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PREPARATIONS AT THE REGIONAL LEVEL

Comprehensive reports on the activities of the regional commissions

Addendum

Report submitted by the Economic and Social Commission for Asia and the Pacific (ESCAP)*

* Report has been reproduced as received.

A. FUNCTIONS OF ESCAP

1. In general, the function of ESCAP is to play its role under the authority of the General Assembly and the Economic and Social Council as the main general economic and social development centre within the United Nations system for its region, having due regard to the responsibilities of the specialized agencies and other United Nations bodies in specific sectoral fields and the co-ordinating role of the United Nations Development Programme in respect of technical co-operation activities. In normal practice, ESCAP undertakes only regional projects, i.e. projects endorsed by at least three or four member Governments.

B. PAST AND CURRENT ACTIVITIES IN THE ENERGY FIELD

2. Energy is one of the main fields of ESCAP and was declared by the Commission at its thirtieth session, held in March-April 1974, as one of the priority areas for urgent action. At the thirty-second session in March-April 1976, integrated rural development was declared another priority area.

3. After the first major oil price rise in the last quarter of 1973, ESCAP convened the Intergovernmental Meeting on the Impact of the Current Energy Crisis on the Economy of the ESCAP Region in February-March 1974, which gave 10 points of view for consideration. Subsequently, based on those views, ESCAP revised its programme of work in the energy field comprising mainly: (a) energy planning and management, which aims at formulating national co-ordinated plans for the investigation, development and management of energy; (b) the development of alternative or non-conventional energy, with an emphasis on their uses in rural areas; and (c) the development of electricity supply, which is the continuation of the programme undertaken since 1951. As these three components are closely related activities pertaining to them have been carried out in complement to each other since 1975.

4. With regard to energy planning, a proposal for a regional programme on the co-ordinated investigation, development and management of energy resources was prepared and submitted to UNDP, which gave its approval in principle; the project document was also endorsed by 11 countries. However, owing to the financial constraints of UNDP the project was not carried out. Subsequently, the Working Group Meeting on Energy Planning and Programming was held in 1978 and the Working Group Meeting on Efficiency and Conservation in the Use of Energy was held in 1979. Late in 1979 a mission visited some countries of the region with a view to preparing a new regional energy programme. The programme has been formulated and revised by ESCAP and its approval by UNDP is awaited. In June 1980 the Working Group Meeting on Energy in the South Pacific was held and a Pacific energy programme was drawn up on the basis of the views of that meeting. Approval of that programme by UNDP is also awaited.

5. With regard to electricity supply, several activities have been undertaken from 1951 onwards. Since 1974, two studies have been published, namely National Power Grids and Extra-high-voltage Systems in the ESCAP Region, 1/ and Peak-load

1/ United Nations publication, Sales No. E.75.II.F.13.

Coverage with Particular Reference to Gas Turbines and Hydroelectric Plants. 2/ A study on optimization of the utilization of electricity-generating plants is nearly completed and printed copies will be available in 1981. Two seminars and study tours were held, one on urban electrification in Japan in 1977 and the other on rural electrification in the Union of Soviet Socialist Republics in 1979. In addition, the recurrent publication Electric Power in Asia and the Pacific, which has been issued since 1951, has continued.

C. PAST AND CURRENT ACTIVITIES IN THE FIELD OF NEW AND RENEWABLE SOURCES OF ENERGY

6. ESCAP has undertaken various activities concerning the development of new and renewable sources of energy. These include:

(a) Two Workshops on Biogas Technology and Utilization, one held at New Delhi and the other at Manila, both in 1975;

(b) Expert Working Group on the Use of Solar and Wind Energy, held at Bangkok in 1976;

(c) Workshop on Biogas and Other Rural Energy Resources, particularly for Pacific island countries, held at Suva in 1977;

(d) Roving Seminar on Rural Energy Development, held in Indonesia, Iran, the Philippines and Thailand, also in 1977;

(e) Expert Group Meeting on Biogas Development, held at Bangkok in 1978;

(f) Seminar-Workshop on the Exchange of Experiences and Technology Transfer on Mini Hydro Electric Generation Units, held at Kathmandu in 1979 in co-operation with the Regional Centre for Technology Transfer (RCTT) and UNIDO;

(g) Workshop on Energy Statistics, Karachi, 1980;

(h) Intergovernmental Meeting on Agro-Industries, with Emphasis on production of Energy and New Resources, held at Tokyo in 1980;

(i) Seminar on Geothermal Energy, held at Rotorua and Auckland in 1980;

(j) Symposium on Solar Science and Technology organized by RCTT at Bangkok in 1980;

(k) Regional Preparatory Meeting for the United Nations Conference on New and Renewable Sources of Energy, held at Bangkok in 1980;

2/ United Nations publication, Sales No. E.77.II.F.19.

(1) ESCAP/FAO/UNEP Expert Group Meeting on Fuelwood and Charcoal, to be held at Bangkok in January 1981.

A seminar on the planning, management and economics of energy for rural areas is scheduled to be held at Bangkok in December 1981.

7. ESCAP has compiled a guidebook on biogas development printed copies of which are expected early in 1981. It has also compiled and distributed lists of organizations concerned with research and development in solar energy, wind energy and biogas. Within the framework of TCDC and ECDC, directories for the ESCAP region on solar energy were compiled for distribution and will be followed by directories on wind energy, biogas, and mini-hydro electricity.

8. At the Working Group Meeting on Energy Planning and Programming and the Working Group Meeting on Efficiency and Conservation in the Use of Energy referred to earlier, the importance of the development of non-conventional energy was also stressed. In view of the past activities of ESCAP in the non-conventional energy field, the ESCAP Committee on Natural Resources, at its fifth session in 1978, and the Commission at its thirty-sixth session in 1979 had expressed their views in favour of holding a regional preparatory meeting, the outcome of which would be a regional input into the United Nations Conference on New and Renewable Sources of Energy.

9. The conclusions and recommendations of previous ESCAP meetings in the field of new and renewable sources of energy, arranged with respect to each source of energy, are contained in annexes I-VII. The outcome of the Regional Preparatory Meeting for the United Nations Conference on New and Renewable Sources of Energy and the ESCAP/FAO/UNEP Expert Group Meeting on Fuelwood and Charcoal will be presented separately in regional papers.

D. PROPOSALS OF FUTURE ACTIVITIES (1982-1983) IN THE FIELD OF NEW AND RENEWABLE SOURCES OF ENERGY

10. The proposed programme of work on energy resources for 1982-1983 is derived largely from the recommendations made at the Working Group Meeting on Efficiency and Conservation in the Use of Energy held in 1979. The programme is tentative and may be modified depending on the outcome of:

(a) The special energy programme undertaken by the secretariat in 1980;

(b) The session of the Committee on Development Planning to be held in March 1981, at which energy will be a main theme;

(c) The thirty-seventh session of the Commission in March 1981, at which energy is to be a main subject;

(d) The UNDP regional energy development programme, when finalized and approved;

(e) The Pacific regional energy programme recommended by the Working Group Meeting on Energy in the South Pacific held in 1980, which is expected to be finalized in 1981;

(f) The United Nations Conference on New and Renewable Sources of Energy scheduled for August 1981 at Nairobi.

11. The following are activities related to new and renewable sources of energy, proposed for action in 1982-1983: (a) modifications of motor vehicles required for the use of alternative sources of energy (LPG, NPG, power alcohol); (b) the use of alternatives to diesel engines in water pumping for agricultural purposes; (c) the supply and use of energy in rural areas (utilizing as much as possible the energy resources, material and labour available locally); (d) co-operation in research on and development of energy supply and use in rural areas; (e) design of high-efficiency kerosene stoves and firewood stoves; (f) research and development on bullock carts and other animal-drawn vehicles; (g) research and development on mini- and micro-hydroelectricity, and (h) study on an appropriate mix of conventional and non-conventional energy supplies for rural areas.

E. PROVISION OF ASSISTANCE TO DEVELOPING COUNTRIES OF THE REGION IN PREPARATION FOR THE CONFERENCE, INCLUDING TECHNICAL ASSISTANCE

12. ESCAP distributed to member countries of the region copies of two letters from the Conference secretariat, one concerning the establishment of national focal points and the other relating to the preparation of national papers, requesting the countries to take urgent action in these matters and inform the Conference secretariat accordingly.

13. Furthermore, ESCAP intended to send a regional adviser and a consultant to visit developing countries of the region with a view to: (a) urging the countries to establish focal points for the Conference; (b) helping the countries in the preparation of their national papers if the Governments intended to present such papers; (c) persuading the countries to attend the Conference at Nairobi in August 1981; (d) rendering technical advice to the countries as far as possible; and (e) obtaining replies to the ESCAP questionnaire sent for the preparation of the Regional Preparatory Meeting for the United Nations Conference on New and Renewable Sources of Energy.

14. The services of a regional adviser were obtained in October 1980. For the first round of his visits to developing countries of the region, seven countries were approached. Two countries did not need his visits and another country proposed the postponement of his visit. Accordingly he visited the following four countries or areas in November 1980: Hong Kong, the Philippines, the Republic of Korea and Singapore. In the meantime, UNDP resident representatives of the remaining developing countries of the region were contacted with the request that they determine whether Governments desired to receive the visits of the ESCAP regional adviser and consultant. By December 1980, the services of a consultant had been obtained. It was planned that the next rounds of visits by the regional adviser and the consultant would begin in February 1981.

Annex I

CONCLUSIONS AND RECOMMENDATIONS OF ESCAP MEETINGS ON SOLAR ENERGY

A. EXPERT WORKING GROUP ON THE USE OF SOLAR AND WIND ENERGY, MARCH 1976, BANGKOK

1. Surveys of energy availability and requirements should be carried out in representative rural communities in the countries of the region. Available data should be published.

2. A handbook of solar radiation data should be compiled for the region, based on available records. The data should be specific to solar energy utilization, including conversion factors for optimum tilted surfaces, solar positions, frequency analysis etc.

3. A handbook of data to assist thermal design of houses and heating and cooling systems should be compiled.

4. The networks of solar radiation stations in countries of the region should be strengthened, using the standards laid down by WMO.

5. To assist collaborative efforts in that field, exchange of information and personnel and the planning of non-conventional energy programmes, ESCAP should publish a regional directory of personnel, institutions, research programmes and commercially available hardware. That directory should contain references to directories available for other parts of the world and also the literature on energy bibliographies. Updating supplements should be provided biennially.

6. In view of the needs and socio-economic priorities, as well as the current state of solar technology and trends for the future, work on research, development and demonstration for and by the developing countries of the region should preferably be grouped according to the following priorities:

Priority I: Crop drying, water pumping, small-scale electricity generation, solar-assisted biogas generators

Priority II: Distillation, water-heaters, passive heating systems, passive cooling systems

Priority III: Refrigeration, cooking, active heating systems, active cooling systems.

7. The specific research and development work required in each of those areas as well as the demonstration/developmental trials required for promoting immediate applications are stated below:

(a) Demonstration trials were required in the following priority areas to promote immediate application of available solar technology within the region:

(i) Solar convective driers for grains in multiple-cropping systems and for cash crops;

(ii) Solar water-heating systems for community uses, such as health centres, tourist hotels, hostels, cottage industries and heating of biogas plants in rural areas;

(b) Evaluation trials were required in the following to introduce and test the viability of solar technology available outside the region for priority needs within the region:

(i) Solar thermal pumps of 1 kW size;

(ii) Solar thermal power stations of 20 to 100 kW size for electrification at village level.

The chosen sites should not only be suitable climatically but should represent the possibility of economically and environmentally satisfactory solutions.

(c) Research and development were required prior to application of potentially available technology for the following:

(i) Autonomous drying systems;

(ii) Solar pumping system for 1 hectare size farms, primarily based on flat-plate collectors and stationary concentrators;

(iii) Systems and components for 100 W-2 kW small-scale power, using direct photovoltaic conversion;

(iv) Development of criteria for socio-economic viability and relevance of specific uses of solar energy;

(v) Multiple-use and architecturally integrated solar water-heating systems;

(vi) Reduction of maintenance and operational problems of solar stills;

(vii) Integration of optimized building design with passive heating/cooling systems in buildings;

(viii) Economic viability of solar refrigeration for proven needs of ice or cold storage in rural areas;

(ix) Reliable cookers which could be used indoors and would not need continuous attention;

(x) Inexpensive thermal storage in greenhouses:

(xi) Use of bittern from salt farms for solar ponds.

8. Countries of the region in the initial stages of solar energy research work should be assisted with the provision of training fellowships, seminars, workshops and advisory services.

9. The Group recommended that ESCAP should take an immediate lead in organizing short-term courses in the region on the application of solar-energy devices for domestic and commercial buildings and for agricultural and industrial uses.

10. The Group recommended that countries should produce attractive and well-illustrated material on the basics and applications of solar energy, for secondary schools. That would probably be the best way to create intelligent awareness as well as provide future sources of trained personnel for solar energy work.

B. WORKSHOP ON BIOGAS AND OTHER RURAL ENERGY RESOURCES, JUNE-JULY 1977, FIJI

1. In selecting solar devices for installation in islands, it was strongly recommended that designs of such devices, suitable for manufacture by local labour, should be developed. That was considered preferable to using fully imported systems.

2. It was suggested that the possibilities of the use of simple solar water heaters, such as the black plastic water-bubble type or water-filled type, should be investigated.

3. A great interest was shown in the use of solar energy for drying agricultural crops. It was recommended that the report of the Brace Research Institute on "a survey of solar agricultural driers" should be used as reference.

4. General interest was expressed in the solar timber kiln and it was desirable that further investigation should be made with a view to putting it into use in the Pacific Island countries.

C. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, JULY-AUGUST 1977, BANGKOK

1. ESCAP should consider the possibility of making available, from time to time, experts in solar energy to advise local specialists.

2. ESCAP should review the activities of the various countries in research and development in solar energy and disseminate relevant information to those organizations concerned, especially in the form of a newsletter published quarterly. It should also assist in co-ordinating the activities among the countries.

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3. The possibility should be considered of setting up a prototype energy unit in a typical village, with provision for training of operators.

4. Action should be taken to publicize and promote the use of solar energy provided the prototype project was successful.

5. Training courses should be promoted in Thailand and abroad for designers and research personnel in solar energy.

6. Regular meetings should be arranged of people working on solar energy in Thailand.

D. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, AUGUST-SEPTEMBER 1977, MANILA

An adequate monitoring network should be established to provide basic information on solar insolation and other climatological information.

E. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, SEPTEMBER 1977, TEHERAN

1. Incentives should be provided to promote the utilization of solar energy particularly low-temperature applications such as water heating, desalination and crop drying.

2. Universities should investigate the possibilities of using old energy technologies which could be viably rejuvenated with the current technology, for example, the natural ventilation system of wind towers.

3. Local materials and local know-how should be incorporated in the planning construction and installation of solar energy systems.

F. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, OCTOBER 1977, JAKARTA

1. Although Indonesia was gifted with abundant sunshine, which was extensively used in agriculture and natural drying of products, it seemed that the technical applications were currently limited to solar distillation and drying.

2. Noting the difficulty in supplying drinking water to many remote areas, a large potential for solar distillation existed. It was strongly recommended that the development of simple solar distillation modules should be initiated.

3. The potential for a combination of salt making and solar distillation in coastal areas should be investigated.

4. The development of economical solar timber dryers should be further encouraged.

G. ESCAP COMMITTEE ON NATURAL RESOURCES, FIFTH SESSION, 1978, BANGKOK

The Committee agreed that there should be special emphasis on the use of solar energy as a source of low-grade heat, and identified areas of concern.

H. SYMPOSIUM ON SOLAR SCIENCE AND TECHNOLOGY, NOVEMBER-DECEMBER 1980, BANGKOK

Recommendations of the technology groups

(a) Drying

1. There should be close interaction among scientists and technologists working in that area in different countries of the ESCAP region.

2. A mechanism should be established for promoting such interaction.

3. Information should be collected and on that basis specific programmes of mutual interest should be evolved. Working arrangements should then be evolved for carrying out the programmes. ESCAP/RCTT could take initiatives in that regard.

4. Technology centres should be established as key institutions for the purpose of exchange of information, building of prototypes and evolving standards.

5. Regional co-operation should be promoted for the exchange of scientists, the organization of workshops or symposiums and the implementing of educational programmes.

(b) Heating

1. The Group felt that its recommendations on that aspect were not all new as a number of them had already been made at earlier meetings on the subject. It was therefore anxious to see the countries and the United Nations take urgent action on those recommendations.

2. ESCAP/RCTT was requested to take the initiative in producing a "handbook of best practice" for solar flat-plate collectors, giving designs, construction details, etc., and to issue the handbook at an early date.

(c) Cooling

1. Courses in solar cooling should be conducted once every two years in the region, commencing perhaps with one at the Asian Institute of Technology (AIT), which already had the administrative structure for organizing such a course.

2. RCTT, using the facilities available in the Renewable Energy Resources Information Centre of AIT, might provide information to scientists. Preferably, existing publications in countries in the region should be used.

3. A panel of the workers in the region on solar cooling should be formed which would be a source of information of what was happening in the various countries, a means of dispensing information from ESCAP and RCTT to workers in the countries, and also serve as liaison between workers.

(d) Pumping

1. Concerned Governments should play a positive major role by heavily subsidizing and creating large markets to give encouragement to the manufacture and marketing concerns, giving tax reliefs, making heavy purchases, etc.

2. Comprehensive market research should be conducted in each country for the benefit of all concerned, namely, industrialists, agriculturists, technologists and general consumers, so that the economies of the product might be controlled to bring the prices to a reasonable level.

3. The technology of fabrication of each component and the whole unit from the point of view of actual mass production should be developed as a special part of the series of stages following that of R and D (product development stage, demonstration projects, evaluation, actual field trials and manufacturing), before it was set for an assembly line. Generally no expertise existed for that purpose in the developing countries and it was strongly recommended that such expertise should be generated on a crash programme basis.

4. Water lifting pumps should be used with discretion so that the hydrological balance of the location was not disturbed.

(e) Cooking

1. Promotion of the use of solar cookers in the ESCAP region required a carefully thought-out plan and its implementation. The plan was as follows:

(a) Select three regions based on differences in available fuels and climatic conditions;

(b) Select three or four types of cooker designs suitable to such climatic conditions;

(c) Undertake a major joint effort of laboratory testing, field demonstration and operation of at least one cooker design in each of the selected countries; at least 50 to 100 items of the selected design should be demonstrated at each field site. The field demonstration must be preceded by an evaluation of local needs and available resources and followed by extensive user instruction and education;

(d) Efforts must be continued in the evaluation of cooker performance and its acceptance in order to improve the design, economics, social acceptance and performance. The whole programme must be designed to respond quickly to obtain feedback.

2. In areas of technology transfer, local organizations such as agricultural and technological committees, women's affairs training centres and village-sponsored committees, youth groups and educational institutions should be utilized as the media for transferring technology to the users.

3. The Government should give incentives to promote the sale of cookers.

4. R and D must be more positively linked to manufacturing and dissemination of currently available solar cooker technologies.

5. Regional co-operation was indicated in the field of information, sharing of experiences, exchange of prototype and organization of academic and manual training.

Recommendations of the science groups

1. Photothermal conversion

Low-temperature applications (25°-100°C)

(a) Drying

1. Thermal performances of various solar air heaters should be studied, evaluated and compared.

2. Studies should be made on the drying characteristics of the various grains and other products with respect to drying temperatures and air flow rates.

3. Field tests of prototype models and systems should be conducted and their performances should be evaluated.

4. Efficiency and durability tests for local materials used in the construction of solar dryers should be made.

(b) Water heating

1. National centres should be established for testing solar collectors and developing and improving national standards and testing procedures.

2. National efforts were required to develop inexpensive, efficient and durable material such as covers, absorber plates, insulation, housing, surface coating and associated systems hardware.

Medium-temperature applications (100°-350°C)

(a) Cooling and refrigeration

1. Basic research into cooling cycles and associated hardware and research to reduce the cost of those systems should be conducted.

2. Further development should be undertaken and intensified work should be done in the field of ice making, especially for rural application.

3. Research should be undertaken towards the development of collectors that could handle directly refrigerants like ammonia.

(b) Thermal power generation and pumping

1. Basic research into prime movers, cycles and hardware was required.

2. Efforts should be made towards developing more cost-effective collectors for thermal processes and special attention should be paid to research on medium-temperature collectors (e.g. materials, design performance, standards, etc.)

(c) Cooking

1. Appropriate designs and sizes should be developed according to the specific requirements of individual families in order to minimize cost.

2. Standards for evaluating the performance of different solar cookers should be considered.

3. Research and development leading to solar cooker designs, using indigenous raw materials with potential for village manufacture, should be encouraged.

4. An intensive demonstration programme to assess the acceptability of particular solar cookers should be carried out in selected areas.

(d) Distillation

Research work should be carried out in other systems, such as flash distillation and freeze distillation, which would require the use of higher temperature and higher efficiency collectors, such as those used for refrigeration and steam production.

(e) Solar pond

More research and development should be undertaken into the suitability of solar ponds for rural applications in the region, specifically in relation to control and operating conditions.

General recommendations

1. In all of the above solar thermal applications, long-term performance and durability tests should be made.

2. In the case of solar water heaters, because of possible fouling and corrosion, water chemistry should be considered.

3. As the current costs of most solar devices were prohibitive, serious efforts should be made to optimize cost-effectiveness.

4. Efforts should be made to develop medium-temperature collectors, giving special attention to heat transfer processes and problems.

5. Solar devices, like conventional devices, needed to be properly maintained, and problems regarding maintenance in the region should be discussed at regional conferences.

6. Since most solar devices (e.g. water heaters) were usually integrated with some other systems, integrated performance tests should be made. The role of instrumentation, control devices and control systems in integrated performance was crucial and work in that area was important.

7. In order to maximize the efficiency of solar devices, transient effects should be studied.

8. There was a need for research to develop more efficient, durable and cost-effective materials.

9. Meteorological data were necessary and required and should be presented in standard (SI) units (i.e. solar radiation data at hourly intervals, dry bulb and wet bulb temperatures, wind velocity, humidity and sunshine hours).

10. There was a need for solar energy availability and wind speed pattern models for different parts of the region.

Conclusions

1. A directory identifying solar energy programmes and research personnel in the various institutions should be published.

2. Appropriate institutions should be identified and funds granted to encourage and increase in-depth research.

3. Steps should be undertaken to:

(a) Co-ordinate, promote and oversee demonstration programmes following the successful research in the above areas;

(b) Organize courses to train academic personnel who, on their return to their respective countries, could conduct similar national courses to train their own personnel;

(c) Organize technical and scientific seminars and workshops to enable researchers to meet and exchange experiences and results;

(d) Establish national focal points (individual or institutional) in the various countries for regional contacts;

(e) Formulate appropriate standards for the installation and testing of solar devices.

4. The group recommended the formation of a suitable agency or a unit in an organization already in existence (e.g. ESCAP, RCTT, UNESCO) to implement the above recommendations.

2. Photoelectroconversion

1. A number of demonstrations and field trials of solar photovoltaic systems (SPS) should be arranged and field evaluation should be made.

2. Particular emphasis should be given to the development of balance of system (BOS) components locally in each country since those constituted an important fraction of the over-all cost of SPS.

3. Priority should be given to developing locally the high-efficiency pump-motors, especially the DC units.

4. A programme should be undertaken by the Governments to install SPS for power applications in remote areas, which would lead to considerable experience in the design and development of SPS.

5. Attempts to build up photovoltaic capability should start with the fabrication of single crystal silicon solar cells. Those facilities were currently available in China, Japan and India.

6. A good mechanism should be developed for exchange of scientific information, documentation and personnel.

7. An annual conference/workshop on "photoelectric solar energy conversion" dealing with all aspects of materials, devices, systems and demonstrations, might be held in the region, as was being done in the EEC area in Europe.

8. Co-operation with developed countries, in some form or other, might be necessary.

3. Photosynthetic conversion

The following action was recommended for the promotion of photosynthetics:

1. Investigation of available plant materials.

2. Investigation of available information and applicable technologies.

3. Investigation of materials for construction.

4. Dissemination of relevant information.

5. Improvement of efficiency (and working conditions, e.g. of biogas; also production at lower temperature).

6. Pyrolysis (including the characteristics of the products and materials used).

7. Rotating meetings on photosynthetics.

8. Workshops (tours) for the training of skills.

9. Policies for the use of photosynthetics, R and D and dissemination.

10. Scientific R and D on improvement of efficiency in photosynthetic-conversion (at present known to be at a maximum of 2 per cent, but could theoretically reach up to 10 per cent).

11. Scientific R and D on fuel trees (through botanists).

4. Storage of thermal energy

1. R and D efforts were necessary to study the effective utility of solar thermal systems particularly from the viewpoint of cost-effectiveness.

2. The research in electrochemical aspects of the materials for the storage batteries and for thermal storage should be intensified.

3. R and D efforts were required to make the water storing system cost effective.

4. For storing energy at temperature (above 250°C), a packed bed like oil and pebble system could be used effectively. Considerable R and D efforts were required on pebble size, compatibility of the pebble quality with the oil, optimization of storage size and insulation and degradation of oil; those appeared to be some of the problem areas.

5. Suitable hydrated salts which could store the heat in the temperature range of 40-60°C were to be selected, and detailed properties like phase separati supercooling nucleation, rate of crystallization and cycling were to be studied.

6. The phase change material (PCM) storage systems working around 350°C would be suitable for solar thermal power generation applications.

7. Solar pond was a potential thermal energy collector-cum-storage system. Research and development work for its efficient performance, maintenance of stability, and optimization of its size had to be undertaken.

8. Properties of combinations of eutectic salts should be studied in depth for their application in solar cookers and also power generation.

9. A well co-ordinated R and D programme in storage with international support should be undertaken. An internationally recognized organization should be identified and entrusted with the lead responsibility of studying the storage systems.

Annex II

CONCLUSIONS AND RECOMMENDATIONS OF ESCAP MEETINGS ON WIND ENERGY

A. EXPERT WORKING GROUP ON THE USE OF SOLAR AND WIND ENERGY, MARCH 1976, BANGKOK

1. A systematic survey of existing wind velocity data in the region should be made with a view to its use for standard wind energy analysis.

2. A variety of simple cheap anemometers should be developed and produced within the region.

3. Standard methodology should be developed for the analysis and extrapolation of incomplete wind speed data.

4. A detailed classification of the performance and construction characteristics of all wind rotors should be compiled in order to facilitate and optimize the design of properly matched wind-powered systems.

5. A detailed survey of component characteristics should be undertaken on an international scale in order to provide an illustrated "catalogue" of proven components which could be used in the design of new hybrid wind-powered systems.

6. A detailed classification of the performance and construction of all water pumping devices between 0.1 and 10 kW should be compiled in order to facilitate and optimize the design of properly matched wind-power pumping systems.

7. A guidebook on windmill design processes should be compiled and made available to development workers.

8. Efforts should be made to encourage research, development and training in universities, technical colleges and research institutes, including fellowships, development of courses and text material.

9. Efforts should be made to stimulate immediate utilization of proven wind-energy technology via existing industry and non-governmental organizations, rural development and extension services.

10. Efforts should be made to stimulate commercial and industrial involvement in production and promotion of wind-energy utilization devices.

11. Expert engineering advice should be made available for optimization of water pumping and electric generating windmills currently available in the region.

12. Socio-economic considerations should be further studied where local labour and renewable materials might be freely available.

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13. Continuing research and development outside the region should be monitored by ESCAP and information on relevant developments disseminated to appropriate organizations in the region for regional adaptation. That might take the form of a regional wind-energy documentation centre.

14. ESCAP should follow up the Expert Group Meeting by further expert technical meetings to report and evaluate current progress in the field.

15. An effort should be made to ensure that the wind energy section in the proposed regional technology transfer centre was adequate for the needs of the region.

16. ESCAP should encourage and co-ordinate the setting up of field demonstrations of wind-energy utilization devices in the region.

Highest priority should be given to recommendation 16, which implied that work related to some of the other recommendations would have been initiated.

B. WORKSHOP ON BIOGAS AND OTHER RURAL ENERGY RESOURCES, JUNE-JULY 1977, FIJI

1. It was generally agreed that for Pacific Island countries the main applications of wind energy would be for electricity generation and for pumping of water.

2. It was considered that windmills of simple design utilizing available local material should be adapted for villages. In that respect reliable wind data should be collected, with the use of a low-cost anemometer, and careful consideration should be given, in the course of the design, to the over-all condition of location, local skill, reliability in operation and safety. The prototype unit should be fully tested before the design was introduced to villages.

C. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, JULY-AUGUST 1977, BANGKOK

1. ESCAP should consider the possibility of making available, from time to time, experts in wind energy to advise local specialists.

2. Action should be taken to publicize and promote the use of wind energy, provided the prototype project proved successful.

3. Meteorological stations in Thailand should be encouraged to expand their installations of wind-measuring equipment and to record the data in a form appropriate for windmill design.

D. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, AUGUST-SEPTEMBER 1977, MANILA

1. An adequate monitoring network should be established to provide basic information on prevailing wind velocities.

2. The dearth to activity in the Philippines on research, development and utilization of wind energy was noted. Considering the many sites where wind speeds could be used for water pumps and low-power electricity, wind energy conservation work should be vigorously initiated and pursued.

E. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, SEPTEMBER 1977, TEHERAN

1. The possibilities of using locally made windmills for water pumping and low-power electricity in various regions should be investigated.

2. Universities should be encouraged to develop simple and reliable windmills, suitable for Iranian conditions.

F. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, OCTOBER 1977, JAKARTA

The possibilities for using windmills for water pumping or generating low-power electricity seemed attractive for some remote areas where wind potential existed. The development of simple and cheap windmills suitable for Indonesian conditions should be further encouraged.

Annex III

CONCLUSIONS AND RECOMMENDATIONS OF ESCAP MEETINGS ON BIOGAS

A. WORKSHOPS ON BIOGAS TECHNOLOGY AND UTILIZATION, JULY/AUGUST 1975, NEW DELHI AND OCTOBER 1975, MANILA

1. National programmes should be drafted in consonance with their relative needs and requirements and as part of an integrated rural development programme.

2. A national co-ordinating body might be set up and adequate financial assistance should be provided for the programme.

3. An information centre might be set up in one of the existing national bodies; demonstration plants, periodic meetings, workshops, symposia and visits to biogas centres might be arranged to promote biogas utilization at both national and regional levels.

4. Training courses might be developed, scholarships and fellowships offered, training manuals prepared and publications issued for technology transfer and dissemination of information concerning biogas.

5. At the regional level, a network might be established connecting national institutions concerned with biogas. The regional focal point could be one of the existing regional bodies or the regional technology transfer centre to be established by ESCAP.

6. Regional studies might be organized with a view to working out solutions to existing problems, for example, collection of dung, batch-type and continuous type plants, etc.

B. WORKSHOP ON BIOGAS TECHNOLOGY AND UTILIZATION, OCTOBER 1975, MANILA

1. Clearing-house for information on biogas

Aware of the fact that a considerable amount of knowledge on various aspects of biogas technology existed within the region and in the rest of the world but that it was not easily accessible to ESCAP member countries, and that new data and publications were continuously increasing the available pool of knowledge, the Workshop recommended that:

(a) Each member country should identify a representative local organization concerned with the country programme for the advancement of biogas technology;

(b) Project leaders of each country organization should be constituted into a Governing Council, having the power to co-opt other suitable personnel;

(c) A co-ordinating body should be established within ESCAP and be suitably staffed;

(d) A programme co-ordinator who would oversee the country programmes should be appointed by the Governing Council;

The terms of reference of the Governing Council would be:

(i) To establish a library of literature on biogas technology and related disciplines, with English translations wherever necessary, and to maintain an annotated world bibliography,

(ii) To prepare and distribute to member countries a regular newsletter on developments in biogas technology and related disciplines;

(iii) To monitor selected projects in various countries and to produce progress reports;

(iv) To make available suitably experienced persons to act as advisers;

(v) To contribute, in whatever other manner the Council deemed appropriate, towards the advancement of the objectives and intentions outlined above.

It was further recommended that, in addition to performing the functions of a clearing-house and co-ordinating centre of the regional information network, the proposed focal point to be set up in ESCAP should bring out a periodical newsletter which would transmit all relevant and useful information relative to developments in the field of biogas. In order to keep abreast of the latest information and developments taking place in that sphere in different countries, ESCAP might establish contact points nominated by the member countries.

2. Technical assistance services

In view of the fact that most countries had recognized the value and potential of the integrated biogas system and that some of them had taken action to set up biogas plants in their countries, there was an urgent need to provide them with sound technological advisory services in case their efforts ran into unanticipated difficulties and proved wasteful and costly for want of timely advice and technical support. Since the programme of biogas production was still at the embryonic stage, with a number of its technical, social and economic issues yet to be clearly sorted out, and the expertise available in that field was still meagre and limited, it was imperative that a technical and advisory service for that programme should be organized at the regional level and made available to member countries at their request.

It was therefore recommended that ESCAP should seek the financial assistance of UNDP to organize a technical advisory service at ESCAP headquarters to assist the countries, at their request, in:

(a) Formulating suitable policies and programmes;

(b) Setting up demonstration projects (with United Nations assistance);

(c) Sorting out the operational, maintenance, design and engineering problems of the plants and such other problems as might arise in the building up and implementation of an integrated farming system around the gas plant;

(d) Preparing national training programmes and holding workshops;

(e) Compiling bibliographies, manuals and guidelines for the field staff.

In the view of the Workshop, such a technical service would also serve as a follow-up mechanism to the work accomplished at the two Workshops which needed to be pursued in the field.

3. Special workshop for South Pacific countries

Recognizing the usefulness and value of the two workshops on biogas technology and utilization organized by ESCAP and the contribution that they had made to clarifying issues which were prerequisites for launching national programmes, the Workshop strongly urged ESCAP to obtain UNDP support to hold a third workshop for South Pacific island countries and territories which could not take full advantage of the New Delhi and Manila workshops and whose problems were very different from those of the other member countries. Suva in Fiji would be a possible venue for such a workshop.

4. Technical and financial support to pilot projects

Some of the countries of the region had decided to set up a few integrated biogas plants, but progress on those plants had not been encouraging, mainly because of constraints of organization, finance and know-how. It was strongly felt, therefore, that UNDP should be requested to extend special technical and financial assistance so that work on those projects might be started immediately and early confidence established in their local authorities and organizations to plan a larger number of such projects and implement them. The Workshop took note of two specific projects presented by the experts from the Cook Islands and the Philippines and, realizing their regional potential, requested that specific UNDP assistance be extended to them through ESCAP. The Workshop also agreed that similar projects of regional relevance, if proposed by other countries, should also receive United Nations support.

The Workshop was of the opinion that UNDP should extend financial support to the regional research projects to be sponsored by member countries, e.g. those identified by its three working groups, such as the installation and operation of neoprene digesters.

5. Support to research and demonstration projects

The Workshop noted with appreciation that, in some countries of the region, a few researchers (in government laboratories and universities) were single-handedly conducting innovative experiments to improve the scientific and engineering aspects of biogas plants and to determine the optimum conditions for maximum utilization of the integrated biogas and biomass system. However, those efforts were ad hoc in nature and had limited relevance to field conditions. Inadequate financial support and insufficient availability of technical personnel were two of the major constraints which limited their work. That area of research called for international support since it held rich promise for the future and could not only provide knowledge in the field of fuel supply to rural areas but also, through the application of the process of photosynthesis, break the total dependence on the costly petrochemical feed stock of fertilizer.

The Workshop recommended the implementation of projects by ESCAP in the interested developing countries, e.g. the projects presented by the experts from the Cook Islands and the Philippines which had a regional element and whose findings would be of benefit to other developing countries.

6. Information and assistance from other countries

The Workshop recognized the valuable research, design and development work in progress in a number of countries, such as Australia, China, India, Japan, the Republic of Korea, the USSR, the United Kingdom and the United States, and requested the ESCAP secretariat to collect and disseminate information on that work.

The Workshop was also of the opinion that it would be of great value to the development of biogas technology if China's experiences in the field of biogas could be made available to other ESCAP member countries. It therefore recommended that the ESCAP secretariat should approach the Government of China requesting assistance for interested countries of the region in regard to various technical and socio-economic aspects of the biogas industry.

C. WORKSHOP ON BIOGAS AND OTHER RURAL ENERGY RESOURCES, JULY 1977, FIJI

1. Reliable operational guidance material for the following purposes would be of special value to Pacific Island countries:

(a) The tolerable salinity and detergent content of water used in digesters and their effect on associated aquaculture;

(b) The production of algae and other protein sources as a feed supplement for livestock;

(c) The use of biogas for internal combustion engines and refrigerators.

2. Biogas plants offered a cost-effective utilization of waste material. Several designs were considered and neoprene bag digesters, fixed volume concrete digesters and floating gas cover digesters were found to have appropriate application. Further investigation of operating parameters was necessary. Evaluation should be done in consultation with the Institute of Natural Resources of the University of the South Pacific.

D. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, JULY-AUGUST 1977, BANGKOK

1. ESCAP should consider the possibility of making available, from time to time, experts in biogas to advise local specialists.

2. Action should be taken to publicize and promote the use of biogas, provided the prototype project proved successful.

3. Training courses should be promoted in Thailand and abroad for designers and research personnel in biogas.

4. Regular meetings should be arranged of people working on biogas in Thailand.

5. Appropriate incentives should be considered to promote the use of biogas plants, where they were appropriate in rural areas.

E. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, AUGUST-SEPTEMBER 1977, MANILA

1. There was an immediate need to standardize the many biogas plant designs existing in the Philippines in order to ensure reliable performance. Biogas production could be optimized and plants made simple and easier to operate if the sizes and components were standardized.

A committee should be constituted to study the different available designs and recommend those suitable for Philippines conditions.

Recognizing the possibility for improving designs and techniques, selected research and development work for biogas should also be identified by the committee.

2. With regard to the nation-wide dispersal of biogas systems, close co-ordination of the Energy Development Board (EDB) with other concerned agencies should take place in order to ensure effective coverage and use of government resources.

3. Incentives should be provided to relevant sectors in order to accelerate the dispersal of biogas plants. That had been the main reason for the success of the biogas programme in India, where the Government subsidized from 20 to 75 per cent of construction costs, depending on the social conditions in the area.

F. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, SEPTEMBER 1977, TEHERAN

In those places where sufficient cattle were available, efforts should be made to establish individual biogas plants by providing the necessary technical guidance to farmers.

G. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, OCTOBER 1977, JAKARTA

1. Noting the potentiality for the application of a biogas technology, it was recommended that the introduction of biogas plants in rural areas should be initiated on a priority basis.

2. Recognizing the possibility for developing designs of biogas plant it was recommended that research should be done on the most suitable designs for Indonesia.

3. Incentives in the form of technical assistance, subsidies and loans, or a combination thereof, might be provided to prospective owners of gas plant in order to accelerate the installation of biogas plants.

4. Establishment of biogas plants attached to community latrines might be given due consideration.

H. EXPERT GROUP MEETING ON BIOGAS DEVELOPMENT, JUNE 1978, BANGKOK

The Group agreed on a detailed outline for the guidebook on biogas which had been compiled and was to be issued by ESCAP. In addition, the Group made the following recommendation concerning the exchange of information:

1. In view of the increasing interest in biogas development in many countries, and the range of departments and other bodies often involved, it would be desirable to establish a focal point for biogas development in each country. Such a focal point could provide a single channel for information on any aspect of the subject for those interested in the country; provide a mechanism for liaison in research and development activities; and would be expected to have additional administrative and executive responsibilities depending on its structure and departmental location.

2. The Expert Group also emphasized the value of exchange of information between countries, and a mechanism was needed to establish that on a more systematic basis.

With regard to research and development, the Group made the following recommendation:

3. The basic objective should be to find ways of reducing the total cost and improving the cost-effectiveness (output in relation to cost), at the same time providing a simple and reliable system.

4. Since the guidebook would be encouraging the use of a variety of current types of biogas plants, and it was believed that there was considerable scope for higher performance with those plants, there was a need for research and development to optimize the performance. That was expected to include:

(a) Carefully monitored studies of the performance of such plants under typical field conditions in order to optimize output in relation to cost, through improved design and operation in relation to such matters as:

(i) Stirring;

(ii) Pattern of flow through digester;

(iii) Level of withdrawal of effluent;

(iv) Different input materials, density and composition;

(v) Temperature (including effect of heating input materials, and of using water jacket);

(vi) Retention time,

(vii) Pressure;

(viii) Effect of water quality;

(b) Development of devices to improve plant management, including:

(i) A device to monitor density of input materials;

(ii) A device to determine the proportion of volatile acids at various points in the digester.

5. For similar reasons more work was needed on alternative materials of construction to reduce costs, including maintenance costs. More data were needed on the use of ferro-cement for gasholders and digesters, and high density polyethylene for gasholders.

6. In the light of information on other design concepts, work should be pursued, preferably in representative environments in different parts of the regi on such concepts, including:

(a) Relatively small diameter, horizontal, plug-flow digesters;

(b) Vertical, up-flow "packed bed" digesters.

7. Having regard to the likelihood of an increase in the use of the fixed gasholder design, more information was needed on measures to regulate gas pressur

8. More data were needed on methods and results with various uses of effl as fertilizer, and the operation of demonstration and experimental systems should be encouraged to record results and make them available, preferably to the nation focal points referred to above.

9. More information was also needed on practical aquaculture, which might be obtained and disseminated by a similar process.

10. There was a great need for research on community biogas systems. That might include determining the socio-economic characteristics of sample communities, so that appropriate forms of management could be determined for the whole system, including distribution of gas and use of effluent from such plants. It could be expected that a variety of arrangements could be successful, depending on the nature and size of the community and its administration. Schemes should be tried, and results carefully documented and disseminated.

11. As mentioned in recommendations 1 and 2 above, liaison and information exchange systems should be strengthened within and between countries, so that research and development were co-operative as far as possible.

Annex IV

CONCLUSIONS AND RECOMMENDATIONS OF ESCAP MEETINGS ON HYDROELECTRICITY

A. WORKSHOP ON BIOGAS AND OTHER RURAL ENERGY RESOURCES, JUNE-JULY 1977, FIJI

It was suggested that an investigation should be made in order to install isolated mini-hydro stations in villages where electricity supply was not available but hydro potential was available.

B. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, JULY-AUGUST 1977, BANGKOK

Small hydroelectric schemes approximately up to 100 kW should be promoted to serve remote and isolated villages in Thailand.

C. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, AUGUST-SEPTEMBER 1977, MANILA

The possibility of using small hydroplants to power isolated and remote rural areas, where such potential existed, should be given priority consideration.

D. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, SEPTEMBER 1977, TEHERAN

The use of small hydroplants to provide energy to isolated rural areas, where potential existed, should be given high priority.

E. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, OCTOBER 1977, JAKARTA

1. The use of mini-hydroplants and mini-geothermal plants to provide electricity to remote rural areas, where such potential existed, should be given high priority.

2. Isolated villages where mini-hydro and mini-geothermal potential did not exist might be electrified by means of small diesel plants. As soon as other more economical sources of energy became readily available those might be replaced.

F. SEMINAR/WORKSHOP ON THE EXCHANGE OF EXPERIENCES AND TECHNOLOGY TRANSFER ON MINI-HYDROELECTRIC GENERATION UNITS, SEPTEMBER 1979, KATHMANDU

1. Regional organizations should promote the formation of a regional network of information on mini-hydropower.

2. A newsletter should be published containing information on the plans and programmes, research and development work, design and manufacture of equipment and such other developments as were taking place in that important area of development.

3. A list of experts and institutions concerned with research and development in mini-hydropower plants should be compiled and published.

4. TCDC in the field of mini-hydropower should be promoted.

5. Governments of countries with mini-hydropower potential should take an active part in the establishment of the manufacturing industry and sponsor such industrial projects.

6. The Chinese as well as the Philippines approach to rural electrification might be studied by other developing countries for possible adaptation.

7. Governments should adopt standards and norms worked out by the international standardization organizations and see that those were implemented by central and local bodies.

Annex V

CONCLUSIONS AND RECOMMENDATIONS OF ESCAP MEETINGS ON BIOMASS

A. WORKSHOP ON BIOGAS AND OTHER RURAL ENERGY RESOURCES, JUNE-JULY 1977, FIJI

General interest was expressed in the coconut, wood and charcoal kilns and it was desirable that further investigation should be made with a view to putting such kilns into use in the Pacific Island countries.

B. ROVING SEMINAR ON RURAL ENERGY DEVELOPMENT, OCTOBER 1977, JAKARTA

1. Noting the increasing denudation of forest for agricultural and other purposes and the still extensive use of firewood for cooking purposes, the careful planning and management of fast-growing trees for firewood must be given high priority in rural energy planning.

2. Considering the low efficiency in conventional stoves, proper attention should be given to improving their efficiency.

3. Considering the tremendous amounts of waste wood in timber exploitation, it should be converted where possible to charcoal or other easily transportable forms.

4. Conversion of agricultural and wood waste by pyrolysis or anaerobic fermentation (biogas) to gaseous fuel should be encouraged, in addition to their direct use.

C. INTERGOVERNMENTAL MEETING ON AGRO-INDUSTRIES, WITH EMPHASIS ON THE PRODUCTION OF ENERGY AND NEW RESOURCES, OCTOBER 1980, TOKYO

1. The Meeting felt that the choice of ethanol production from biomass merited consideration on a priority basis. Ethanol was capable of fulfiling the energy needs for different categories of use in rural as well as urban areas. The consensus was that its products for substitution of petroleum products should receive highest priority.

2. The balance of advantage in the production of ethanol lay in favour of sugarcane. The productivity of sugarcane from farms could be increased by adopting known technologies and through assured prices and improved terms of trade to cane growers.

3. To investigate the possibility of encouraging growth of plants like Euphorbia Lathyris and trees like copifera which were capable of directly producing by photo-synthesis, hydro-carbons similar to diesel and which at present were found in a few countries only, the possibility of growing them in other areas and on a large scale would require careful consideration.

4. Each country had to examine its specific situation in terms of its energy needs and resources and had to make a careful choice of the feedstock, the conversion technology, the transportation methods and the utilization systems.

5. Programmes for raising the productivity of agro-products required for industry as well as for energy should receive due attention in ESCAP programmes.

6. A regional study should be commissioned as proposed by ESCAP, entitled "Production of alcohol from agro-products".

7. An information network system should be established for exchange of data, information and experiences of various countries in the production of energy and new resources, particularly ethanol from biomass.

8. The Meeting considered that it would be useful to organize an expert group meeting in which the specific country experience, technical, financial and economic data regarding the production of feedstock conversion costs and costs of the utilization systems could be discussed in detail.

9. The need for a special programme for the least developed countries in the region was recognized.

10. The programme should receive the support from the highest decision-making authority at the national level. The dispersed national efforts should be brought together by setting up a nodal point/agency in each country.

11. Five new activities were identified for inclusion in the programme of work and priorities under the heading "Development of liquid energy and new resources from agro-products" for consideration by the Commission at its thirty-seventh session.

Annex VI

RECOMMENDATIONS OF THE ESCAP SEMINAR ON GEOTHERMAL ENERGY OCTOBER-NOVEMBER 1980, ROTORUA AND AUCKLAND

1. A regional research centre on geothermal energy should be established.

2. Regional seminars and workshops should be organized on a regular basis.

3. Study tours and short courses on specific topics should be arranged.

4. Information should be collected and disseminated by ESCAP on geothermal energy. In that connexion, regional directories containing information on institutions concerned with research and development, experts and ongoing projects as well as a bibliography on geothermal energy should be compiled and distributed to member countries.

5. Advisory services should be made available to member countries.

6. Funds should be made available by Governments, financial agents or donor countries for exploration, research and development and constructional work of geothermal projects.

Annex VII

RECOMMENDATIONS OF THE ESCAP/IEA/EEC WORKSHOP ON ENERGY STATISTICS, OCTOBER 1980, KARACHI

1. The Workshop expressed the desire that the Statistics and Natural Resources Divisions of ESCAP should work in close collaboration on the development and analysis of energy statistics. It felt that co-ordination with regional and international organizations outside the United Nations system should also be fostered

2. The draft United Nations manual on energy statistics (STAT/WES/CRP.3) should be finalized and circulated as soon as feasible. The Workshop noted with appreciation that the United Nations Statistical Office would be prepared to make some minor extensions to the manual, particularly in the field of non-conventional energy sources, without delaying its publication.

3. The Workshop considered that a bulletin on energy statistics for Asia and the Pacific would be useful.

4. It was essential that the Natural Resources and Statistics Divisions of ESCAP should work together in order to be really effective in meeting the needs of, and disseminating information to countries of the region. Similarly, strong links would need to be maintained with other information systems within and outside the United Nations system.

5. The secretariat itself might review surveys on non-conventional energy sources already undertaken, focusing on data collected and methodologies used. The study could also include a comparative analysis of the data available.

6. Technical meetings might be more fruitful if they could be organized, where possible, on a subregional basis, i.e., for Asian and Pacific countries separately.

7. Training courses covering general or specific aspects of energy statistics could be tailored to impart basic or advanced knowledge of the subject matter and could be conducted at the regional, subregional or country level. Users as well as producers of energy statistics should be included among both the lecturers and trainees.

8. The provision of regional advisory services in energy statistics was endorsed by the Workshop.

9. The Workshop also urged the secretariat to promote the designation of energy statistics liaison officers in national Governments.
