and social forces that result in the concentration of resources in urban areas and in industrialized countries;

(d) The competition for non-renewable energy resources in world markets, particularly from industrialized countries, and the fact that so far the attempts of industrialized countries to reduce their consumption of oil-based energy resources have proven inadequate;

(e) Lack of awareness on the part of many Governments and people regarding the nature of rural energy needs and the possibilities of meeting those needs;

(f) The complex problems encountered in almost all previous attempts to achieve technical and other changes in rural areas (such as those associated with the introduction of new agricultural practices, rural water supplies, basic health services and other elements of rural development);

(g) The difficulties experienced in securing the active participation of all sectors of rural society in the specification of problems and the design and implementation of solutions; and

(h) The difficulty of dealing with rural energy matters because they fall between the traditional areas of responsibility handled by ministries, institutions, professional groups and academic disciplines.

65. The Ad Hoc Expert Group recognized that no easy or universal solutions to rural energy problems were likely to emerge. The viability of those solutions that do exist are likely to be location specific. Fuelwood and agricultural residues will remain the major source of inanimate energy for the mass of rural people at least until the year 2000. Of equal importance is the supply of energy from both conventional and renewable sources of energy to sustain and increase food and agricultural production. But in the light of these constraints, the Group recommends six major areas for action, which are discussed below.

#### A. Policy, planning and political commitment

66. Action: Develop and sustain rural energy policies and programmes for the provision of adequate supplies of energy for rural development programmes.

67. If the energy needs of the rural sector are to be met, massive concerted action is urgently required within carefully planned strategies; action is required not only to increase and organize the supply of fuels and to improve their efficiency in conversion and use but also to manage and monitor the demand in rural areas. Rural energy strategies should be carefully developed as an integral part of national energy and rural development policies and programmes. The aim is to ensure that the rural sector has adequate and equitable access to both renewable and non-renewable sources of energy which are indispensable for the subsistence of all socio-economic groups.

68. The main objectives are:

(a) To ensure adequate energy supplies at reasonable prices for domestic use, for agriculture and for rural industry;

(b) To guarantee to the rural sector adequate supplies of conventional and non-renewable sources of energy to sustain rural development during the transition period until dependence on non-renewable sources of energy is reduced by proven technologies for conversion and the use of renewables;

(c) To combine economically efficient fossil and renewable energy sources into systems that meet the needs and capabilities of specific groups of rural people;

(d) To encourage the transition to the greater and more efficient use of locally available renewable sources of energy through decentralized and environmentally, socially and economically sound integrated rural energy systems;

(e) To undertake massive and sustained action-oriented fuelwood programmes as an integral part of rural energy and development programmes;

(f) To stimulate local participation and co-responsibility in the identification of rural energy needs and in the design development, adaptation, implementation, evaluation and management of rural energy systems;

(g) To implement actions that have both short-term and long-term effects, reflecting the evolving nature of the rural energy situation and the need for urgent measures;

(h) To regulate energy prices with due concern for equity between social groups and absolute poverty, the relative competitiveness of alternative new and renewable sources of energy, and the prices of other commodities which the rural areas buy and sell to the urban and industrial sectors;

(i) To consider the social and economic consequences of competition for land and other resources in the production of food and fuel. In particular, efforts should be made to prevent the development of new and renewable sources of energy from worsening the distribution of income, or the ecological balance.

### Responsibility and methods

69. These actions are the responsibility of national Governments which should raise the general awareness and commitment of all concerned - both institutions and people.

70. International and regional organizations should review their current practices in order to reinforce their assistance capability in line with the scale of action required and should devote particular attention to strong supporting efforts in developing countries for technical assistance and the building and strengthening of institutions particularly in the fields of planning, project formulation, implementation and evaluation of energy programmes and projects.

### B. Institutions

71. Action: Strengthen existing institutions, or creating such institutions where necessary, for the identification of rural energy development needs and the design, selection and implementation of rural energy programmes.

72. If rural energy is to be developed adequately it should be the responsibility of institutions with sufficient influence to integrate actions relating to rural energy with other energy activities in the urban and industrial sectors and with rural development.

### Responsibilities and methods

73. At the national level the necessary action would involve the strengthening (or creation, if necessary) of institutions at all levels under the co-ordination of the relevant ministry. These institutions should be responsible for the co-ordination of energy programmes, the operation and maintenance of facilities, research and development, training, extension and credit. In many countries the capabilities of the non-governmental organizations and the private sector should be utilized where possible. Local participation should be strongly encouraged in the operation of these institutions. Participation in the operation of rural energy programmes should be particularly encouraged.

74. Basic to the effective implementation of a national rural energy policy are the following considerations:

(a) At the central government level a ministerial (or national) organization should take responsibility for evolving an effective national energy policy, for supervising the preparation of national and rural energy plans and for co-ordinating their implementation.

(b) Training activities should, to the extent possible, be the responsibility of existing training and educational institutions. Supervision of these training programmes in rural energy should be the joint responsibility of the ministries of education and other relevant agencies. A major emphasis must

be the training of village-level workers in new and renewable energy resources and technologies related to production, conversion, conservation and utilization.

(c) Another important dimension of training involves the training of energy technicians (to train village-level workers) and specialists.

(d) A third aspect of training is the conduct of seminars, symposia and the like on energy issues in order to create awareness of the dimension of the rural energy situation and its relation to broader socio-economic objectives and feasible approaches to ameliorate these problems.

(e) Programmes at national research institutes should be strengthened or expanded to address energy-related research tasks. In the field of renewable energy, national research efforts in biomass production, conversion and utilization will be particularly important.

(f) Rural technology centres or workshops should be strengthened, and where necessary established, to fabricate, test, maintain and repair rural energy devices and agricultural implements, including such rural transportation machinery as ox carts.

At the international level action would include developing the capability to meet the requests of national Governments for assistance. In particular, the international agencies should increase the capacity of developing countries to develop and implement comprehensive rural energy programmes; encourage and strengthen international, regional and interregional co-operation in research and development in new and renewable energy sources through the exchange of literature, visits, symposia and joint research and development projects. In these activities the international agencies should further strengthen their co-ordination procedures to prevent duplication of effort.

### C. Finance

75. Action: Commit a considerably increased level of financial resources which reflects the urgency and scale of the rural energy problem.

76. The global levels of funding required to adequately develop rural energy use is not currently known. The Ad Hoc Expert Group notes the recommendation of the Technical Panel on Fuelwood and Charcoal that to meet basic fuelwood requirements by the year 2000 will require an expenditure in excess of \$1,000 million per year; such a figure does not include the cost of the necessary institutional infrastructure. Although fuelwood will continue to be the fuel of necessity for the majority of rural populations, the development of an optimal mix of energy sources will inevitably cost considerably more than this.

77. Direct investment will be required to develop and introduce new energy-conversion technologies. In addition, funds will be required to shift the pattern of energy end-uses, such as changes to less energy-intensive production systems, and retrofitting of energy-saving devices in rural industries.

### Responsibilities and methods

78. At the national level increased levels of funding to meet energy needs would be ear-marked for the rural sector. Financial institutions and procedures would have to be adapted to increase access to financial resources for all socio-economic groups under terms that are appropriate to the circumstances of the recipient and the specific nature of the energy-related activities.

79. Prices, taxes and subsidies should be reviewed to remove those elements that favour inequities in the use of scarce energy resources and promote the continued use of non-renewable energy sources. Temporary subsidies and other incentives may be required to assist the introduction of new energy technologies, although Governments should take account of the true scarcity value of internationally traded commercial fuel.

80. International agencies would take further steps to develop emergency funding mechanisms which meet the particular problems of countries with acute rural energy shortages in order to ensure their access to the required energy supplies for subsistence and development. Action will be required at the international level to finance those countries already heavily in debt to the world financial system in order to permit their transformation to economies that are less dependent on fossil-based sources of energy.

81. In evaluating rural energy projects international agencies should consider not only financial returns but also the returns to broader social, economic and environmental objectives. For example, account could be taken of the employment that might be generated through the fabrication, installation and maintenance of the devices associated with small-scale energy-producing and conserving technologies. Such additional employment may have considerable positive implications for income distribution.

82. If and when the financial resources are made available through institutions such as the proposed international fund for energy development, a significant proportion should be ear-marked for rural energy, including new and renewable sources.

83. It is recommended that bilateral regional and international aid agencies should:

(a) Strengthen their programmes of financial assistance and technical co-operation in the field of non-conventional energy-generating and energy-using technologies for application in the rural areas of developing countries;

(b) Establish a public exchange of information on these activities to promote compatibility between programmes, such a mechanism to be instituted within one year of the conclusion of the Conference;

(c) Be increasingly prepared to finance rural energy projects with a high element of local costs (which may be especially important relative to other projects).



84. It is further recommended that paragraph 12 of General Assembly resolution 34/190 of 18 December 1979, on United Nations assistance to developing countries on new and renewable sources of energy, should be extended beyond the Conference.

#### D. Knowledge and skills

85. Action: In conjunction with the action programmes, a greater understanding and mastery of skills must be obtained on:

- (a) Rural energy needs and their relationship to rural development;
- (b) The extent and local potential of new and renewable sources of energy; and
- (c) Technologies for converting and using new and renewable sources of energy.

86. The Ad Hoc Expert Group is of the opinion that the lack of political will has been a greater constraint to undertaking rural energy programmes than has the lack of knowledge; sufficient knowledge exists to initiate programmes of rural energy development, but it is recommended that ongoing research should be conducted to permit the design of better policy and improvements in implementation and evaluation. In particular, the following should be considered:

(a) Thorough studies should be made concerning the nature of the interrelationships and complexities of the physical, social, economic and institutional structures associated with the technical supply and use of largely non-monetized energy in the rural sector - for example, the division of labour at the household level in the utilization of energy. There is a need to extend a detailed understanding of the current situation in a range of locations in order to determine the likely future position as the basis of future action.

(b) While the nature of the many technologies likely to satisfy rural energy needs in the next 20 years are already largely known, detailed evaluations of these technologies and their potential for combination in integrated systems are required in order to determine their viability and relevance to particular socio-economic and physical environments, using rigorous methods which allow effective comparison.

(c) Additional applied and basic research must be undertaken to establish the extent, regeneration and rates of use of new and renewable sources of energy for the rural sector in order to identify areas with critical shortages of energy or areas where the ecological balance is threatened.

(d) Specific rural energy situations in which serious imbalances between supplies and needs of energy will result in energy scarcity should be identified and monitored.

(e) The possibilities for the utilization of new and renewable energy sources will depend on advances in physical, biological and other technical

research. In the short term, this is most likely to mean the adaptation of technologies to local situations; only in the longer term will more fundamental research show results. This research and development effort should give particular consideration to rural needs and conditions, should involve genuine field evaluation and should be firmly linked to extension services.

(f) In the planning and location of research it will be important to distinguish between those elements which are location specific and may require multidisciplinary research and those which are basic and universal;

(g) Available knowledge and experience should be exchanged more effectively.

#### Responsibilities and methods

87. As much of the knowledge required is highly specific to rural locations, the surveys of energy-use requirements and the endowment of new and renewable resources, as well as the field tests of technological devices, will necessarily be most effectively carried out by national and local institutions and will involve rural people, particularly women. National Governments would co-ordinate these studies, provide access to the results through a focal point and disseminate the results.

88. National Governments must expand their capability to undertake such work and, where necessary, create the necessary facilities and capabilities. To evaluate and implement the use of a combination of new and renewable sources of energy, national Governments must establish a number of detailed village studies to determine more fully the nature of the interactions between social, economic, physical and institutional factors and rural energy systems.

89. National Governments would organize the systematic collection of information and monitor the availability of new and renewable energy sources for the supply of energy in rural areas. Special emphasis should be attached to the integration of energy potential in current natural resources assessment programmes; specific surveys of new and renewable resources and potential for energy; and the identification of the available land suitable for biomass production, with due consideration to other competing land uses.

90. The international agencies have a useful contribution to make in those aspects of research which are not location specific; in particular, the international agricultural research centres may wish to consider supporting energy-related research which is complementary to their existing work.

91. International agencies would rationalize and strengthen existing networks for the collection, analysis and dissemination of relevant information and experience, creating new networks where appropriate. They must draw up methodologies for studies that would facilitate the comparison of legitimate results. They would identify and solve those technical problems which are not location specific. They should actively discourage the dissemination of unsubstantiated or self-interested claims for particular devices.

### E. Training

92. Action: Intensify or organize the training of required technical staff in the various fields of renewable energy sources, technologies and systems suitable to rural areas; training of technicians should be organized in line with the urgency and scale of action required for rural energy.
93. A shortage of technical staff is usually one of the main limiting factors in rural energy programmes in developing countries. The intensification of existing training programmes and the organization of such programmes on an adequate scale is therefore essential to the success of action programmes, not only current programmes but also any major future policy and programmes on rural energy. The Expert Group noted in particular the view of the Technical Panel on Fuelwood and Charcoal that because of the particular importance of this source of energy, training programmes for forestry technicians and extension staff should be increased five-fold to seven-fold, according to the situation of the particular country and the size of the fuelwood programme. For other sources of energy, training can be integrated into related disciplines or be the subject of special programmes. Training in communication and the social sciences is essential for stimulating social participation.

#### Responsibilities and methods

94. Energy-related subjects should be included in existing technical-level training curricula and when appropriate should be presented in specialized courses. The number of technicians to be trained should be carefully adjusted to the needs of rural energy programmes, with due consideration to the time factor.
95. International organizations should promote and support, both technically and financially, national, regional and interregional training programmes related to all aspects of the organization, management, research and use of renewable energy sources in the rural sector.

### F. Extension

96. Action: Organize or expand and intensify the extension capability of rural energy systems and technologies within the appropriate extension services of forestry, agriculture and other institutions involved in rural development; raise rural people's awareness and stimulate their capability to organize, manage and efficiently use their renewable energy resources.
97. The awareness and capability of rural people to operate and manage their renewable energy supplies within the framework of their specific situation and on a systematic basis are essential to the implementation of effective solutions to the rural energy problem. Extension services therefore have an important role

to play which should be based on a full understanding of the social structure and perceived needs and preferences of the rural people and of adapted proven technologies. The objective should be to promote and demonstrate the suitability of proven renewable energy-based technologies and systems in typical rural situations and to provide adequate technical support to rural areas at the community, farmer and household levels. Pilot demonstration projects would be necessary to accomplish this objective. Motivating, facilitating and stimulating the permanent participation of rural people in local solutions to their energy needs is basic to long-lasting action. Two-way communications is a continuing need in achieving participation from rural people.

#### Responsibilities and methods

98. Governments and institutions involved in agriculture and rural development should organize or intensify systematic training on the application of renewable energy in rural areas, either as part of extension training or of in-service training for existing extension staff. They should also increase substantially the number of new extension staff as a basic supporting element of rural energy programmes.

99. International agencies should particularly support national and local programmes for training rural extension staff in energy matters through appropriate technical assistance and funding. Furthermore, they should maintain, as an ongoing objective, the improvement of national technical competence to carry out training courses and demonstration projects.

XVI. Report of the Ad Hoc Expert Group on Industrial Issues Including  
Utilization of Energy in Transportation and Allied Sectors  
(A/CONF. 100/PC/36)

RECOMMENDATIONS

60. The Panel recommended strengthening and deepening international assistance to Governments of developing countries for their national energy assessments, giving due attention to new and renewable sources of energy. Most developing countries will require technical assistance in order to conduct national energy assessments, which are a prerequisite for their formation of national energy strategies, plans and programmes. In view of the great potential for commercial utilization of new and renewable sources of energy in many developing countries, the technical assistance activities should include:

(a) Provision of information on possibilities in new and renewable sources of energy for the developing country;

(b) Evaluation of the country's potential in new and renewable sources of energy;

(c) Advice on the probable timing of technological developments which will enable realization of the potential for specific new and renewable sources of energy;

(d) Appreciation of the implications of new and renewable sources of energy on industrial structure and development plans.

61. It was also recommended that international financing institutions provide highly concessional financial assistance and risk capital to developing countries for pioneer experimentation and commercialization of specific new and renewable sources of energy in order to accelerate utilization by all developing countries.

62. The potential of new and renewable sources of energy in developing countries is probably greater than popularly believed. International financial assistance is needed to enable developing countries with important potential for specific new and renewable sources of energy to carry out - nationally, bilaterally or multilaterally - the experimentation and commercialization of the new and renewable sources of energy. Since the degree of financial risk in such projects is high, the financial assistance needs to be highly concessional and may include a substantial grant element. Technological information derived from projects largely funded by such financial assistance should be made freely available, without charge, if possible, to all developing countries possessing substantial resources of the specific new and renewable sources of energy, so that its widespread utilization may be accelerated.

63. A master plan was proposed for the development of hydro-electric resources in the developing countries.

64. A planning exercise should be conducted in order to develop the available potential in the common interest of the countries involved. That would permit the use of available financial resources and technological capacities to be used advantageously. Further, isolated projects face the risk of being turned down for

lack of markets owing to the remoteness of the location. Further, such integrated approaches to the problem could lead to the setting up of industrial complexes which would make the projects benefit from infrastructural investment shared by the totality of the industries involved in the complex. Such a procedure would allow the development of industrial capacities for construction of the hydro-stations and other necessary infrastructure and development requirements.

65. A similar approach may be appropriate in the case of other large-size projects using, for example, geothermal or oil shale.

66. It was recommended that an international task force should be set up to examine all aspects of development and production of usable fuels and other industrial products using bio-technology in general. Bio-technology is developing at a fast pace, is leading to increased applications in the energy industry, transport and other sectors. Fermentation alcohol is used as a fuel for transport and can be used as a chemical feedstock.

67. It was recommended that the United Nations system, especially UNIDO, should expand its services of industrial information and technology to small- and medium-size enterprises in the fields of new and renewable sources of energy and industry, since the development of new and renewable sources of energy in developing countries will need an appropriate supply of specific investment and industrial information for a large number of small and dispersed users.

68. A suitable arrangement, possibly involving a competent agency such as UNIDO, would be made for monitoring the industrial aspects of new and renewable sources of energy related international activities. This would be necessary since industry-related issues on new and renewable sources of energy need joint action by a number of competent agencies - bilateral and multilateral - for the different aspects involved, such as formation, financing, information etc. The United Nations co-ordinating body could ensure a proper, timely co-ordination of the efforts, bring forward the implementation of industrial projects in new and renewable sources of energy, and achieve a higher efficiency in this crucial activity.

69. It was recommended that Governments establish an appropriate mechanism to co-ordinate national strategies and policies on energy-related issues and to supervise national energy assessment.