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REPORT OF THE REGIONAL SEMINAR
ON SOLAR ENERGY IN AFRICA

Niamey, 8-13 January 1979

REPORT
OF THE REGIONAL SEMINAR ON SOLAR ENERGY IN AFRICA
Niamey (Republic of Niger), 8 - 13 January 1979

PART ONE

A. OPENING OF SEMINAR AND ATTENDANCE

Opening of the Seminar

1. The Regional Seminar on Solar Energy in Africa organized under the auspices of the United Nations Economic Commission for Africa was held at Niamey in the Republic of the Niger from 8 to 13 January 1979.
2. The Seminar was opened on 8 January 1979 by the Secretary-General of the Ministry for Foreign Affairs and Co-operation of the Niger. After welcoming participants, the Secretary-General listed the tasks assigned to the Seminar, as follows: defining the role of renewable energies in the economic and social development of the African countries; evaluating the results obtained; weighing the difficulties and analysing the obstacles to be overcome in research and development and in the industrial manufacture and diffusion of devices using solar, wind and bio-energy. The Seminar was called upon to formulate a strategy and tactics for the African continent and concrete proposals on which the Governments of African States were expected to give their views since they would have to implement them within their structures for regional and subregional co-operation.
3. The Secretary-General drew attention to the situation in the Niger, which, as a land-locked country where conditions favoured the use of solar energy and other renewable energy sources, had spared no effort and was still striving to promote the use of such energies for the benefit of the whole population. Where intra-African and international co-operation was concerned, the Office de l'énergie solaire (ONERSOL) was helping to train African specialists in solar energy by organizing post-graduate courses in solar technology and by accepting trainees from other African countries.
4. The representative of the Executive Secretary of the United Nations Economic Commission for Africa welcomed the participants and, on behalf of the Commission, thanked the Head of State, the members of the Government and the people of the Republic of the Niger for having agreed

to host and organize the Regional Seminar on Solar Energy. The Niger was also the site of ONERSOL, one of the most dynamic and enterprising research and development centres in Africa, which had been created with active assistance from ECA in co-operation with the Government of the Niger.

5. He reminded participants of resolution 113 (VI), which had been adopted at the sixth session of the Commission and related to solar energy and the setting up in conjunction with the subregional office of ECA for West Africa at Niamey, of a solar energy experimental centre to perfect the various prototypes of solar apparatus and to disseminate the results of experience. Ten years later the fact that the price of crude oil had quadrupled demonstrated the farsightedness of seeing how important energy problems would become. The decision recently taken by the countries members of OPEC to raise the price of petroleum substantially in 1979 strengthened the Commission in its conviction that there was need to develop the wave of interest in solar energy which had arisen in African countries within the framework of an imaginative policy of co-operation which would have the support of all African countries and of the international community. He also drew attention to the recommendations adopted at the second African Meeting on Energy held at Accra, Ghana, in November 1976, which outlined a medium-term programme of work for the use of renewable energy in Africa with special reference to solar energy and its derivatives.

6. As far as the present Seminar was concerned, the objective of ECA was to obtain suggestions from African research workers and specialists on the paths to be explored and on objectives towards which part of the human and financial resources made available to the Commission by African countries and other members of the international community could be channeled with a view to the rational exploitation of solar energy and its derivatives for the benefit of the African people. The immediate objectives of the Seminar were the following: under a co-ordinated global energy policy at the national, subregional and regional levels, to identify the role to be played by renewable forms of energy in general and by solar energy and its derivatives in particular in the economic and social development of African countries; to make an objective assessment of the results already obtained, the difficulties encountered and the obstacles to be overcome in research and development, in the design of prototypes and in the manufacture and diffusion of equipment using solar, wind and bio-methane energies; to outline new approaches conducive to the rapid promotion of the use of such forms of energy; to formulate a programme of priorities and a strategy for its implementation; if possible, to create a permanent structure for subregional and regional co-ordination and co-operation and to submit recommendations to the next ECA Conference of Ministers concerning practical action to be undertaken with a view to the rapid promotion of the use of renewable forms of energy in all States members of the Commission.

7. ECA was concerned to see that the exploitation of renewable energy sources was no longer confined to laboratory research and to demonstration devices, although they were undeniably of value, that considerable resources were allocated to applied research and to the transfer and adaptation of new technologies in the African context and, above all, that African States began to co-operate with one another since the pooling of financial resources and of technical and scientific expertise was absolutely essential to the large-scale exploitation of renewable energy sources and in particular of solar energy and its derivatives and of wind and bio-energy.

8. The Commission was therefore asking the participants to list the obstacles which might stand in a way of that project and to suggest realistic ways of surmounting them with a view to ensuring that Africa participated as actively as possible in the establishment of a fairer and more equitable world economic order and also because such an approach seemed to it to provide the only solution to the threat of economic suffocation hanging over those third world countries which did not produce petroleum. Thanks to its favourable geographic position, to the fact that its population was not very dense and to its determination to bring about collective self-reliance, Africa could benefit by exploiting renewable forms of energy intensively and rationally. A realistic and imaginative policy of regional co-operation could promote the integrated development of productive areas and might save African countries which did not produce petroleum from the economic suffocation which was almost inevitable if present trends continued owing to the financial burden of importing fossil fuels.

Attendance

9. The seminar was attended by representative of the following States: Algeria, Burundi, Cape Verde, Chad, Gabon, the Gambia, Guinea, Kenya, Madagascar, Malawi, the Niger, Nigeria, Sierra Leone, Senegal, Tunisia and the Upper Volta. It was also attended by a representative of the United Nations Development Programme (UNDP) and the United Nations Industrial Development Organization (UNIDO) and representatives of the United Nations Sahelian Office (UNSO), the Food and Agriculture Organization of the United Nations (FAO), the International Labour Office and the World Meteorological Organization (WMO). Representatives of the following Intergovernmental organizations attended as observers: The African and Mauritian Common Organization (OCAM), the European Economic Community (EEC), the Inter-African Committee for Hydraulic Studies (CIAH), the Inter-State Committee for Drought Control in the Sahel (CILSS), the Organization of Arab Petroleum-Exporting Countries (OAPEC), the River Niger Commission (CFN), the Union Africaine et Malgache des Postes et Télécommunications (UAMPT) and the West African Economic Community (CEAO).

Election of officers

10. The Seminar unanimously elected the representative of the Niger as Chairman, the representative of Algeria as first Vice-Chairman, the representative of Malawi as second Vice-Chairman and the representative of Chad as Rapporteur.

11. A drafting committee chaired by the Rapporteur and composed of the representatives of Tunisia, Kenya, Burundi and Sierra Leone was also appointed as was a recommendations committee chaired by the representative of Senegal and composed of the representatives of Nigeria, Madagascar and Tunisia.

B. AGENDA AND ORGANIZATION OF WORK

12. The seminar adopted the following agenda:

1. Opening of the Seminar
2. Election of officers
3. Adoption of the agenda and organization of work
4. Review of current and planned activities in the field of research into and practical applications of solar energy in the various areas of utilization in Africa and the difficulties encountered
5. Elaboration of a programme of priorities for ECA and of a strategy for the implementation of this programme
6. Consideration of specific measures for immediate implementation to carry out the programme and strategy
7. Establishment of a permanent co-ordination and co-operation framework at the subregional and regional level and consideration of the conditions under which it would operate
8. Presentation of scientific and/or technical communications by the participants
9. ECA training programme
10. Project on the promotion of the use of solar energy in Africa
11. Consideration and adoption of the recommendations of the Seminar

12. Other matters
13. Adoption of the report of the Seminar
14. Closure of the Seminar

13. It was decided to allow representatives of organizations invited to the Seminar in an observer capacity to deliver messages of a general nature to the Seminar under agenda item 3 if they so desired on the understanding that they would still be free to take the floor during the substantive part of the debate.

14. Speaking under that arrangement, the representative of CEAO outlined the work already done and the efforts under way at his organization to promote solar energy research and its application to development. The global development of industry, the growing importance of energy to development and the world energy crisis had led the Governments of many African countries, such as Mali, the Niger, Nigeria and Senegal, to allocate an increasing amount of funds to the application of new energies. Research workers in solar energy should be congratulated for their courage in having entered the field well in advance of the energy crisis and in spite of the material and psychological difficulties which advancement to the industrial phase of any new technology always posed. However, unless industrialization occurred, research would stagnate and markets might be inundated with solar devices manufactured outside Africa. It was for those and other reasons that CEAO, five of whose members were Sahelian countries and therefore particularly affected by the energy crisis, supported solar energy research and its application to development and had given it an important place in its three-year development programme. Past and future action included the organization in Bamako of the largest symposium on solar energy and development ever held in the subregion. Copies of the report of that symposium had been made available to participants in the present Seminar. In conclusion, the organization of a second symposium in the field of solar energy reconfirmed the usefulness of the CEAO programme, and his organization was ready to co-operate with ECA, other subregional bodies and financing agencies to promote a vigorous energy policy.

15. The representative of the United Nations Industrial Development Organization (UNIDO) read out a cable he had received from UNIDO expressing the keen interest of that organization in solar energy; the promotion of applied research and development and local fabrication of solar equipment, such as solar water heaters, grain dryers, solar pumps, water distillation units and solar cookers. UNIDO suggested that applied research should be carried out with respect to solar cooking and refrigeration and that the technology for photovoltaic cells and the production of electricity should be evaluated and expressed its

support for the UNIDO-ECA co-operative programme for strengthening existing research institutions with emphasis laid on technology assessment, local manufacture and popularization.

16. The representative of the Organization of Arab Petroleum-Exporting Countries (OAPEC) said his organization, whose membership included several African countries, was interested in the development of new energy sources because the new energies would eventually be of value to all countries and not only just to those with no fossil fuels. For that reason, OAPEC was especially grateful for having been invited to attend the Seminar.

Review of current and planned activities in the field of research into and practical applications of solar energy in the various areas of utilization in Africa and the difficulties encountered. / Agenda item (47)

17. In introducing document E/CN.14/NRD/E/18 containing a summary review of activities of accomplishments in use of solar energy in Africa, the representative of ECA explained that the document was intended to show where activities for the promotion of the use of solar, wind and biogas energy stood in the various African countries and how the information contained in it had been collected from sources both within and outside the United Nations. He further explained that the information in the document was by no means complete, in that it covered only 34 of the 49 countries members of ECA and that it had not always been possible to check the data with the research workers and specialists most familiar with it. The ECA secretariat hoped that the participants would provide it with additional information so that after the Seminar a more exhaustive document could be prepared. He drew attention especially to paragraph 251 in which action was proposed for the effective and rational exploitation of solar energy by African countries referring in particular to action concerning the promotion of local industries in the building, metal-working, glass-making, mechanical and electrical engineering and other sectors. If such action was not possible nationally, it might be possible at a multinational level and ECA would give urgent consideration to the matter if the participants in the Seminar felt that there was need to do so. Where inter-State co-operation was concerned, ECA had formulated some ideas as to the creation of a permanent co-ordinating structure in the field of solar energy and its derivatives and hoped that the Seminar would enable it to ascertain to what extent African Governments desired such co-ordination.

18. In commenting on the paper submitted by the ECA secretariat, the representative of Burundi said his Government had not yet carried out any R&D in connexion with solar, wind and bio-methane energy. It had, however, been in touch with ECA and the United Nations Secretariat in New York with a view to obtaining assistance in initiating such energy activities. Following the mission carried out in his country by the ECA Regional Adviser

in Solar Energy in March 1978 and the mission conducted by an energy expert at United Nations Headquarters, his Government had undertaken the following actions:

- (a) A national hydrometeorological centre had been established under the Ministry of Transport and Aeronautics, by grouping operations formerly conducted by a number of separate offices and ministries for the sake of efficiency;
- (b) A department of energy had been created within the Ministry of Public Works, Transportation and Housing dealing, inter-alia, with research and with cost/benefit comparison studies on various energy sources including a number of pilot projects;
- (c) A national energy commission to determine government energy policy had also been established.

19. In connexion with the Department of Energy and the Energy Commission, another ECA/UNDP mission would be necessary to make new recommendations and to identify the action which should be taken in the early stage of their operation. A report on that subject was being drafted by a UNDP expert in New York and would be available in the middle of January 1979. Since the Government of Burundi attached great importance to integrated rural development, the first action to be undertaken would probably be aimed at the implementation of pilot projects relating to the production of methane digesters; solar water pumps for use in rural areas and solar stills to provide rural dispensaries and schools with water.

20. The representative of the Gambia said that the development of the use of solar and wind energy was still at an early stage in his country, which as a primarily agricultural country, was particularly interested in the possibilities of using such energy for purposes of irrigation, food drying and preservation and cooking. In that connexion, he mentioned the recent creation of an organization to develop the Gambia River basin, where 24,000 hectares of land would be irrigated. New techniques in the development of solar pumps were thus of great interest to his Government. In implementing such programmes, his country had encountered a manpower problem and would be grateful for ECA's help in manpower and organization programmes and for co-operation, and especially advisory services with neighbouring countries.

21. The representative of Kenya said that one of the problems in the field of the development of the use of solar energy in his country was that most of the research was being carried out by individuals working in different departments of the University of Nairobi and there was no real co-ordination of the work they were doing. The Faculty of Engineering was working primarily on the application of solar energy in, for example, refrigeration and solar sudryers whereas the Physics

Department was concentrating on basic research. The Government had also launched some programmes and, under contract with the Federal Republic of Germany, was installing some demonstration solar cookers. In his view, it was no use having solar equipment if the properties of the material used in manufacturing that equipment were unknown. What Africa badly needed was help in carrying out its own basic research and apparatus for testing its own local material.

22. The representative of Madagascar said his Government was especially interested in the work of the present Seminar, particularly in connexion with the problems of irrigating the arid areas in the southern part of his country and the difficulties encountered in preserving perishable foodstuffs. He mentioned the establishment at Antananarivo on 5 January 1979 of a new energy company founded by the national electricity and water works, the national petroleum company and some members of the Faculty of Sciences of the University of Antananarivo. The new company would concern itself with all kinds of research and co-operation, especially in the use of renewable energies in the national effort to raise the standard of living of the working classes. He ended by saying that solar energy was one of the sectors in which constructive co-operation was envisaged with other African countries in general and with neighbouring countries in the Indian Ocean in particular.

23. The representative of Malawi said that in his country work was being carried out in the field of solar, bio and wind energy. In the field of wind energy, priority was given to water pumps in view of the importance of water in rural areas. Where biomass conversion was concerned, priority had been granted to settlement schemes and agricultural projects where there was a concentration of livestock. Solar water heating in houses was considered important, and the Government intended to approach UNIDO for assistance in that connexion. In addition, some work was being done with solar refrigeration and drying, but it had been borne in mind that solar equipment would remain expensive for sometime to come, especially in rural areas. Malawi's primary needs in developing the exploitation of solar energy and its derivatives were for the training of manpower, for which ECA assistance was very welcome, and for equipment for collecting solar data. He associated himself with the representative of Kenya as to the need for assistance in installing and testing equipment manufactures in Africa and for testing equipment from outside.

24. In speaking of the work done at ONERSOL, the solar energy organization of the Niger, the representative of the Niger pointed out that the document submitted to the participants by the ECA secretariat dated back to 1976 and hence was not entirely up to date. Since the time of its publication, ONERSOL had since embarked upon three main projects, one for the manufacture of solar engines to be used in irrigation pumps, one for the construction of a 50kw solar oven for use in the manufacture of ceramics

and cement and one for the installation of solar pumps in villages in the rural parts of the country. In connexion with training the delegation of the Niger mentioned that in 1978 post graduate courses had been held at Niamey during the Easter and the long university holidays and had been attended by about 10 students from other West African countries and Algeria. There were plans to hold the same courses again in 1980. The only reason why they were not being held in 1979 was that UNESCO, which was providing funds for student travel and honoraria for the teaching staff, had been unable to provide assistance covering that year. This delegation called on the other participants for suggestions as to ways of improving the courses.

25. He said he was curtailing his statement on purpose since on Friday, 12 January 1979 it was planned to visit the ONERSOL research laboratory and plant for the manufacture of solar devices and also to visit the solar pump at Bossey Bangou which had been installed to supply water to the inhabitants of the countryside and their livestock. Moreover, a recently published information leaflet describing ONERSOL's activities had been distributed to the participants and should make it possible to bring the basic document prepared by ECA up to date.

26. The representative of Nigeria said his Government regarded the Seminar as being carried out in implementation of a decision taken at the second African Meeting on Energy held in Accra in 1976. Nigeria was honoured to be associated with the work of the Seminar since energy was essential to the national economy and standard of living of all countries. To avoid dependence on fossil fuels, the developed countries had been concentrating on alternative forms of energy, of which solar energy was readily available in Africa and the best source of alternative energy for that continent. He advocated African countries' getting together and planning programmes to accelerate its application. Since it was now known that fossilized fuels would be exhausted around the turn of the century, African countries had no choice but to look for alternatives. In Nigeria of course refined types of energy from liquid sources predominated in industry, transport and households. Electricity was also important and was derived from water power, gas, oil and coal in that order. However, the Government recognized the necessity of diversifying to conserve the country's petroleum resources, which brought in foreign currency. Moreover, although the construction of a number of hydro-electric plants was planned, it was recognized that in the not too distant future the country would be short of energy. Consideration was therefore being given to the need to develop the exploitation of solar energy. At a national energy conference organized recently by the Nigerian Policy Development Centre, it was agreed to set up a national energy commission, and priorities as to the best areas for development in the solar field were now being mapped out. A national scientific and technological development agency had been set up for the purpose, inter-alia, of working on scientific innovations. However, his Government believed that joint efforts in research were better than working in isolation. It had asked the secretariat to circulate

copies of a pamphlet on work in Nigeria which it hoped would be of interest to the participants. In addition to intra-African co-operation in the field of solar energy co-operation with third world countries in other regions, such as Brazil and India, would also benefit African countries.

27. A number of experiments in the use of solar energy were being carried out in various Nigerian universities, although with limited material resources. In the Mechanical Engineering Department of the University at Zaria, a solar drier and a small demonstration solar water heater, both using flat-plate collectors, had been constructed and tested. A small parabolic collector had also been constructed using aluminum sheets. Some work had also been done on solar stills and solar salt ponds. Research and development was now under way in the field of solar water pumping and solar cooling systems, both of which were considered to have great potential in Nigeria. Extensive solar radiation measurement and data compilation had also been initiated. At the University of Lagos, research had been carried out in the measurement of solar radiation by the Department of Mechanical Engineering. The Faculties of Engineering and Physics Departments of the Universities of Ibadan, Ife, Nsukka and Benin were also engaged in some solar energy research.

28. The representative of Sierra Leone said his country's efforts in the use of solar energy had been concentrated in the Faculty of Engineering at Fourah Bay College at the University of Sierra Leone and that the work done had been carried out with very limited financial and human resources. He outlined the main activities in his country as follows:

(a) Over five different designs of flat-plate collectors had been built and tested for use on various solar water heaters. The 200-litre solar water heater units had been mounted on buildings at the University and tested over long periods to assess their performance. A project was currently under way to use the experience gained so far in designing solar water heaters for commercial production. That project should be completed in about 18 months;

(b) A solar cooker based on the hot-box principle had been designed and tested under local conditions. The results indicated that cooking could start at between 10 and 11 a.m. on an average sunny day. Solar steam cookers, which could be used indoors, were also being developed, and a prototype had already been tested. Prototypes of two solar dryers had been built and tested. The great agricultural potential of Sierra Leone and the need for drying crops had caused work to be accelerated in that area. Work was under way on the development of a dryer using solar energy and an auxiliary source of heat. That project was expected to be completed by the end of 1979. Another project for the development of solar devices for drying rice might get under way early in 1979 depending on funding from an external agency;

(c) A small-scale project to produce distilled water for the University had recently been initiated, and its results would serve as a base for larger projects in rural areas where there was a great need for potable water;

(d) Considerable improvement was required in the facilities available in Sierra Leone for measuring solar radiation intensities. No reliable insolation data was available at present, but efforts to obtain suitable equipment were under way. Theoretical work had been done and continued to be carried out with a view to obtaining formulae for predicting solar radiation intensities until such time as reliable data were available. Meteorological stations for recording readings were located in various parts of the country;

(e) It was possible that Sierra Leone would work with a foreign company in carrying out a solar electrification project. Whether or not that project was implemented would depend on the availability of funds;

(f) Little work on wind energy had been done in Sierra Leone, but the limited data available was being used to assess the potential of wind power in various areas. Windmills were being designed in co-operation with a private individual for the purpose of studying the power which could be obtained from various wind machines;

(g) Much work had been done on the use of agricultural waste, such as sawdust and rice husks, as fuel. Various types of equipment using such fuel had been designed and were under construction and testing with a view to manufacturing them locally.

29. In Sierra Leone, as in other African countries, rapid progress was stifled by a shortage of financial and human resources, and he hoped that the Seminar would yield some concrete suggestions of ways of alleviating that problem.

30. The representative of Chad said that despite the numerous internal difficulties besetting his country which blocked any progress in development the Government of Chad was particularly interested in promoting the use of solar energy and between 1976 and 1978 had established three identical pumping stations, but the one at Afi was no longer operating as it needed repairs. The creation of a national solar energy research and development centre had been envisaged but might not be realized in the near future because of the internal situation of the country and the lack of suitable personnel.

31. Two important projects, which had not yet been implemented for a number of reasons including lack of financing, were a solar pumping project at the

cattle market at Ndjamena and an irrigation scheme on the Chary. At present Chad was mainly concerned with the pumping and treatment of water and the preservation of food and pharmaceuticals. An experiment on bio-gas energy was being carried out under the auspices of the Ministry of Town Planning and Housing, and the University of Chad already had the beginnings of a solar energy laboratory. In closing, he said his Government very much hoped that measures would be taken to develop the uses of solar energy at the intra-African level.

32. The representative of Tunisia said that in considering in the information on Tunisia contained in the secretariat document it should be borne in mind that in Tunisia research into solar energy dated back about 20 years and had resulted in the installation of a number of plants operated on solar energy, such as the water heater facilities at the Kairouan Lycee. However, really serious consideration had not been given to the use of solar energy until 1973 when the world energy crisis had set in. In its attempts to combat the crisis, the national engineering school at Tunis had engaged in research and had devised a flat-plate collector, photovoltaic cells and a thermal solar pump. In addition, units dealing with new forms of energy had been set up within national structures responsible for matters relating to energy. For its part, the Entreprise tunisienne d'activités pétrolières (ETAP) had undertaken studies relating to various applications of solar energy, such as the heating of houses and the pumping of water. In these studies it had been found that on the basis of the present cost of petroleum products and electricity, solar energy was still not-competitive. ETAP had accordingly recommended to the Tunisian authorities that all equipment using solar energy should be tax-exempt, that various users of solar energy should be granted subsidies and that equipment should be developed for local manufacture and that such equipment should, insofar as possible, be manufactured from materials produced on the spot with a view to keeping prices at a minimum. Those recommendations were still under study.

33. In his statement under this item, the representative of Senegal commended CEAO on its action to unite the efforts of a number of African countries by providing support for the work conducted in their research centres and promoting applications based on the use of renewable forms of energy. It was the wish of all African countries to co-operate with each other dynamically and effectively in the field of solar and related energies, and the best course of action was to do everything possible to advance the common effort. The use of renewable forms of energy held out great hopes for development, especially in the least favoured areas. It was for the experts in the solar energy field to do what they could to ensure that those hopes were not in vain.

34. In the solar energy programme implemented in Senegal, priority was given to water. The programme was justified by, among other things, the rising price of conventional forms of energy and a concern for environmental protection. The Scientific and Technical Research Delegation was responsible for co-ordinating research programmes and applications and for their financing

either by national funds or by external resources. The Institut de physique météorologique (IPF) of the University of Dakar was provided with impressive scientific equipment, especially for the measurement of solar radiation, an operation which had been performed systematically for almost 20 years. It had equipment to work in the four fields of research and application provided for under its programme, which was aimed at:

- (a) Enhancing the performance of the solar engine used for pumping water in villages, cattle ranges and farms;
- (b) Heating water for domestic and community consumption;
- (c) Preserving foods, especially fish, by drying it by the hot-air method; and
- (d) Distilling water for hospitals and dispensaries located in the bush and treating brackish water by distillation. IPM was being turned into a renewable energy studies and research centre with an integrated R&D programme.

35. The semi-conductors laboratory at the Faculty of Sciences was especially concerned with photovoltaic conversion. Research was aimed at promoting the use of voltaic cells in producing electricity and pumping water. The Institut universitaire de technologie (IUT) had the task of training technicians in a broad range of fields of direct interest to industry in Senegal. It had a high-level staff, certain members of which specialized in the use of renewable forms of energy. The students were brought into association with applied research in the fields of high-temperature thermodynamic conversion, the use of photo cells for refrigeration and lighting, the study of housing in terms of locally produced building materials taking weather and life styles into account and the construction of windmills. The polytechnical school at Thies had the task of training high-level engineers, but it also popularized equipment such as solar pumps and wind machines in rural areas.

36. The Government had created an industrial association for the application of solar energy and was also studying some projects in conjunction with France, Canada, the United States of America, the Federal Republic of Germany and other countries with a view to promoting more effective use of renewable forms of energy. There were plans to establish a rural energy centre for studying the best way of using in combination energy derived from the sun, the wind and the biomass. The goal of that project, which would be undertaken with assistance from UNEP, was to meet the energy needs of a small village at minimum cost. With aid from FAC, a 1-kw stations had been put into operation in four locations, where they were supplying small village communities with water. Moreover, a 1-kw hydro pump had been installed at the National Centre for Agronomical Research at Bambey where it was used in tests on the watering of market crops. Work was in process on the installation of a 60-kw pumping station at Bakel for

the purpose of irrigating about a 100 hectares of land, thereby making it possible to diversify agricultural production in that part of the Senegal River Valley.

37. To end his intervention, the representative of Senegal said it would be useful for the participants if his colleague from the National Electric Company of Senegal (SENELEC) could, as a user of renewable forms of energy, address a few words to them.

38. The representative of SENELEC said that his company's concern with solar energy dated back a number of years and that in 1978 a two-man renewable energy unit had been established in its technical division. In the middle of the 1979 those two men would be joined by the recipient of a fellowship from SENELEC for a post-graduate course in Perpignan (France). SENELEC's work in solar energy was carried out both within and outside the company. On the outside, SENELEC's agent played an active role, both nationally and within international meetings, in the formulation of a consistent policy for research in and the promotion of the use of renewable forms of energy. Moreover, it expected to play a leading role in the Renewable Energy Research Centre. Within the company, the work of the unit involved a contract with a Franco-Senegalese consortium to construct a solar power station in the village of Diakha which would be associated with a centre to test various kinds of solar equipment. That project was financed out of the Central Fund for Economic Co-operation. More of such stations would be constructed in the future with a view to reducing the cost of the kilowatt hours produced, providing energy over a larger area of the country and to diversifying the sources of energy supply. The company was also in a position to offer specialized in-service training or post-graduate courses for technicians or engineers. Moreover, any contract with a supplier systematically provided for the training of administrators or technicians in the equipment covered by the contract.

39. The representative of Algeria said that in his country solar energy research was carried out primarily under the auspices of the l'Organisme National de la Recherche Scientifique (ONRS) and of the universities, which worked in close co-operation with it, which some of the research was carried out at the solar energy station at Bouzareah, which was a branch of ONRS. At that station there was a parabolic concentrator with an automatic solar tracker. A technical and economic feasibility study on the establishment of an electric solar station was being carried out on the basis of experiments conducted at that station. At the same time the duration of solar radiation was being measured in conjunction with the national meteorological service with the view to setting up radiometric network throughout the national territory, and research was being conducted on the low use of solar energy at low temperatures in connexion with the construction of flat-plate collectors and the production of hot water for purposes of washing. He noted that the water heaters produced were manufactured from materials available in Algeria and were operational at the station. Other projects would include the study and realization of household heating, the application of solar

energy to agriculture, a study on the storage of all forms of solar energy and a study leading to the production of a cooker.

40. Research concerning work on solar cells was carried out in another research centre, also under ONRS, where the results obtained had been encouraging and the output met international standards. A third branch of research in Algeria was concerned with the creation of a low-temperature station at Oran at the national polytechnical institute. The construction of an integrated socialist village using renewable energies as often as possible was planned under agreement with the United Nations University in Tokyo. The site of that village had already been chosen and the feasibility studies completed. An operation was being carried out under the aegis of the centre for research in architecture and town-planning. The University of Annaba was working primarily on solar pumps and concentration systems and on the integrated use of solar energy.

41. Since it was impossible to complete a research operation without adequately trained men to carry it out, courses of the post-graduate level were to begin in September 1979 at the science and technology university at Algiers.

42. With regard to the use of wind energy, he said that experimental pumping stations were already in operation and that the encouraging results obtained from them made it possible to consider using them throughout the country.

43. He explained that some of the operations referred to above had been undertaken by Algeria operating on its own whereas others were being carried out under agreements with countries such as the Federal Republic of Germany and France, or with international agencies. In establishing and carrying out its solar energy programme, Algeria had been guided by its constant concern to integrate Algerian production into solar energy research insofar as that was possible.

44. Difficulties in communication concerning research problems had arisen among African States, and it was his delegation's hope that some kind of subregional or even regional co-operation might be developed so that African products might serve as inputs in the solar energy industry which would undoubtedly grow by leaps and bounds.

45. The delegation of the Republic of Cape Verde said that his country had already begun to measure solar rays systematically at the national level and had installed one solar pump and several wind-driven generators and pumps. The Government had also begun a study aimed at the creation of a national technological research centre and had sent a number of cadres and students abroad to study.

46. The delegation of the Upper Volta said that after a certain number of new institutions had been established, the Ministry of Higher Education and Scientific Research and the Department of Scientific and Technological

Research had been playing leading role in research in solar energy. In particular, he said that the role of the Department of Scientific and Technological Research would be one of co-ordination, promotion and compilation because the use of solar energy or its derivatives related to a number of sectors which did not in fact fall within the purview of the Department.

47. A network for measuring global radiation and the number of hours of sunshine had been set up in the Upper Volta as long ago as 1971 and operated at the preparatory stages in the collection of data on the amount of solar radiation received at ground level. At the university level, a group of research workers were working on heat conversion and another group on the conversion of bio-energy. The work of both those groups was still in its initial phases. Finally, he said that in the Upper Volta some applied research was conducted by bodies not directly controlled by the Government.

48. The representative of Guinea drew the attention of the Seminar to the importance his Government attached to the use of solar energy despite the enormous hydroelectric potential of the country. For example, back in 1971, a solar energy programme had been introduced in the curriculum of the University of Guinea with a view to training personnel in that field. To date about 10 dissertations relating to both the theoretical and the practical aspects of the use of solar energy had been submitted.

49. In 1973, Guinea and the Union of Soviet Socialist Republics had entered into a bilateral agreement on the construction of a centre for research in solar energy, oceanography and standardization. That centre was under construction and would be opened early in 1981. Other action in the use of solar energy had been taken in conjunction with international organizations and friendly countries. Finally, also at the national level, the National Institute of Research and Documentation had, in co-operation with the National Meteorological Bureau, installed measuring devices in most of the administrative subdivisions of Guinea with a view to preparing an actionometric map of the country.

50. The WMO representative stated that activities of WMO in the field of solar energy, and other forms of renewable sources of energy were described in a statement to be circulated by the ECA secretariat in due course. He therefore intended to be brief.

51. In emphasizing some points that WMO considered fundamental to the efficient exploitation of solar radiation and wind as energy sources, he associated himself with those member States who, in their statements, had stressed the importance of the monitoring of meteorological parameters like solar radiation and wind speeds for the exploitation of solar and wind energy.

52. He stated that in all solar energy systems and appliances, solar radiation was the input and it was therefore necessary to understand and evaluate that input for determining the sizes and designs of solar energy systems and appliances. The same argument held in the case of wind as an input in wind energy appliances.

53. Giving a brief summary of the meteorological parameters to be measured for solar and wind energy purposes, he informed the seminar of the efforts by WMO to assist its members in establishing stations for the measurement of their parameters. He cited as an example, the planned installation of 40 radiation stations in the CILSS countries which would be completed in the middle of 1979.

54. In conclusion, he stated that there was still more work to be done to improve the network of observing stations in Africa, stating that that problem should continue to be given urgent attention. He further stated that WMO was ready to collaborate with ECA and the member States in promoting the exploitation of solar and other forms of energy on the African continent.

55. The representative of OAPEC explained that his organization's concern with solar energy had begun when several Arab countries had become active in the solar energy field and the need had been felt for trying to put some order into the activities carried out in that domain. The Ministers of Energy of the 22 States members of the Arab League were due to meet in Abu Dhabi in March 1979 to study problems related to new energy sources and to decide on a united programme of action. In preparation for that meeting, it had been decided to send a two-man fact-finding mission to all 22 member States, 9 of which were African States to study their policies and activities. That mission, of which the speaker was himself a member, would submit its report to the Ministerial Conference in Abu Dhabi and would propose that programmes in the development of the use of solar energy should be based on the development of Arab expertise. The mission had identified the following seven categories of barriers to the exploitation of solar energy in the countries concerned:

- (a) Lack of policies, plans and strategies;
- (b) Weak R&D programmes;
- (c) Problems relating to transfer of technology;
- (d) Problems relating to education and training;
- (e) Problems relating to international co-operation;
- (f) Lack of inter-Arab co-operation; and
- (g) Legal problems.

The creation of two kinds of structures was possible -- a pan-Arab centre on solar energy programmes and an Arab solar energy commission. Experience showed that in the Arab countries there was the danger that a pan-Arab centre would turn into a national venture. A commission was more likely to become a reality especially since the idea of creating it included plans for a common fund to encourage research.

56. The representative of CIEH said that his organization was concerned with all problems related to water including pumping. Attempts to solve the problem of water-pumps had led to experimentation with wind energy and bio-gas. Thus some of the activities of CIEH fell within the purview of the Seminar. Such activities included projects involving experiments on pumping, windmills and above all the production of bio-gas, on which he had several documents to make available to the secretariat. For several years research on the production of bio-gas had been carried out with assistance from FAC. As part of that programme two storage tanks had been installed at the Committee's headquarters at Ouagadougou and eight others outside of Ouagadougou. That arrangement corresponded to the two-fold thrust of the programme, which had both an energy aspect and an agronomical aspect. The results of the programme, which had been in implementation for two years, included the construction of a small cooker which operated on the gas produced and the use of bio-gas to operate a pump. The programme included a project to solve the problem of converting pumps operating on petrol to bio-gas. In the second phase of its programme, the Committee had included a survey to determine needs and a project regarding the use of human feces and the problem of treating them; and effort would continue in those areas where progress had already been made. Finally, CIEH intended to work towards the improvement of information and documentation in connexion with the use of new forms of energy.

57. After statements have been delivered on the situation in all countries represented at the meeting and by those observers who wished to make statements, the Chairman called on the representative of countries to give practical examples of difficulties encountered in mounting programmes related to the use of solar and other new forms of energy.

58. The representative of Senegal mentioned the difficulties encountered in the training of technicians for research centres and in financing such centres. Difficulties were also experienced in the promotion and transfer of technology although intra-African co-operation in that field had been increased to the extent that co-operation was possible within such groupings as CEAO. Still it was difficult to co-ordinate research within one's own country much less among different countries.

59. The representative of Kenya said he felt that the difficulties experienced could be put into three categories. First, there were difficulties relating to communication. It was in fact easier to communicate with non-African countries than with other African countries particularly

in the field of research. He himself had to come to a gathering such as the Seminar to see that much work was being done in the French-speaking countries which was not mentioned in any of the journals available to him in Kenya. Such difficulties in communication meant that a certain amount of work was being needlessly duplicated, and he suggested that some kind of medium of communication should be established. The second category of difficulty related to personnel and to the prevalence of expatriate personnel in the energy field in Africa, which might in fact aggravate the communication problem. He felt there should be some kind of exchange of personnel or of experience between French and English-speaking African countries. The third difficulty related to the testing of equipment. That problem might be solved by ascertaining where in African equipment might be tested.

60. The head of the delegation of the Niger, said he agreed with the representative of ECA that the possibility of promoting industrial production of material in Africa deserved serious consideration because in many cases material produced in Africa was exported in a semi-finished state only to be imported back into Africa later in the form of a finished product. Another difficulty in promoting the use of solar energy was how to convince the people and the public authorities of the value of using solar energy. Unless such difficulties were overcome, it would be impossible to progress in the use of solar energy. Other difficulties related to co-operation, both at the intra-African level and with entities outside of Africa. Such difficulties could not be blamed solely on faulty communications because at meetings held outside of Africa, some kind of relationship was always established among African countries. The important thing to remember was that intervention on the part of the public authorities was always required in following up on the decisions taken at meetings. In that connexion, he drew attention to a fact that the resolution of the Economic Commission for Africa on the promotion of solar energy had been adopted 15 years previously and since then little headway had been made. He felt that African countries should learn from past experience and that ECA might consider the possibility of working with such organizations as CEAO, ECOWAS and UDEAC at which political decisions were taken. Outside Africa, African countries should defend their own interests and strive for open ended co-operation so as to not be dependent on any one country.

61. In connexion with the view expressed by the representative of the Niger that ECA should work more closely with political organs, the representative of ECA informed participants that it was highly possible that decisions taken at the Seminar would eventually be submitted to OAU through the ECA Conference of Ministers.

Review of current and planned activities in the field of research into and practical applications of solar energy in the various areas of utilization in Africa and the difficulties encountered (Agenda item 5)

62. Before discussing this item, participants listened to a statement by the representative of CEAO, in which he enumerated the priorities adopted as a result of the Symposium on Solar Energy and Development held at Bamako, Mali, from 28 September to 2 October 1976. The report of that symposium had been distributed at the Seminar.

63. In the discussion which followed, representatives told what priorities their respective countries had adopted on the basis of their individual and regional natural, geographical, climatic and other characteristics. Whereas the Sahelian countries were primarily concerned with problems related to water and with freeing themselves from the difficulties occasioned by their climate, some of the countries in eastern Africa, for example, were mainly interested in the drying of the tea, coffee and tobacco they produced, and West African countries in refrigeration or the drying of fish or groundnuts. Recognition was given by the Seminar in general to the overriding need to enhance the living conditions of rural inhabitants, who lived in widely scattered communities all over Africa.

64. Emphasis was placed on the need to increase the effort to exchange information among countries with the same concerns so that their activities would not be duplicated, and some representatives suggested the creation of a data bank and an international network for information relating to solar energy. Where intra-African co-operation was concerned, the role played by subregional organizations, like JEAO, CILSS and ECOWAS in West Africa, was stressed, and some of the participants spoke of the difficulties which might arise from co-operation on a continental scale. In that connexion mention was made of the large gatherings sometimes organized by institutions outside Africa.

65. One representative spoke of the need for standardization in connexion with the use of solar energy and stressed the importance of defining the parameters to be attained. He felt it would be desirable to combine the efforts made under the aegis of ECA as an organization which represented all African countries.

66. One of the observers enumerated the uses of solar energy (drying, the recycling of water, pumping, greenhouses, refrigeration, electricity, heating, etc.), stressing the ease of using that form of energy, whose main advantage was that it was available throughout Africa and could meet the needs of Africa's widely scattered population. However, he called attention to the need of African countries to join together to enlarge the market for solar appliances and instruments, thereby reducing

manufacturing costs so that African articles could compete with those produced outside. He also advocated the use of local materials rather than materials imported at great cost in the manufacture of solar apparatus. To that end, there was a need to create exchange and liaison between universities and local industries. Finally, he suggested the creation of an African commission on solar energy to encourage research by providing it with general guidance and to make it easier for researchers to meet with each other in an African context and to communicate with each other through a medium such as, for example, a journal.

67. One representative drew attention to the danger of Africa's becoming a potentially enormous market for the advanced countries already manufacturing solar appliances and instruments. He gave example of some of his country's achievements using local materials, including the manufacture of flat-plate collectors incorporating sheet-glass, which it also produced, and a cork-based insulator with the same properties as fibre-glass. He called for training programmes in the field of solar energy.

68. Where the creation of an African structure in the field of solar energy was concerned, participants found the shortage of African personnel to staff such an institutions regrettable. One representative said he wondered whether it would not be enough to set up an energy division in the African Regional Centre for Technology which was being established.

69. In his summation of the discussion, the Chairman, said the following ideas had been advanced: The only way out for African countries was co-operation, under which they could pool their human and financial resources and facilitate the mobility of trained personnel; the status of research workers would have to be defined as ECA had suggested; there was a need to create basic industries for solar energy (sheet-glass, aluminium, insulators) and reduce the dependency of African countries on the outside world; an inventory should be made of all possible uses of solar energy; indigenous technology should be developed and, finally, real transfer of technology should be initiated; i.e. expertise as well as products should be acquired.

Consideration of specific measures for immediate implementation to carry out the programme and strategy (Agenda item 6)

70. Under this agenda item, participants were invited to suggest priorities to guide ECA in the conduct of its activities in the field of solar and related energies. To aid them in their consideration of this matter, they were provided with copies of the report of the second African Meeting on Energy (E/CN.14/665) and of the report on the Symposium on Solar Energy and Development organized by CEAO from 28 September to 2 October 1976.

71. From a thorough discussion of the matter, it emerged that the participants agreed that the criteria to be used in determining priorities for any programme of action or strategy on the use of solar energy in Africa should be first that the action should bring about an improvement in the living conditions of people in rural areas and make it possible to economize on energy. On the basis of those two criteria, the following order of priorities for basic action was laid down:

- (a) Increased knowledge of the solar and wind potential available, inter-alia, through improved and more extensive measurement and monitoring
- (b) Problems related to water
 - (i) Pumping
 - (ii) Distillation
 - (iii) Irrigation
- (c) Solar heating
 - (i) Heating of air and water
 - (ii) Solar cookers
 - (iii) Solar furnaces
 - (iv) Greenhouses
- (d) Preservation of products
 - (i) Drying
 - (ii) Refrigeration
- (e) Production of electricity
 - (i) Rural electrification
 - (ii) Telecommunications
 - (iii) Air-conditioning
- (f) Biomass
 - (i) Wood and vegetable wastes
 - (ii) Charcoal
 - (iii) Biogas
- (g) Integrated use of solar, wind and biomethane energy to benefit rural areas.

72. At the same time, it was decided that the basic action outlined above should be supported by parallel action in the following order of priority:

- (a) Training of research workers, engineers, technicians and support personnel
- (b) Information
 - (i) Creation of structures for the promotion of co-operation among research workers and countries
 - (ii) Measures to make government authorities and the general public aware of advances in the field of solar and related energies
 - (iii) Exchange of ideas and expertise
- (c) Industrialization and extension
 - (i) Use of local materials
 - (ii) Transfer of technology
 - (iii) Regional co-operation in the development of indigenous industry and in the standardization of equipment
- (d) Integration of research and development in industrial and social activities

Establishment of a permanent co-ordination and co-operation framework at the subregional and regional level and consideration of the conditions under which it would operate (Agenda item 7)

73. Under this agenda item, participants had before them document E/CN.14/NERD/E/21 containing a draft constitution of an African regional centre for solar energy, which had been prepared by the ECA secretariat for their consideration.

74. Some of the representatives said they feared that the creation of the type of centre for which the draft constitution had been prepared might present practical problems and also that they wondered whether the time was ripe for such a venture. For instance it was stressed that a regional network of scientific and technical institutes already existed, one of whose tasks was to co-ordinate work in research and development related to solar energy. One representative said he was concerned about the large number of associations and centres that had recently been created in Africa and suggested that it might affect savings in both money and staff if a regional solar energy organ were incorporated into the African Regional Centre for Technology.

75. However, a larger number of representatives strongly endorsed the idea of creating a regional centre, and eventually a consensus emerged in favour of examining the draft constitution with a view to approving

it for submission to the next Conference of Ministers of the Economic Commission for Africa.

76. The draft was accordingly examined and approved after it had been amended to meet the wishes expressed by participants. That amended draft constitution is attached to this report as annex I.

77. After approving a constitution for an African regional centre for solar energy, participants turned their attention to another draft constitution prepared by ECA for their consideration and contained in document E/CN.14/NERD/E/22. As the ECA representative explained when he introduced the draft constitution of a solar energy society of Africa, it had been prepared in response to a request addressed to the secretariat on behalf of a number of African scientists and researchers in the field of solar energy. The purpose of the society for which the constitution was intended was, inter-alia, to meet the need to facilitate communications and the exchange of information in the field of renewable energies. The constitution provided, for example, for the members of the Society to meet together from time to time to discuss their common problems and to decide what joint action might be taken to solve them. He stressed that the idea of creating such a society had originated with members of the solar energy community in Africa and that, whereas ECA was entirely willing to advance the realization of that idea in any way it could, the decision as to whether or not such a society should in fact be created rested with the participants and their colleagues in Africa.

78. The Seminar was in accord as to the desirability of establishing some kind of society for the purposes outlined by the ECA representative in his introduction. It was, however, in two frames of mind about the time for the establishment of such a society. It was pointed out that there had already been an abortive attempt to create an association of researchers in solar energy, which had arisen out of the solar energy conference organized by UNESCO (in Paris in July 1973). Difficulties were cited in connexion with financing and the special communications problems of Africa. In some cases, there were even political factors which mitigated against the creation at the present time of a society of the type reflected in the draft prepared by ECA. Participants who held that point of view felt, however, that not enough background information was available to embark on a new venture of that sort and that representatives should, before approving a draft constitution, go back to their own countries and canvas the views of their colleagues as to the kind of regional establishment they wanted to have. Solar energy research was, after all, a new field, and there might not be enough demand for an association to justify the creation of one on so formal a basis as the one under consideration. It might be better to wait and see how the Centre fared before launching another new organ.

79. On the other hand, there were those who took the view that, where there was a will, there was a way and that the view expressed by their colleagues was too pessimistic. It was pointed out that, at a conference in Trieste the previous year, it had been decided that workers in the field of solar energy in Africa needed some kind of association through which to channel their ideas and exchange information on their activities and especially some medium through which they could publish findings without being compelled to go outside Africa. One of the participants who followed that line of thought urged his colleagues to seize the opportunity presented by the Seminar to lay the groundwork for such an association as it might be years before a similar opportunity arose. Even though the society might not get under way immediately, at least something practical would have emerged from the Seminar.

80. Accordingly, it was agreed to go through the draft constitution, step by step on the understanding that when it had been amended, it might serve as a useful base on which a society might one day be erected. A draft incorporating the amendments agreed upon is attached to this report as annex II.

Presentation of scientific and/or technical communications by the participants (Agenda item A)

81. It was decided that participants with scientific or technical communications to present would submit them to the secretariat in writing and that they would then be reproduced and distributed to the other participants. As part of their work under this agenda item, the participants in the Seminar, at the invitation of the Government of the Niger, visited the Office de l'énergie solaire (ONERSOL) and some solar energy facilities developed by the Niger.

82. At the Office de l'énergie solaire (ONERSOL), participants were able, first of all to look at some highly interesting devices which made use of solar energy, including some solar water heaters of varying capacities; a solar cooker; solar stills with various capacities, a solar furnace under construction and a solar pump, which would operate with the help of a solar engine using a cylindrical parabolic mirror. The whole engine had been conceived and patented by the staff of ONERSOL. Participants then visited the solar pumps at Bossey Bangou, which operate on flat collectors, had a capacity of 2,000 square metres and was used to supply water to the people of the area and their livestock.

83. The various facilities seen convinced participants that the use of solar energy was necessary and even indispensable for raising the standard of living of Africans. Participants commended the entire staff of ONERSOL for their invaluable contribution to an understanding of the problems presented by the use of solar energy.

ECA training programme (Agenda item 9)

84. The representative of the Executive Secretary of ECA introduced the document on the ECA Training Programme for Research Workers and Technical Personnel in the field of solar energy in Africa (E/CN.14/NERD/E/23), which had a three-fold orientation, including:

- (a) A short training programme (1-3 months) for administrators and engineers intending to work on the formulation of a national programme for the use of renewable energy in their country;
- (b) A 6- to 12-month technical and scientific training course for research workers and engineers wishing to broaden their technical knowledge and competence in the exploitation of solar energy and its derivatives. It was planned, insofar as possible, to supplement training provided in non-African institutions with practical training courses in African centres; and
- (c) A training programme for technicians and craftsmen in jobs involving the manufacture, assembly, maintenance and repair of apparatus run on renewable energy.

85. A list of institutions and of the programmes offered by ECA had been prepared and disseminated by ECA in all member States. An appeal was alunched to all institutions and centres in Africa, which dealt with renewable energies, to help ECA to add to that list. The secretariat also wanted member States to inform it as soon as possible of the number of people they wanted trained in renewable energies so that it could plan its activities in that field.

86. A number of representative commended ECA on its efforts to organize training for Africans in solar techniques and asked that a complete list of existing training programmes in Africa should be drawn up to keep governments fully informed of the possibilities available in Africa in that field. Mention was made of, for example, training institutions in Algeria, Egypt, the Libyan Arab Jamahiriya, Morocco, Tunisia and the Sudan. The secretariat took note of that suggestion.

Project on the promotion of the use of solar energy in Africa (Agenda item 10)

87. The representative of the Executive Secretary introduced the secretariat document on the project on the promotion of the use of solar energy in Africa (E/CN.14/ECO/155 - E/CN.14/NERD/E/24) and enumerated the five components, as follows: The strengthening of existing centres and the creation of new centres; the training of research workers, engineers and technicians; a campaign to measure direct and diffuse solar energy; an operation to demonstrate solar infrastructure and equipment with a view to increasing governmental and public awareness of their possibilities; and, finally, the convening of a seminar each year for persons who had gained recognition for their efforts to develop the

use of solar energy in Africa. The project budget totalled about 3 million United States dollars to cover implementation over a period of five years.

88. Representatives commented favourably on the project. One of them, however, warned of the danger that manufacturers of solar equipment outside Africa would use the "demonstration" component to advertise their own products, and another said he thought that in the early phases of the project, only 30 per cent of the budget would be needed for demonstration. The ECA representative said that ECA would attempt, whenever it could, to acquire the equipment used from existing centres through its own initiative so as to cut down on the amount imported.

89. The representative of the United Nations Sahelian Office (UNSO) indicated that UNSO was ready to help to launch priority action in the field of solar energy, whose use was referred to in the Plan of Action to combat desertification, which UNSO was called upon to help the Sahelian countries to implement. Since solar energy made it possible to reduce deforestation and to fuel water pumps, the plan of action called for the production, testing and diffusion of simple solar devices, which were inexpensive but effective and could be used by the inhabitants of arid regions. Consequently, the United Nations Sahelian Office was willing to give favourable consideration to any projects submitted to it for financing by States or by their regional organizations provided that such projects lay within its purview.

Consideration and adoption of the recommendations of the Seminar (Agenda item 11)

90. After giving thorough consideration to the recommendations proposed by the Recommendations Committee, the Seminar adopted the text contained in part two of this report.

Other matters (Agenda item 12)

91. Under this item, the representative of the Executive Secretary of ECA called the attention of participants to the fact that on the occasion of its fourteenth session (fifth meeting of the Conference of Ministers) at Rabat, Morocco, in March 1979, the Commission was planning to organize an exhibition of equipment run on renewable energy, especially solar energy, with demonstrations. He also said that ECA was planning to open a solar energy demonstration centre in Addis Ababa and that it needed equipment for both of those ventures, which it hoped to obtain from existing centres and was counting on the active participation of the African countries. Finally, he suggested the creation in each subregion of a small centre combining the use of solar, wind and bio-methane energies for the purpose of assisting small communities until such time as concrete proposals had been made in that connexion.

Adoption of the report of the Seminar (Agenda item 13)

92. At its final meeting the Seminar considered and adopted this report in two parts and with two annexes, part one containing a record of its discussions and part two, the recommendations adopted by it, which concerned, inter-alia, the creation of an African regional centre for solar energy and a solar energy society of Africa. The draft constitutions of both the Centre and the Society as approved by the Seminar are contained in annexes I and II, respectively, to this report.

Closure of the Seminar (Agenda item 14)

93. On 13 January 1979, at its final meeting, the Seminar adopted a vote of thanks to the Government of the Republic of the Niger and another to the secretariat of the United Nations Economic Commission for Africa, the texts of which are contained in section B of part two of this report. After the customary expressions of thanks and congratulations, the Chairman pronounced the Regional Seminar on Solar Energy in Africa closed.

PART TWO

A. RECOMMENDATION ADOPTED AT THE REGIONAL SEMINAR
ON SOLAR ENERGY IN AFRICA

94. The African Regional Seminar on Solar Energy in Africa convened at Niamey from 8 to 13 January 1979 under the auspices of the Economic Commission for Africa,

Having expressed in plenary session its appreciation to the United Nations Economic Commission for Africa (ECA) for its initiative in convening the meeting, for having invited to it all member States, the observers of developed countries, developing countries and those of the international, governmental and non-governmental organizations and for the excellent documentation it submitted for discussion,

Having expressed its appreciation to the members of the United Nations Headquarters Secretariat, and ECA, and especially from the United Nations Development Programme (UNDP), the United Nations Industrial Development Organization (UNIDO), the United Nations Sahelian Office (UNSO), the International Labour Office (ILO), World Meteorological Organization (WMO) and governmental and non-governmental organizations, in particular the Organization of Arab Petroleum Exporting Countries (OAPEC), the Canadian International Development Agency (CIDA), the West African Economic Community (CEAO), African and Mauritian Common Organization (OCAM), the African Union of Posts and Telecommunications (AUPT), the Inter-African Committee for Hydraulic Studies (CIEH) and the River Niger Commission for their contributions to the preparation of this important documentation, its presentation and discussions,

Having expressed further its gratitude to the representatives of member States who furnished useful information on the level of achievement attained in the development and utilization of solar energy in their respective countries, and for their active role in the discussions,

Having recognized ECA's interest in the rapid promotion of the use of renewable forms of energy in Africa and the importance of its project for the promotion of the use of solar energy and, its derivatives in the countries of the continent,

Having noted the interest expressed in this meeting, which constitutes eloquent testimony of the importance attached to the various problems still impeding the development and use of solar and other renewable sources of energy in Africa,

Having wished to stress unanimously that the documentation presented and the discussions that ensued made an extremely useful contribution to kindle the minds of all participants and, in particular, those who are

actually engaged in the research and development of solar and other renewable energy resources,

Considering that Africa possesses appreciable resources in terms of solar radiation and has considerable energy potential,

Considering that the optimum development and judicious utilization of these renewable resources require concerted effort, regional and subregional motivated co-operation among African States based on short- and long-term strategies with determined commitment for implementation,

Considering further that apart from Africa's enormous hydro-power potential, its hydro-carbon and fossil fuel resources are not inexhaustible,

Considering the need to improve the standard of living of the communities in the rural areas, to arrest the continuous drift of population from these areas to the towns and to accelerate the rate of growth in the rural areas,

Considering the vital role of adequate training to the over-all development of technology in Africa,

Mindful of the results so far recorded in the research into and application of solar energy and its derivatives, whose cost/benefit ratio looks promising for Africa,

Also mindful of the role which this source of energy can play in enhancing the living conditions of the inhabitants of rural areas, particularly in the following fields:

- (a) The pumping of water;
- (b) The preservation of products through drying and solar refrigeration;
- (c) The heating of water and air;
- (d) The use of solar furnaces and cookers;
- (e) The production of electricity and educational television and telecommunications;
- (f) The exploitation of the bio-mass and of wind energy,

Very interested in the possibility of deriving an appropriate technology from local resources and of effecting a transfer of technology which is

better geared to the needs of and conditions prevailing in African countries.

1. Recommends to African leaders that they:
 - (a) Firmly support research in their countries into solar energy and its derivatives and their application by enhancing the facilities available to and the status of research workers by creating research centres in their countries if the need for such centres is felt;
 - (b) Embark immediately upon an effort to disseminate information and to promote extension in the African countries in connexion with the possibilities offered by renewable energies;
 - (c) Promote at all levels of scientific and technological training, education based on the study and use of solar energy;
2. Endorses the following priority actions to attain these objectives:
 - (a) The establishment of a Regional Centre for Solar Energy Research and Development in accordance with the provisions contained in ECA document E/CN.14/NRD/E/21 of 14 November 1978 as discussed and amended in the Plenary;
 - (b) The creation of the Solar Energy Society of Africa as proposed by the ECA secretariat in document E/CN.14/NRD/E/22 of 14 November 1978 as discussed and amended in the Plenary;
 - (c) The initiation of a vigorous training programme for African technicians and other professionals with a view to improving the standard of skills and to provide necessary manpower for the expansion of solar research and development as discussed and approved by consensus in Plenary on 12 January 1979 through ECA's document E/CN.14/NRD/E/23 of 30 November 1978;
 - (d) The encouragement of research and development through a clear-cut policy of strengthening existing solar research centres, the establishment of new ones and the training of research workers with a view to improving their skills and status and the rapid promotion of the use of renewable energy in Africa;
3. Earnestly desires ECA to work towards the following objectives:
 - (a) The promotion of subregional groupings which can handle problems relating to the use of solar energy;
 - (b) The establishment of inter-State structures to sponsor the rapid promotion of the use of solar energy;

(c) Facilitating the free movement of scientists and technicians among African countries;

4. Requests the Executive Secretary of ECA to give all his support to the speedy implementation of the present recommendations, in co-operation with the Administrative Secretary-General of OAU, all United Nations specialized agencies and other governmental and non-governmental organizations and institutions which are directly connected with promoting and ensuring African development and self-reliance in this field;

5. Urges the Governments of member States to provide transparent effective assistance to ECA for the purpose of achieving the objectives earlier enumerated and to take the steps needed for the speedy implementation of the aforementioned recommendations.

B. RESOLUTIONS

VOTE OF THANKS TO THE GOVERNMENT OF THE REPUBLIC
OF THE NIGER AND TO ONERSOL

The Regional Seminar on Solar Energy,

Deeply grateful to the Government of the Republic of the Niger for the fraternal welcome, warm hospitality and facilities provided by the Niger authorities and the management of ONERSOL,

1. Expresses its thanks to the Government of the Niger for the very encouraging message contained in the opening address delivered by the Secretary-General for Foreign Affairs and Co-operation;

2. Conveys its heartfelt gratitude to the Government and people of the Niger for the excellent arrangements made for participants by the authorities and management of ONERSOL;

3. Decides that this vote of thanks should be conveyed to the Government of the Republic of the Niger by the Executive Secretary of the Economic Commission for Africa.

C. VOTE OF THANKS TO THE SECRETARIAT OF THE
ECONOMIC COMMISSION FOR AFRICA

The Regional Seminar on Solar Energy in Africa,

Considering the efforts made by the secretariat of ECA and the satisfactory results noted at the close of the deliberations of the Seminar,

Considering also the number, quality and usefulness of the documents prepared and submitted to the representatives of African States and the observers,

Bearing in mind the magnitude and complexity of the tasks assigned to the secretariat and carried out by its members,

Conveys its sincere and heartfelt congratulations to the secretariat of ECA and its staff, including the interpreters and translators, for their tireless devotion and excellent contribution to the success of the Seminar,

Expresses its gratitude for the very impassioned and instructive message contained in the opening statement delivered on behalf of the Executive Secretary of ECA by Mr. Mourtada Diallo, Senior Regional Adviser on Energy,

Decides that this vote of thanks should be transmitted to the Executive Secretary of ECA by the Chairman of the Seminar.

DRAFT CONSTITUTION
OF THE AFRICAN REGIONAL CENTRE FOR SOLAR ENERGY

Preamble

The Governments of the African States on whose behalf this Constitution is signed,

Aware of the importance of solar energy and the advantages to be derived by them from its effective harnessing and utilization,

Noting the problems of African countries which are facing difficulties in the fields of energy production, transport, supply and the costs,

Considering that the shortages of indigenous specialized manpower which most African countries still face constitute an obstacle to their assuming full control over their energy resources and ensuring their rational use,

Considering further that it is necessary and urgent to assign high priority and all due importance to the formulation of sound, co-ordinated energy policies at the regional, subregional and national levels,

Recognizing that the optimum harnessing and use of solar energy requires concerted action, co-operation, political commitment and solidarity on the part of African States,

Recognizing further that the establishment of an African regional centre for solar energy could serve these purposes,

HEREBY AGREE AS FOLLOWS:

Article I

Establishment

The African Regional Centre for Solar Energy (hereinafter referred to as "the Centre") is hereby established and shall operate in accordance with the provisions of this Constitution.

Article II

Objectives of the Centre

The objectives of the Centre shall be:

(a) to encourage African Governments to include in their development plans, with priority status, projects for the development and utilization of renewable sources of energy in general and of solar, wind and bio-methane energy in particular;

(b) to encourage the introduction of studies of new energy utilization in school and university curricula and strengthen research in solar energy and its derivatives and experimentation and applications of such energy;

(c) to aid member States in carrying out fundamental research in solar energy, to strengthen existing centres or promote the creation of new centres, and to carry out research and products development as necessary and test products, systems, or appliances for performance, reliability and adaptability;

(d) to promote multinational co-operation with regard to the practical use of solar energy and other renewable sources of energy;

(e) to encourage the establishment of new national centres as necessary and establish subregional centres for purposes of liaison and co-ordination in the field of research and development of solar energy utilization;

(f) to encourage the popularization of local manufacture of equipment using solar energy and promote local industries in the fields of solar technology so as to reduce the cost of equipment making use of solar energy in Africa;

(g) to do everything in its power to improve the conditions in which research is conducted and to enhance the working conditions of researchers by awarding prizes;

(h) to work towards the establishment of a data bank in solar energy and its derivatives;

(i) by means of demonstrations, seminars, workshops, meetings, trade fairs, exhibitions of equipment and films, to arouse awareness among States members of the region of the sources, uses and benefits of solar energy;

(j) to disseminate results of solar energy studies co-ordinated in the region of elsewhere in the world;

(k) to take such other steps and do such other things as are related to or are incidental to the functions of the Centre or as may promote the attainment of the objectives of the Centre;

(l) to ensure that research findings are made the common property of the member States.

Article III

Headquarters of the Centre

1. The Headquarters of the Centre shall be at in
. (hereinafter referred to as "the host country").
2. The Centre shall, by agreement with the Government of the host country, make appropriate arrangements for the provision of premises, facilities and services required for the proper and efficient discharge of its functions.

Article IV

Membership of the Centre

The member States of the Centre shall consist of such States members of the United Nations Economic Commission for Africa and of the Organization of African Unity as adhere to this Constitution in accordance with Article 18 hereof.

Article V

Obligations of States members of the Centre

The member States of the Centre shall co-operate in every way with a view to assisting the Centre in achieving its objectives. They shall in particular use their best endeavours:

- (a) to take all such steps as may be necessary to implement the decisions of the Council and of the Executive Board;
- (b) to facilitate the collection, exchange and dissemination of information;
- (c) to submit such reports, agreements and information relating to the development, transfer and adaptation of technology in their possession as may be required by the competent organs of the Centre and which are not classified as confidential;
- (d) to make available training and research facilities upon such terms and under such conditions as may be agreed with the competent organs of the Centre;
- (e) to make available national personnel for the operations and activities of the Centre on such terms and conditions as may be agreed upon with the competent organs of the Centre;
- (f) to pay their annual contributions as determined by the Council and such special contributions as may be determined by the Council or by mutual agreement for particular programmes or projects carried out in their territories and to ensure a proper accounting for any grants or loans received from or through the good offices of the Centre; and
- (g) to accord such facilities, privileges and immunities as may be required under Article 14 of this Constitution.

Article VI

Organs of the Centre

The Centre shall have the following organs:

- The Council;
- The Executive Board;

- The Secretariat, Technical Committees and such other subsidiary organs as may be established in accordance with the provisions of this Constitution.

Article VII

The Council - establishment, composition and functions

1. There is hereby established the Council of the Centre (hereinafter referred to as "the Council"), which shall be the supreme policy-making organ of the Centre.
2. The Council shall consist of:
 - (a) the Minister responsible for energy in the Government of each member State of the Centre;
 - (b) the Executive Secretary of the United Nations Economic Commission for Africa or his representative;
 - (c) the Administrative Secretary-General of the Organization of African Unity or his representative; and
 - (d) a representative of the Association of African Universities.
3. It shall in particular, for the purpose of achieving the objectives of the Centre:
 - (a) approve the general principles and policies governing the activities of the Centre;
 - (b) approve the work programme, budget and accounts of the Centre;
 - (c) determine the annual and special contributions to be paid by the States members of the Centre and matters related thereto;
 - (d) elect the members of the Executive Board, having regard to equitable geographical and linguistic distribution;
 - (e) appoint, upon the recommendation of the Executive Board, the Executive Director and Deputy Executive Director of the Centre and prescribe for them their terms and conditions of service provided that, in making any appointment under this subparagraph, the Council shall have regard to the desirability of appointing a person with considerable experience and qualifications in the field of solar energy and development and in the management of an institution similar to the Centre;
 - (f) consider proposals submitted to it by the Executive Board relating to the objectives of the Centre and to take decisions thereon for their implementation by the Centre or its member States;

(g) subject to the provisions of this Constitution, prescribe and/or approve the staff, financial and other regulations, including those relating to the secrecy of the Centre;

(h) select the location of the headquarters of the Centre;

(i) approve periodic reports on the activities of the Centre;

(j) establish such special or technical committees or departments as it may deem necessary or desirable;

(k) generally perform such other functions as may be necessary, desirable or incidental to the achievement of the objectives of the Centre or which may contribute thereto.

Article VIII

Sessions of the Council

1. The Council shall meet in ordinary session once every two years. It may meet in an extraordinary session if it so determines or if requested by at least two thirds of the member States of the Centre or by at least two thirds of the members of the Executive Board.
2. The ordinary and extraordinary sessions of the Council shall be held at the headquarters of the Centre unless convened elsewhere in pursuance of a decision taken at a previous session of the Council.
3. Decisions of the Council shall normally be by consensus.
4. Subject to this Constitution, the Council shall determine its own procedure, including that for the convening of its sessions, quorum, the conduct of business thereat and at other times, and for the rotation of the office of Chairman and other offices among the members of the Council.
5. The provisions that the Council may make under paragraph 4 of this Article for the dispatch of business at times when it is not meeting, may if it so determines, include arrangements under which the exercise of any function of the Council under this Constitution is delegated, subject to such conditions as the Council may specify, to a committee of the Council, the Executive Board or the Executive Director of the Centre.
6. The Council may, on the recommendation of the Executive Board and subject to its procedure, invite such persons, Governments or institutions as it deems desirable to attend all or particular sessions of the Council as observers.
7. If a member of the Council is unable to attend a meeting of the Council and it is not convenient to postpone the meeting, the member State of the Centre which he represents may, by notice in writing delivered to the Executive Director to act as a member of the Council for that meeting, and a person so appointed

shall, in respect of the meeting for which he is appointed to act, have all the rights and duties of a member of the Council.

Article IX

Executive Board - establishment, composition and functions

1. There is hereby established the Executive Board of the Centre.
2. The Executive Board shall consist of:
 - (a) the Executive Secretary of the United Nations Economic Commission for Africa;
 - (b) one third of the number of the member States of the Centre elected by the Council in accordance with the provisions of subparagraph (d) of paragraph 3 of Article 7 of this Constitution, who shall hold office in accordance with the provision of paragraph 3 of this Article;
 - (c) The Executive Director of the Centre, ex officio, in a consultative capacity, who shall act as Secretary of the Executive Board;
 - (d) Directors of national and subregional centres for solar energy.
3.
 - (a) One half of the member States as directed by the Council shall retire two years after they have been elected and shall be replaced by the same number of member States elected by the Council for that purpose;
 - (b) the remaining half of the member States shall retire four years after they have been elected and shall be replaced by the same number of member States elected by the Council for that purpose.
4. A member State of the Centre elected to serve on the Executive Board shall be represented thereon by the head of the national institution concerned with solar energy which the member State may designate for that purpose.
5. The Executive Board shall:
 - (a) subject to such directions of a general nature as the Council may give, have over-all responsibility for the execution of the work programme of the Centre and shall take all necessary steps to ensure the effective and rational execution of such work programme;
 - (b) consider the draft work programme and corresponding budget of the Centre submitted to it by the Executive Director of the Centre and submit them with such recommendations as it deems necessary for the approval of the Council;
 - (c) mobilize and co-ordinate assistance from co-operating Governments, States and institutions referred to in Article 13 of this Constitution;
 - (d) submit through its Chairman to each ordinary session of the Council a periodic report on the activities of the Centre including the financial statements of its income and expenditure;

- (e) propose for the consideration of the Council the annual and special contributions to be paid by member States of the Centre;
- (f) determine from time to time the offices of the secretariat other than those of the Executive Director and the Deputy Executive Director of the Centre and appoint persons to such offices;
- (g) propose for the approval of the Council the staff, financial and other regulations including those relating to secrecy of the Centre;
- (h) approve arrangements for the provision by the Centre of services in the field of solar energy to the member States of the Centre;
- (i) subject to such directions as the Council may give, supervise the co-ordination of the work of the Centre with that of such other institutions pursuing or interested in the same objectives as the Centre, as it may determine;
- (j) recommend to the Council the persons to be appointed Executive Director and Deputy Executive Director of the Centre;
- (k) establish such special or technical committees or departments as it may deem necessary or desirable and prescribe for such committees rules for the conduct of their affairs;
- (l) exercise such other powers and perform such other functions as are conferred or imposed upon it by this Constitution.

6. The Executive Board may delegate any of the powers and functions conferred or imposed on it by this Article to a committee of the Executive Board, the Executive Director of the Centre or as provided for in this Constitution.

Article X

Meetings of the Executive Board

1. The Executive Board shall meet in ordinary session once a year. It may meet in an extraordinary session if so requested by its Chairman or by two thirds of its members.
2. Meetings of the Executive Board shall be held at the headquarters of the Centre or such other convenient place as may be determined by the Executive Board.
3. Where for any reason the Chairman of the Executive Board is unable to attend a meeting of the Executive Board, the members of the Executive Board present shall elect from among themselves one of them to act as Chairman for that meeting.

4. Subject to the provisions of paragraph 3 of this Article, the Executive Board shall adopt its own procedure including that for the convening of meetings, quorum and the conduct of business thereat and at other times.

5. Subject to such directives as the Council may give, the Executive Board may invite such persons and representatives of such Governments or organizations other than those referred to in paragraph 2 of Article 9 of this Constitution as it may deem necessary or desirable to attend its meetings as observer.

Article XI

The Executive Director and the Secretariat

1. The Secretariat shall be headed by the Executive Director of the Centre who shall be appointed as provided for in this Constitution to serve in such office for a term of five years and shall be eligible for reappointment for another term of five years only.

2. The Executive Director of the Centre shall be the Chief Executive Officer of the Secretariat. He shall, in accordance with the policies, decisions and directives of the Council and the Executive Boards, have responsibility for the organization, direction and administration of the secretariat.

3. The Deputy Executive Director, who shall assist the Executive Director of the Centre in the discharge of his functions, shall be appointed as provided for in this Constitution to serve for a term of five years and shall be eligible for reappointment for another term of five years.

4. The Executive Director of the Centre shall with the assistance of the other officials of the secretariat among other things:

(a) service and assist the organs of the Centre in the performance of their functions;

(b) keep the functioning of the Centre under continuous review and, where appropriate, report the results of his review to the Council or the Executive Board for their action in that regard;

(c) submit the draft work programme and corresponding budget of the Centre to the Executive Board for its consideration;

(d) submit periodic reports on the activities of the Centre including financial statements of its income and expenditure to the Executive Board for its consideration;

(e) carry out the work programme of the Centre and co-ordinate the work of the Centre with that of such other institutions active or interested in the objectives of the Centre as the Executive Board may determine;

(f) undertake such work and studies and perform such services relating to the objectives of the Centre as may be assigned to him by the Council or the Executive Board and also make such proposals thereto as may assist in the efficient and harmonious functioning and development of the Centre, to the Council or the Executive Board as may be appropriate; and

(g) convene, in consultation with the chairmen of the organs of the Centre, the meetings of such organs in accordance with the provisions of this Constitution or as may be provided for thereunder.

5. The Executive Director and the Deputy Executive Director of the Centre shall be entitled to attend and participate at all sessions of the organs of the Centre or be represented thereat by a senior official of the secretariat designated by them except that, with respect to the sessions of the Council or the Executive Board, the Executive Director or Deputy Executive Director of the Centre or the person for the time being acting for them as such shall attend and participate.

Article XII

Financial provisions

1. The financial resources of the Centre shall consist of annual and special contributions from the member States of the Centre; assistance, aid, loans, gifts, bequests or grants from Governments, international organizations, financial institutions, public or private institutions, associations, juridical or individual persons; and fees and other charges levied by the Centre for services rendered under the provisions of this Constitution.

2. Subject to such financial regulations as the Council may make, the budget of the Centre shall be administered by the Executive Director of the Centre under the supervision of the Executive Board.

3. The Executive Director and Deputy Executive Director of the Centre may, with the approval of the Executive Board, receive directly gifts, bequests, aid and other resources from Governments, public, private and international institutions, associations, juridical or individual persons and from Governments, States or institutions with which the Centre has established relations under the provisions of Article 13 of this Constitution, and may for this purpose, enter into related agreements.

Article XIII

Co-operating States and institutions

1. In pursuance of its objectives, the Council may seek and maintain active co-operation with Governments or States not parties to this Constitution and with institutions, or organizations (collectively referred to in this Constitution as "Co-operating States and institutions"), which are desirous of assisting the Centre or its member States in achieving the objectives of the Centre.

2. Subject to the provisions of this Constitution, the Council may enter into arrangements with co-operating States and institutions, defining methods of co-operation in general or relating to individual activities or projects.

3. The Council or the Executive Board may entrust the United Nations Economic Commission for Africa on behalf of the Centre with:

(a) the collection of and the accounting for contributions due from member States of the Centre under the provisions of this Constitution; and

(b) seeking assistance from co-operating States and institutions for the implementation of approved projects of the Centre and acting as executing agency in respect of such projects in respect of which it has been able to obtain assistance from co-operating States and institutions under the provisions of this subparagraph.

4. The United Nations Economic Commission for Africa shall, through its representative, keep the Council, the Executive Board and the Executive Director as the case may be, informed of contributions and assistance received and acts undertaken by the United Nations Economic Commission for Africa under the provisions of paragraph 3 of this Article.

Article XIV

Status, capacity, privileges and immunities

1. To enable it to achieve its objectives and perform the functions with which it is entrusted, the Centre shall possess in the territory of each member States of the Centre juridical personality. For these purposes, the status, capacity, privileges, immunities and exemptions set forth in paragraphs 2 to 13 of this Article shall be accorded to the Centre in the territory of each member State of the Centre.

2. The Centre shall for the purposes of this Constitution have the capacity:

(a) to enter into contracts;

(b) to acquire and dispose of immovable or movable property; and

(c) to sue and be sued.

3. The Centre, its property and assets shall enjoy immunity from every form of legal process except insofar as in any particular case it has, through the Executive Director of the Centre, expressly waived its immunity; provided however that no waiver of immunity shall extend to any measure of execution.

4. The headquarters of the Centre shall be inviolable. The property and assets of the Centre shall be immune from search, requisition, confiscation, expropriation and any other form of interference whether by legislative, executive, judicial, or administrative action.

5. The archives of the Centre and in general all documents belonging to it or held by it shall be inviolable.
6. The Centre, its property, assets, income and transactions shall be exempt from all taxation and from customs, duties and prohibitions and restrictions on imports and exports in respect of articles imported or exported by the Centre for its official use. The Centre shall also be exempt from any obligation relating to the payment, withholding or collection of any tax or duty, in accordance with existing practices as applied to the United Nations Economic Commission for Africa.
7. Representatives of the member States of the Centre who are not otherwise officials of the United Nations or of the specialized agencies of the United Nations shall enjoy such privileges and immunities as are provided mutatis mutandis by Article IV of the Convention on Privileges and Immunities of the United Nations.
8. Officials of the Centre who are not otherwise officials of the United Nations or of the specialized agencies of the United Nations shall enjoy such privileges and immunities as are provided mutatis mutandis by Article V of the Convention of Privileges and Immunities of the United Nations.
9. Without prejudice to the foregoing provisions, the member States of the Centre undertake to accord to all representatives of the member States of the Centre, all officials of the Centre, co-operating States and institutions and experts providing advice or assistance to the Centre, such facilities and courtesies as are necessary for the exercise of their functions in connexion with the Centre.
10. The Executive Director of the Centre shall have the right and duty to waive the immunity of any official of the Centre who is not an official of the United Nations or of a specialized agency of the United Nations in cases where in his opinion the immunity would impede the cause of justice and can be waived without prejudice to the interests of the Centre.
11. All persons undergoing training or taking part in a scheme for the exchange of personnel at the headquarters of the Centre or organized elsewhere within the territory of a member State of the Centre in pursuance of the provisions of this Constitution shall have the right of entry into, sojourn, or exit as is necessary for the purpose of their training or the exchange of personnel. They shall be granted facilities for speedy travel and visas, where required, shall be issued promptly and free of charge.
12. Officials of the United Nations or specialized agencies of the United Nations performing functions in connexion with the Centre shall respectively enjoy appropriate privileges and immunities provided under the Convention on Privileges and Immunities of the United Nations and the Convention of Privileges and Immunities of the Specialized Agencies.

13. The Centre shall co-operate at all times with the appropriate authorities of the member States of the Centre to facilitate the proper administration of justice, secure the observance of national laws and prevent the occurrence of any abuse in connexion with the privileges, immunities and facilities mentioned in this article.

14. The Executive Director of the Centre shall conclude with the member State in whose territory the headquarters of the Centre is established an agreement concerning the privileges and immunities to be granted to the Centre.

Article XV

Amendments

1. Any member State of the Centre may submit proposals for the amendment of this Constitution.

2. Any such proposals shall be submitted to the Executive Director of the Centre who shall transmit them to the other States members of the Centre.

3. The Constitution shall be amended by a two-thirds majority of the member States of the Council.

4. The Council shall make rules for the application of the provision of this Article.

Article XVI

Withdrawal and lapse of membership

1. Any member State of the Centre wishing to withdraw from the Centre shall give the Executive Director one year's notice in writing. If at the expiration of such period the notice is not withdrawn, the member State which submitted the notice shall cease to be a member of the Centre.

2. During the period of one year referred to in paragraph 1 of this Article, a member State of the Centre which has given its notice of withdrawal, shall have all the rights of a member State, shall observe the provisions of this Constitution and shall remain liable for the discharge of its obligations thereunder.

3. (a) Membership of a State member of the Centre shall be deemed by the Council to have lapsed if:

- (i) in spite of written reminders it has failed to meet its financial obligations towards the Centre for three consecutive years;
- (ii) it has failed to fulfil its other obligations under this Constitution; or
- (iii) it has failed to comply with the decisions of the Council.

(b) The Council shall prescribe the time during which membership of the Centre shall be deemed to have lapsed under the provisions of subparagraph (1) of this paragraph and the conditions governing that lapse of membership.

(c) A member State of the Centre whose membership has lapsed under the provisions of subparagraph (1) of this paragraph shall, during the period that its membership is deemed to have lapsed cease to derive any benefit from the activities of the Centre or be represented on any of the organs of the Centre and shall be subject to such other disadvantages as the Council may determine.

(d) The lapse in membership of a member State of the Centre shall not relieve that member State from the fulfilment of its financial obligations incurred prior to the lapse, unless the Council decides otherwise.

(e) The expiry of the period of lapse or the termination of voluntary withdrawal from the membership of the Centre shall be subject to such terms and conditions as the Council may stipulate and shall be communicated by the Executive Director to the member State concerned and to the Executive Secretary of the United Nations Economic Commission for Africa.

Article XVII

Settlement of disputes

Any dispute that may arise among the member States or between a member State and any organ of the Centre other than the Council regarding the interpretation or application of the Constitution shall, unless amicably settled, be referred to the Council, whose decision shall be final.

Article XVIII

Dissolution

1. The Centre may be dissolved by a two-thirds majority of the States members of the Centre at a special meeting duly summoned for the purpose of dissolving the Centre.
2. For purposes of paragraph 1 of this Article a special meeting shall not be duly summoned unless not less than six months written notice of it has been given to States members of the Centre.
3. Upon the Centre being dissolved for any reason whatever, its assets and liabilities shall vest or be deemed to have vested without further assurance in a liquidator appointed by the special meeting of the Centre. The liquidator shall arrange for the orderly dissolution of the Centre.

Article XIX

Final and transitional provisions

1. This Constitution, of which the English and French texts are equally authentic, shall be deposited with the Executive Secretary of the United Nations Economic Commission for Africa.
2. The Constitution shall enter into force when signed on behalf of at least seven of the States members of the United Nations Economic Commission for Africa and the Organization of African Unity and shall be open for signature at the Office of the Executive Secretary of the United Nations Economic Commission for Africa.
3. Instruments of ratification, acceptance or approval shall be deposited with the Executive Secretary of the United Nations Economic Commission for Africa.
4. A State referred to in Article 14 of this Constitution which is desirous of becoming a member of the Centre after the entry into force of this Constitution, may do so by depositing with the Executive Secretary of the United Nations Economic Commission for Africa its instrument of accession to this Constitution.
5. The Executive Secretary of the United Nations Economic Commission for Africa shall transmit certified copies of this Constitution and information concerning ratification, acceptance, approval or accession to this Constitution to States members of the Centre and all States members of the United Nations Economic Commission for Africa and the Organization of African Unity.
6. The Executive Secretary of the United Nations Economic Commission for Africa shall call the first meeting of the Council and, until the secretariat of the Centre is established, its functions shall be performed by the secretariat of the United Nations Economic Commission for Africa.

DONE at _____ this _____ day of _____ 1979.

IN WITNESS WHEREOF the undersigned being duly authorized have signed this Constitution.

Country	<u>Name and signature</u>	<u>Date</u>
Algeria	_____	_____
Angola	_____	_____
Benin	_____	_____
Botswana	_____	_____
Burundi	_____	_____
Cameroon	_____	_____
Cape Verde	_____	_____
Central African Empire	_____	_____
Chad	_____	_____
Comoro	_____	_____
Congo	_____	_____
Djibouti	_____	_____

<u>Country</u>	<u>Name and signature</u>	<u>Date</u>
Egypt	_____	_____
Equatorial Guinea	_____	_____
Ethiopia	_____	_____
Gabon	_____	_____
Gambia	_____	_____
Ghana	_____	_____
Guinea	_____	_____
Guinea-Bissau	_____	_____
Ivory Coast	_____	_____
Kenya	_____	_____
Lesotho	_____	_____
Liberia	_____	_____

<u>Country</u>	<u>Name and signature</u>	<u>Date</u>
Libya	_____	_____
	_____	_____
Madagascar	_____	_____
	_____	_____
Malawi	_____	_____
	_____	_____
Mali	_____	_____
	_____	_____
Mauritania	_____	_____
	_____	_____
Mauritius	_____	_____
	_____	_____
Morocco	_____	_____
	_____	_____
Mozambique	_____	_____
	_____	_____
Niger	_____	_____
	_____	_____
Nigeria	_____	_____
	_____	_____
Rwanda	_____	_____
	_____	_____
Sao Tome and Principe	_____	_____
	_____	_____

<u>Country</u>	<u>Name and signature</u>	<u>Date</u>
Senegal	_____	_____
Seychelles	_____	_____
Sierra Leone	_____	_____
Somalia	_____	_____
Sudan	_____	_____
Swaziland	_____	_____
Togo	_____	_____
Tunisia	_____	_____
Uganda	_____	_____
United Republic of Tanzania	_____	_____
Upper Volta	_____	_____
Zaire	_____	_____
Zambia	_____	_____

E/CN.14/713
E/CN.14/NRD/E/25
Annex II

DRAFT CONSTITUTION
OF THE SOLAR ENERGY SOCIETY OF AFRICA
PROPOSED BY THE PARTICIPANTS
IN THE REGIONAL SEMINAR ON SOLAR ENERGY IN AFRICA
HELD IN NIAMEY, REPUBLIC OF THE NIGER,
FROM 8 to 13 JANUARY 1979

DRAFT CONSTITUTION
OF THE SOLAR ENERGY SOCIETY OF AFRICA

Preamble

The scientists present at the regional seminar on solar energy in Africa held in Niamey, Republic of Niger, from 8 - 13 January 1979;

Mindful of the benefits to be gained by sharing practical experiences, technical and scientific know-how, between and among scientists, engineers and technicians working in various institutions in the African region concerned with solar, wind and bio-methane energy,

Realizing that these benefits can best be achieved by co-operation among African countries through the establishment of an African Solar Energy Association,

HEREBY AGREE on the following draft constitution for submission to a constituent assembly to be convened for the purpose of establishing a solar energy society of Africa:

Article I

Establishment and name

There is hereby established a learned Society to be known as the Solar Energy Society of Africa (hereinafter referred to as "the Society") which shall operate and be governed in accordance with the provisions of this Constitution.

Article II

Definitions

For the purpose of this Constitution:

- "Society" means the Solar Energy Society of Africa;
- "Council" means the Council of the Solar Energy Society of Africa;
- "President" means the President of the Solar Energy Society of Africa;
- "Secretary" means the Secretary of the Solar Energy Society of Africa.

Article III

Objectives of the Society

The Society shall have the following objectives:

- (a) to promote the development of solar, wind and bio-methane energy and their use in Africa;

- (b) to provide a forum for discussion and co-operation among scientists, engineers, technicians and associations working on solar energy in Africa;
- (c) to provide information on scientific and technical research and discoveries;
- (d) to establish and maintain professional standards among scientists, engineers and technicians working in the field of solar energy;
- (e) to help to elaborate solar energy programmes in the African continent;
- (f) to assist African national Governments in the acquisition and training of specialized personnel in the solution of their manpower requirements in the field of solar energy;
- (g) to publish a liaison bulletin and/or publications in the field of solar, wind and bio-methane energy development in Africa.

Article IV

Headquarters

The headquarters of the Society shall be at such place as the Constituent Assembly may determine.

Article V

Membership of the Society

1. Full membership of the Society will be open to all African scientists, engineers, and technicians or others working in Africa concerned with any aspect of solar energy;
2. African institutions engaged in solar energy may be admitted to affiliate membership of the Society.

Article VI

Admission to membership

1. Subject to the provisions of Article 5, any person desirous of becoming a member of the Society shall submit an application form. The Secretary shall, on behalf of the President and with the approval of the Council, admit such a person to membership of the Society.
2. Any African institution desirous of becoming a member of the Society shall submit an application in writing to the Secretary. The Secretary shall, on behalf of the President, and with the approval of the Council, admit such an institution to affiliate membership of the Society.
3. The President may with the approval of the Council invite an institution to affiliate membership of the Society.

Article VII

Status of the Society

1. To enable it to achieve its objectives and perform its functions, the Society shall, subject to the laws of the host country, possess juridical personality with legal capacity to acquire and dispose of movable and immovable property, to enter into contracts, to sue and to be sued.
2. The Society shall enter into an agreement with the Government of the host country concerning the provision of premises, facilities, services, privileges and immunities deemed necessary for the purposes and efficient discharge of its functions.

Article VIII

Membership fee

1. Individual minimum membership fee as may be determined by the Council of the Society shall become payable immediately on admission and, thereafter, on the first day of every calendar year, it being understood that all rights of membership will be honoured.
2. The minimum institutional membership fee shall be determined from time to time by the Council of the Society and shall become payable on admission and, thereafter, on the first day of every calendar year, with attendant benefits.

Article IX

Removal from membership

Membership of the Society shall be deemed by the Council to have ceased after a member ceases to comply with the provisions of this Constitution.

Article X

Officers of the Society

1. There shall be a President, two Vice-Presidents, a Secretary, a Treasurer elected every two years at a general meeting.
2. All members of the Council are eligible for re-election for a second period.
3. The retiring President of the Society shall automatically become an honorary member of the Council of the Society.

Article XI

Council of the Society

1. The Council of the Society shall consist of the officers of the Society and five other members elected every two years at a general meeting of the Society.

2. The Council shall meet at least once a year.
3. The Council shall from time to time make rules and regulations for the proper and efficient conduct of the Society, such rules and regulations shall be submitted to the general assembly of the Society for adoption by single majority.

Article XIII

Functions of the officers

1. The President shall be the spokesman of the Society and shall preside at all meetings of the Society and the Council. In the absence of the President, one of the Vice-Presidents shall preside in the order in which they are elected.
2. The Secretary shall keep the records of the meetings of the Council and of the Society and shall draw up the role of membership. The Secretary shall, in addition to what is laid down in Article 6 of this Constitution, perform such other functions as are from time to time assigned to him by the Council.
3. The Treasurer shall be responsible to the Council for management of the financial affairs of the Society.

Article XIII

Statutory meetings

1. There shall be a general meeting of the Society once every two years at such place and date as may be decided at the general biennial Conference of the Society called for the purpose of reviewing progress on solar, wind and biogas energy use in Africa, new methods for the promotion of these energies in Africa, the reading of technical papers relevant to Africa and the election of the officers of the Society.
2. The last meeting of the General Meeting shall be a business meeting at which new officers shall be elected.
3. The Council shall meet at the beginning and at the end of every General Meeting and at such other times as may be decided at a meeting of the Council.
4. The President, at his discretion, may at any time call a special meeting of the Council.

Article XIV

Financial provisions

1. The financial resources of the Society shall include membership fees paid by full members and affiliate members; assistance, aid, gifts, loans, bequests or grants from Governments, financial institutions, international organizations, individuals, proceeds or sales of the publications of the Society; fees and other charges levied by the Society rendered under the provisions of this Constitution.

2. Subject to such financial regulations as the Council may make, the budget of the Society shall be administered by the Treasurer under the President of the Society.

Article XV

Quorum

The quorum of the Council shall be six, including at least two office bearers. The quorum at the last meeting of a conference for the purpose of business and election of officers shall be one-fourth of the membership.

Article XVI

Honours and awards

The Society may on the recommendation of the Council or another committee set up for the purpose, confer honours on any of its members or other persons for meritorious service to solar energy in Africa. The title or citation for the purpose of such an award shall be subject to the approval of the Council.

Article XVII

Publications

1. The Society will publish a bulletin twice each year as well as proceedings of its bi-annual meeting.
2. The format of the publications of the proceedings shall conform to that laid down by the Council.
3. The Council may authorize other occasional or regular publications, and may decide on the title, format and periodicity of such publications.

Article XVIII

Amendments

1. This Constitution may be amended by a two-thirds majority of the general meeting.
2. No proposed amendment to this Constitution shall be considered by the general meeting unless it shall have been notified by the Secretary to all members of the Society three months prior to such consideration.
3. Any member of the Society will have the right to propose amendments to this Constitution.

Article XIX

Dissolution

1. The Society may be dissolved by a two-thirds majority of full members present at a special meeting of the Society especially summoned for the purpose.
2. For purposes of paragraph 1 of this Article a special meeting shall not be duly summoned unless not less than three months written notice of it has been given to members of the Society.
3. All assets and liabilities of the Society at the time of its dissolution shall devolve without further assurance upon a liquidator appointed by the Society to call in all outstanding assets of the Society, pay all its debts, and distribute the residue, if any, among societies, organizations or institutions concerned with the advancement of Solar energy studies, researches and work in Africa.

Article XX

Transitional provisions

1. This Constitution, of which the English and French texts are equally authentic, shall, until such time as the Society is established, be deposited with the Executive Secretary of the United Nations Economic Commission for Africa, and thereafter with the Secretariat of the Society.
2. This Constitution shall enter into force when signed by the persons or institutions mentioned in Article 5 of this Constitution and shall be open for signature at the office of the Executive Secretary of the United Nations Economic Commission for Africa and at offices of the United Nations Development Programme in their subregions not later than the day of , 1979.

DONE AT

this

day of

1979.

IN WITNESS whereof the undersigned have signed this Constitution on the date appearing under their signatures: