



**General Assembly**

Distr.  
GENERAL

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A/CONF.100/PC/51/Add.1  
6 June 1981

JUN 9 - 1981

ORIGINAL: ENGLISH

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PREPARATORY COMMITTEE FOR THE  
UNITED NATIONS CONFERENCE ON NEW  
AND RENEWABLE SOURCES OF ENERGY  
Fourth session  
8 - 26 June 1981  
Item 3 of the provisional agenda

PRELIMINARY DRAFT  
OF A PROGRAMME OF ACTION

Addendum

#### IV. MEASURES FOR CONCERTED ACTION

29. The challenges and objectives set out in the preceding sections will be most effectively met if efforts undertaken at the national, regional/subregional and international levels are mutually supportive. The Conference preparatory process has involved examination of general policy measures applicable to all sources as well as measures specific to each individual source with a view to determining areas for concerted action.

##### A. Policy measures

30. On the basis of the results of the preparatory process, the Conference has identified six broad policy areas for concerted action with the support of the international community:

- (a) Energy assessment and planning;
- (b) Information flows;
- (c) Research, development and demonstration;
- (d) Transfer and application of mature technologies;
- (e) Education and training;
- (f) Mobilization of financial resources.

##### 1. Energy assessment and planning

31. The role of new and renewable sources of energy in meeting the needs of countries can only be determined in the context of national energy policy planning, an essential element of which is national energy assessment. It is an especially acute problem with respect to the data infrastructure pertaining to energy demand and resource inventories, which can provide the basis for assessing the possible future role of new and renewable energy sources and related technologies and institutions. Action is required as follows:

- (a) Map, survey and undertake other appropriate activities to establish the full range of physical resource endowment, using, whenever possible, standardized instruments and procedures for data collection, processing and storage and dissemination;
- (b) Undertake studies to determine energy supply and demand and energy balances, including projections of future energy requirements;

(c) Identify mature and near-term promising energy technologies as well as on-going research, development and demonstration activities and assess their economic, socio-cultural and environmental costs, potential and benefits;

(d) Establish the institutional infrastructure to collect, maintain, analyse, classify and disseminate information on all the above as well as information pertaining to the policy, programme and project decision-making process; the legislative framework and related procedures (and their impact on energy supply and use patterns); and the availability of financing.

## 2. Information flows

32. The availability of adequate information is a prerequisite for sound decision-making for development policy and planning and for co-ordinated and effective basic and applied scientific and technological research. The need for improved information flows on energy generally and on new and renewable energy sources, in particular, must be viewed within the broader context of global information-sharing and exchange in all relevant sectors.

33. Access to information pertaining to the development and utilization of new and renewable sources of energy raises particular issues and problems associated with the newness of much of the subject matter and the rapid pace of development in the area. A series of measures are called for along the following lines:

(a) Identify currently available information systems and services and assess their capability to provide the required categories of information on all aspects of the development and utilization of new and renewable sources of energy, in a manner and form suitable to different types of users, taking into account existing studies in that area;

(b) Establish and/or strengthen energy information centres with a related programme of workshops, seminars etc., and link them to an integrated regional and global network;

(c) Develop standardized methodologies, terminologies, procedures and equipment (software and hardware) for the collection and dissemination of information to facilitate the linkage of data centres and system;

(d) Support measures which increase access to proprietary information, especially with respect to technologies developed by use of public funds.

## 3. Research, development and demonstration

34. The pace and extent of the contribution of new and renewable sources of energy and related technologies will depend to a large extent on scientific research directed towards their development. While such research is expanding rapidly worldwide, co-ordination and information sharing are poor, duplication

is widespread, and certain important aspects are relatively neglected and receive few resources. Moreover, the bulk of current research is being carried out in developed countries, and much of it will have to be extensively adapted for use in developing countries. The following series of measures are needed in order to enhance the indigenous scientific and technological capabilities of developing countries, enabling them to exploit their own resource potential fully and independently and to enter into collaborative research, development and demonstration efforts on an equal footing when it is in their interest to do so:

(a) Select promising technologies (both new and arrested technologies which may require modernization) with a view to launching concerted efforts to accelerate their development, increase their cost effectiveness and widen their applicability;

(b) Identify the research needed concerning the economic, social and environmental implications of emerging technologies, including employment consequences;

(c) Establish or strengthen institutional machinery for undertaking and co-ordinating research, development and demonstration activities, on the basis of a review of present capabilities and existing resources to respond to identified needs and priorities, in particular to those of developing countries;

(d) Establish or strengthen institutional machinery to provide links between research and development activities and the productive sector (public investments, industrial property systems etc.);

(e) Establish on a world-wide basis a long-term system testing programme to increase the ability of prospective consumers, producers and investors to make informed decisions regarding technological options;

(f) Identify and implement demonstration projects relating to new and renewable energy technologies, including those which can be undertaken on a collaborative basis, taking into consideration the benefits in terms of stimulating further related research and development, the training of specialists, and increased industrialization.

#### 4. Transfer and application of mature technologies

35. There are a number of technologies utilizing new and renewable sources of energy which have reached a stage of maturity at which little or no further research and development is required for their commercialization and use. In those cases in which the technology has been developed in the industrialized countries, the problem arises of identifying the channels and conditions for its transfer to developing countries. Furthermore, issues related to the climatic, cultural and institutional settings within which the technology is to be applied and the managerial aspects associated with its introduction and

full operation in industry, agriculture, transport and human settlements will need to be addressed. In addition, comprehensive analyses of its economic and social costs and benefits are needed in relation to any definitive commitments on its widespread implementation. The following measures are required in order to accelerate the transfer of mature technologies and to enhance their contribution to total energy supply:

(a) Identify with respect to mature technologies utilizing new and renewable sources of energy their role within sectoral programmes and establish/strengthen institutional arrangements to promote their application;

(b) Establish and implement measures at the international level to facilitate and accelerate the transfer of technologies utilizing new and renewable sources of energy to developing countries;

(c) Support and promote measures to increase economic and technical co-operation among developing countries, including the undertaking of joint programmes and activities;

(d) Build up in-country capabilities to undertake, inter alia, the manufacture, adaptation, management, repair and maintenance of devices and equipment related to technologies utilizing new and renewable sources of energy;

(e) Strengthen the ability of developing countries to select, unpackage, assess, negotiate and acquire technologies utilizing new and renewable sources of energy;

(f) Formulate innovative schemes for large-scale and capital-intensive investments, including the establishment of joint industrial programmes among interested countries for the manufacture and commercialization of capital goods;

(g) Review and assess fiscal (pricing, tax, credit), regulatory, socio-cultural and other policy aspects required to accelerate the introduction of new and renewable sources of energy;

(h) Undertake full-scale demonstration projects prior to a decision on commercial operation and widespread implementation.

## 5. Education and training

36. The building, operation, maintenance and dissemination of new energy systems requires skilled scientific and technical manpower and increased public awareness and support. Specific educational and training programmes are required, not only in schools and universities but also for the training of decision makers, planners, managers, extension workers, and the general public. Those programmes, while taking into account the special needs relating to technologies utilizing new and renewable energy within the framework of broader energy programmes, must be viewed in the context of the general educational system.

37. In order to help meet the required educational and training needs, the following actions are called for:

(a) Estimate the requirements for the various categories of trained personnel;

(b) Assess the capability of existing institutions to undertake the training of required personnel, and strengthen institutional infrastructure accordingly, paying special attention to the training of teachers and trainers;

(c) Co-ordinate and promote the exchange of information on educational systems, teaching materials, training programmes and technical experience relating to new and renewable sources of energy, between developed and developing countries and particularly among developing countries;

(d) Support efforts directed at the establishment/strengthening of national, subregional and regional training and educational centres;

(e) Establish programmes to increase the awareness of the general public of the opportunities that exist for using new and renewable sources of energy, especially in small-scale, decentralized applications, involving the general educational system and the mass media so as to ensure the full and effective participation of the entire population at all stages of the development process.

## 6. Mobilization of financial resources

38. The contribution of new and renewable sources of energy to total energy supply will depend to a large extent on the effective mobilization of adequate and additional financial resources to meet major capital-investment needs and associated pre-investment activities. A considerable number of supportive measures will also have to be undertaken and financed, such as overall energy planning, data collection, research, development and demonstration, training and education etc. The amount and nature of the financial requirements will vary for each resource and in each particular situation. The scale and timing of financing needs and of the appropriate mechanisms to meet them must be determined. Action will be needed to:

(a) Mobilize both public and private domestic investment resources for new and renewable sources of energy (including supportive investments in infrastructure and energy related sectors) and increase national capability to benefit fully from available international financial co-operation;

(b) Improve co-ordination among existing and prospective sources of international finance, including multilateral, regional and bilateral sources, in order to achieve greater integration of energy strategies;

(c) Strengthen the ability of financial institutions to assess projects involving new and renewable sources of energy and develop improved lending criteria for the financing of such projects;

(d) Support co-operative activities among developing countries and between developed and developing countries in areas of mutual interest;

(e) Develop innovative schemes involving both the public and private sectors, as appropriate, for financing energy investments directed at both small-scale, local projects and large-scale projects, where financing through joint efforts may be appropriate;

(f) Expand the existing available capital base for international finance by - for example - developing underwriting schemes to insure prospective investors in projects and programmes involving new and renewable sources of energy and rapidly changing, and sometimes unproven, technology.

## B. Specific measures

39. Within the above-mentioned broad policy areas, specific activities by source of energy must be undertaken. It must be recognized that many of the areas of new and renewable sources of energy considered during the Conference preparatory process are in a stage of scientific and technological evolution. Therefore, specific findings and related priorities and measures must be kept under ongoing review. With this in mind, the Conference, after due consideration of the results of the preparatory process, has identified the following specific actions, by source of energy, to be considered and undertaken. The actions are to be regarded as indications of broader activities in the context of such comprehensive programmes as may subsequently be developed.

### 1. Hydropower

40. Bearing in mind the immense and unused hydraulic potential that exists, especially in developing countries, and the current availability and widespread use of hydropower technology for the exploitation of water resources, the following specific actions are required:

(a) Evaluate river hydrology, using short period stream records, and develop a methodology to determine stream flow at ungauged sites;

(b) Develop criteria for the evaluation and integration of micro, mini and small hydraulic hydropower resources within overall hydropower systems;

(c) Strengthen national research, development and demonstration programmes aimed at assessing, selecting and adapting relevant hydropower technologies;

(d) Standardize hydropower equipment specifications and the "package plant" design of small-scale plants;

(e) Expand research directed at the relation between stream flow and aquatic life;

(f) Promote local or regional design, production and/or adaptation of hydropower equipment in developing countries;

(g) Support the collaborative efforts of developing countries in large-scale joint projects, including the interconnexion of electrical networks;

(h) Support pre-investment studies related to enhancing the industrial capabilities of developing countries to manufacture hydropower equipment;

(i) Promote massive utilization of micro-hydropower technologies;

(j) Enlarge substantially the financial resources available for hydropower development.

## 2. Fuelwood and Charcoal

41. Bearing in mind that fuelwood and charcoal constitute important sources of energy for large populations in the rural areas of developing countries; that their adequate management requires the assessment of projected supply and demand and the identification of deficit areas, and that their proper role must be seen in the context of the overall energy requirements and problems of rural areas; and, finally, that broad-based support and participation of men and women in the development, management and efficient use of fuelwood are essential, the following specific actions have been identified:

(a) Improve forest management practices and tree species for planting, in order to increase the supply;

(b) Improve the efficiency of stoves and promote studies of social and cultural issues relating to stoves and the reduction of their cost;

(c) Develop fuelwood substitution possibilities, utilizing alternative energy sources;

(d) Improve pre-processing of fuels for use in direct combustion and increase the conversion efficiency of charcoal-making;

(e) Organize production and distribution systems relating to the organization of emergency mechanisms directed at ensuring energy access for subsistence during the transition to new energy systems in areas of extreme deforestation or for the time required to restore fuelwood supplies;

(f) Strengthen the institutional framework dealing with fuelwood (energy, forestry, agriculture, agro-industry);

(g) Support programmes, projects and activities with respect to the establishment of large-scale plantations and community wood lots, distribution, control and pricing policies, conversion and utilization technologies (charcoal production and gasification, kilns, ovens).



### 3. Biomass

42. Bearing in mind that considerable information and experience is available on biomass production and conversion systems within the international community but that there is a lack of practical experience with those systems in the developing countries, where they are often most needed, and that further evaluation of the potential of the biomass resources available for energy conversion requires the development and utilization of specific assessment techniques in order to determine the quantity and quality of biomass agricultural residues and wastes and standing vegetation available for energy conversion and water masses which could be utilized for aquatic biomass production, the following areas requiring urgent action have been identified:

(a) Intensify research and development on biological/thermochemical conversion systems, including biomethanation, ethanol fermentation of sugars from cellulose saccharification, gasification and indirect liquefaction.

(b) Accelerate the utilization of biomass resources for energy production, through:

(i) Support demonstration schemes - biomethanation of manures, agricultural residues and other organic materials in different regions of the world; integration of biomethanation and ethanol production; small-scale gasifiers and stationary engines; small-scale electricity production, using gasifiers and engine generators; gasification and indirect liquefaction to produce methanol and/or synthetic liquid fuels and ethanol from lignocellulosic materials.

(ii) Expanded financial and technical resources for the implementation of the following mature technologies: direct combustion; gasification (low joule-value gas); biomethanation of manure, sewage sludge and industrial waste; ethanol production from sugars and starches; aerobic microbiological processes and the production of fuels from vegetable oils, giving due consideration to possible implications for food production.

### 4. Solar energy

43. Bearing in mind that solar technologies are currently going through an exciting phase and are on the threshold of large-scale and extensive applications in developing and developed countries alike, and that several solar applications have reached a mature state of development and are therefore ready for implementation - among them domestic and industrial water-heating with flat-plate collectors, low-pressure steam production, solar ponds for electricity production and process heat, solar crop and timber drying, active and passive space-heating, water pumping (thermal and electric), water desalination, telecommunications and other applications of solar photovoltaic power - the following specific actions have been identified:

(a) Evaluate solar resources through:

(i) Meteorological surveys, radiation and other relevant data collection, using ground-based measuring stations, satellites and reliable photo-interpretation techniques;

(ii) Development of methodologies to interpolate radiation data based on space and time correlation functions;

(iii) Preparation of guidelines for the assessment of solar energy potential in various climatic zones;

(iv) Preparation of a solar atlas on world-wide distribution of solar radiation.

(b) Intensify research and development in promising applications in order to reach a level of development sufficient for their consideration in implementation schemes: solar cooking, solar large-scale electricity production (thermal and photovoltaic), solar air conditioning and refrigeration, solar industrial process steam and solar power satellites. Among the main areas for research and development are material sciences, durability of products, adaptation of processes, reliability levels, system analysis and control, storage systems and social acceptability;

(c) Promote and accelerate solar applications through:

(i) National and regional solar technology centres, supported by the international community;

(ii) Collaborative research and development programmes between scientists from developing and developed countries;

(iii) Demonstration programmes at the subregional, regional and international levels, taking due consideration of the benefits to the research and development process, to the industrial experience and to mass diffusion;

(iv) Implementation of solar technologies in agricultural, housing and industrial schemes;

(v) Investment schemes for capital goods related to solar industries at the regional, subregional and national levels;

(vi) Legislative measures relating to tax rebates, tax exemptions and other incentives, which would support both the embryonic solar industry and the potential consumer;

(vii) Regional standardization of final products as protection to consumers;

(viii) Measures relating to right-to-sunlight, transfer of development rights, building codes and warranties. Insurance of solar devices should be explored.

## 5. Geothermal energy

44. Although important and unused geothermal resources exist, further work is required if their potential is to be fully developed. The following specific actions have been identified:

(a) Evaluate the resources by:

(i) Extending geological and geophysical surveys to include remote sensing, ground research and well-logging;

(ii) Using geothermometry based on gas analysis, measurements of water and soil temperature, and remote infrared scanning in cartographic studies of anomalies in high-level geothermal fields;

(iii) Utilizing oil and gas exploration data in the identification and assessment of geothermal energy prospects.

(b) Undertake research and development in:

(i) Drilling technologies;

(ii) Multiple-purpose developments;

(iii) Hot dry rock (HDR) technologies directed at developing economic heat recuperation techniques and demonstrating hot dry rock energy feasibility under different social, economic and climatic conditions;

(iv) Scientific studies on rock mechanics and heat transfer in solid and fractured mediums;

(v) Salt recovery;

(vi) Binary cycles;

(vii) Development of geopressurized zones.

(c) Promote geothermal applications by:

(i) Locating industrial activities near the source;

(ii) Creating and/or strengthening regional or national centres dealing with the development of geothermal technologies, with appropriate technical and financial support;

(iii) Supporting the initial stages of exploration of promising sites and the manufacture of capital goods at the national and regional levels.

## 6. Wind energy

45. Bearing in mind that wind energy has been one of the few forms of renewable energy which has traditionally been practical and cost effective, that several wind technologies have been available for a long time - namely, windmills for shaft power and wind energy for sea transport - and that wider use of the resource, based on technological advance and changes in the energy structures could make an important contribution to future energy needs, the following specific actions have been identified:

(a) Assess the resource by:

(i) Wind data collection (including coastal areas and islands) and evaluation at standard heights (10m and 50m);

(ii) Meteorological services, wind power and other appropriate data collection procedures;

(iii) Preparation of a world atlas on wind power based on macro-scale surveys;

(iv) Guide-lines for the assessment of wind energy potential in various climatic zones.

(b) Intensify research, development and demonstration in the following promising technologies: wind turbine/energy storage systems (wind-hydro, wind-fuel cells, wind-hot water); large wind turbines and arrays of turbines for power generation (from 200kW to 50MW) in fuel-saving, water-saving or grid-connected mode through both on-shore and off-shore systems;

(c) Support scientific and technological work on fluid dynamics (mathematics and physical modelling of wind patterns), rotor design (aerodynamics, mathematical and physical modelling), low-weight materials for large rotors (materials science, physics and chemistry), material resistance to high winds and corrosion, storage systems, matching wind turbine-storage system (electrical engineering), environmental impact (interference with radio, television communications noise), safety standards, social acceptability and aesthetics;

(d) Establish national and/or subregional centres on the development of wind energy technology and on research and development and demonstration schemes;

(e) Implement schemes of wind energy applications, especially wind energy for transport, mechanical power from windmills, multibladed windmills for water pumping and irrigation, domestic electric power generators (less than 10kW) and grid-connected or diesel-backup wind turbines for electrical power generation (larger than 10kW).

## 7. Oil shale and tar sands

46. Bearing in mind that oil shale and tar sands produce oil as a primary energy product, which can be fed into established consumption patterns and can be used also to produce thermal energy by direct combustion or to produce hydrocarbon gases, the following specific actions have been identified:

(a) Intensify resource assessment by:

(i) Reviewing and indexing possible occurrences, using the existing literature in geological and mineral exploration;

(ii) Standardizing evaluation and measurement procedures.

(b) Undertake research and development on:

(i) Small-scale retorting;

(ii) The environmental implications of waste disposal.

(c) Promote oil shale and tar sands projects directed at rural and domestic energy requirements;

(d) Establish national and regional/subregional centres for:

(i) The identification of existing sources of equipment and services required to establish oil shale and tar sands industries;

(ii) The selection of technologies;

(iii) The identification of training institutions and programmes;

(iv) Assistance in co-operative programmes of research, development and demonstration.

## 8. Ocean energy

47. Bearing in mind that ocean thermal energy conversion (OTEC) seems to be a most promising ocean energy source for generating electrical power, the following specific actions have been identified:

(a) Assess the ocean energy resource by:

(i) Identifying sites of potential OTEC tidal and wave energy, using archival data and other existing information;

(ii) Undertaking detailed OTEC tidal and wave-energy reconnaissance work, through the joint efforts of oceanographic and meteorological organizations.

(b) Undertake research and development in the following areas: aquaculture based on nutrient-rich deep waters; floating and land-based OTEC systems directed to fertilizer production; water desalination;  $\text{NH}_3$  and  $\text{H}_2$  production and liquefaction; extraction of sea-water chemicals; aluminium processes and metallurgical processing;

(c) Accelerate the application of ocean energy technologies through:

(i) An extension of existing facilities (OTEC-1 and MINI-OTEC) for use as regional/international demonstration platforms;

(ii) Efforts directed at small-scale off-shore and, especially, island-based systems, and the combination of OTEC systems with traditional power stations, using the bottoming cycle.

#### 9. Draught animal power

48. Bearing in mind that draught animal power is and may continue to be for a long time a major source of energy, particularly in the rural areas of certain developing countries, the following specific actions have been identified:

(a) Resource assessment and planning through:

(i) Collection of basic data on distribution of species, breeds, draught capabilities, the effect of energy on crop yields, agricultural implements, harnessing devices and existing draught animal power technologies;

(ii) Consideration of animal power as a basic energy input in agriculture planning.

(b) Research and development activities in the following areas:

(i) The design, development, testing and evaluation of agricultural implements, animal-drawn vehicles, harnesses and hitching devices;

(ii) Appropriate breeding schemes, draught animal feeding and management, fodder and improvement of pastures.

(c) In order to ensure more efficient application, where appropriate, measures should be taken to:

(i) Promote awareness of existing draught animal technologies and their contribution to agricultural and rural development;

(ii) Support on-going draught animal programmes in developing countries.

10. Peat

49. Bearing in mind that small- and large-scale peat technology is well in hand and has been tested for decades, is normally site-specific, and, in some cases, the only energy source, especially in remote areas, that it offers a viable alternative to scarce fuelwood for home cooking purposes in developing countries and can replace imported or limited sources of other fuels in generating heat or power in a number of countries, and that only partial surveys have been carried out, the following specific actions have been identified:

- (a) Expand the data base on the availability of peat in order to have a precise understanding of its potential;
- (b) Select suitable peat production areas, taking into consideration the location of potential consumers;
- (c) Develop and improve technologies for peat production, combustion and processing, including gasification and liquefaction processes;
- (d) Conduct studies on alternative uses of peat;
- (e) Strengthen and co-ordinate the handling of information on peat, including publishing of specialized and general material, and the organization of seminars, meetings etc.;
- (f) Undertake studies on the environmental impact of peat-land exploitation and its socio-economic effect;
- (g) Promote measures designed to encourage the use of peat briquettes in households as a replacement for fuelwood and charcoal;
- (h) Provide technical and financial assistance to countries for the exploitation of their peat resources.

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