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**INTERNATIONAL WORKSHOP ON APPLIED SOLAR ENERGY
Tashkent, Uzbekistan, 9-14 June 1997**

REPORT

Summary

The Workshop was organized to promote international exchanges of information and experience on the use of solar energy and to facilitate international cooperation in bringing solar energy technologies to the market. Particular attention was paid to assisting the integration of the Central Asian countries in transition into the European economy and multilateral collaborative programmes and networks.

The participants agreed that a variety of marketable solar energy technologies exists and that they should be increasingly used. Studies of the markets of eastern Europe and the Commonwealth of Independent States (CIS) reveal that many of these countries have a good potential and a need for renewable energy application. Energy shortages, inefficiencies and import dependencies could be mitigated through the use of solar and other domestic renewable energy sources. Solving ecological problems has become a further important motivation for a local production and use of renewable energy technologies.

The Workshop stressed the need for a stable legal framework, supportive Government policies and incentive measures to attract private investors in the production, marketing and use of the new renewable technologies. Private investments are considered to be an essential component of economically viable projects. Renewable energies should be used also in combination with conventional energies and energy efficiency measures. This would enhance their market penetration, the same as large-scale and large-size use such as solar power plants.

The United Nations Framework Convention on Climate Change (UNFCCC) is expected to become a powerful instrument for environmental and climate protection throughout the world. Since solar energy could make a significant contribution to these aims, promoting its use should form part of the global efforts for implementing the Convention and reaching sustainable development.

I. WORKSHOP ORGANIZERS AND SPONSORS

1. The Workshop was organized and sponsored by the Academy of Sciences, State Committee for Science and Technology, Scientific Association "Physics-Sun", Institute of Power Engineering and Automation and National Bank for Foreign Economic Activity of the Republic of Uzbekistan as well as the Central Asia Energy Advisory Group/EU Synergy Programme, United Nations Economic Commission for Europe (UN/ECE), European Commission, IEA Solar PACES Programme, United Nations Educational, Scientific and Cultural Organization (UNESCO) and United Nations Industrial Development Organization (UNIDO).

2. The Workshop was supported by contributions in kind as well as financial support from the sponsors, including a major financial contribution under the European Union INCO Programme and financial support under the IEA SolarPACES Programme to finance, among other things, the participation of experts from central and eastern Europe and the Commonwealth of Independent States (CIS). The consulting company International Centre for Energy and Environmental Technology Leipzig GmbH (ICEU) managed the project under assignment by the European Commission and carried out preparatory expert work, project organization, financing arrangements, workshop follow-up activities and other tasks in close cooperation with the Uzbek host organizations and the UN/ECE secretariat.

3. The Chairman of the Organizing and Programme Committee was Mr. Kadyr Gulamov, Chief Scientific Secretary, Academy of Sciences of the Republic of Uzbekistan. The Vice-Chairmen were Mr. Pulat Riskiev, Deputy Chairman, State Committee of Science and Technology; Mr. Mukhtar Saidov, Head, Scientific Association "Physics-Sun"; Mr. Marat Tashpulatov, Executive Secretary, Central Asia Energy Advisory Group; Mr. Roman Zakhidov, Director, Institute of Power Engineering and Automation. The Executive Secretary was Mr. Sultan Suleimanov, Scientific Association "Physics-Sun".

II. PURPOSE OF THE WORKSHOP

4. Marketable solar energy technologies are available and should be increasingly used as this would lead to economies of scale and lower solar energy unit costs. The Workshop was organized to promote international exchanges of information and experience and to facilitate international contacts and cooperation for bringing solar energy technologies to the market. Particular attention was paid to assisting the integration of the Central Asian countries in transition into the European economy and multilateral cooperative programmes.

III. ATTENDANCE

5. The Workshop was attended by about 70 participants from 22 countries: Albania, Armenia, Austria, Azerbaijan, Belarus, Bulgaria, France, Georgia, Germany, Greece, Kazakhstan, Kyrgyzstan, Republic of Moldova, Romania, Russian Federation, Saudi Arabia, Spain, Tajikistan, Turkmenistan, Ukraine, United Kingdom, and Uzbekistan, and by representatives of UN/ECE, the World Bank, European Parliament, Central Asia Energy Advisory Group/EU Synergy Programme, IEA SolarPACES Programme, World Energy Council and the European Photovoltaic Industry Association (EPIA).

IV. ELECTION OF OFFICERS

6. Mr. Kadyr Gulamov (Uzbekistan) was elected Chairman of the Workshop.

V. PROGRAMME

7. The programme comprised working sessions, a poster session, a round-table discussion and a one-day technical visit.

VI. OPENING SESSION

8. The Workshop was opened by Mr. T. Juraev, President of the Academy of Sciences of the Republic of Uzbekistan, who welcomed the participants and wished them a successful meeting and pleasant stay in Uzbekistan. Mr. Juraev said that solar energy is of particular interest to Uzbekistan, since the country is located in the sun belt of the earth. He expressed the wish that the Workshop would help to increase solar energy use as a contribution to sustainable development and improving people's daily life.

9. Mr. T. Aripov, Adviser of the President of the Republic of Uzbekistan, greeted the participants on behalf of the Government and wished them a useful and enjoyable stay in the Uzbek capital. He referred to the important and in-depth reforms which are underway, including in science and technology. With a large number of energy specialists and more than 300 sunny days a year, Uzbekistan was well endowed to make greater use of solar energy in the future. Mr. Aripov expressed appreciation to all sponsor organizations for their contributions to this international Workshop.

10. Mr. P. Khabibullaev, Chairman of the State Committee for Science and Technology of the Republic of Uzbekistan, stated that Uzbekistan had a long tradition in research and development, including in solar energy. A number of institutes and recognized specialists are involved in furthering the development and utilization of solar energy in the country. Uzbekistan has the largest solar furnace in the world. Hopefully, the Workshop would lead to increased cooperation and closer international contacts in solar energy research and application.

11. On behalf of the Executive Secretary of UN/ECE, Mrs. J. Andorfer, Economic Affairs Officer, Energy Division, thanked the Government of Uzbekistan, the Uzbek host organizations and the other sponsors for having invited UN/ECE to cooperate in this international Workshop. Increased use of solar energy could contribute significantly to the rational use of natural resources and to environmental and climate protection. The Workshop is a timely and important event and UN/ECE was pleased to be associated with it.

12. Mr. W. Grasse, Executive Secretary, IEA SolarPACES Programme, expressed appreciation for the initiative taken by the Academy of Sciences of the Republic of Uzbekistan and the other Uzbek hosts for organizing this international gathering on solar energy application. The IEA SolarPACES Programme was pleased to be among the sponsors of this meeting. Mr. Grasse stressed the need for building large size solar power plants and harnessing international financial and technical cooperation for this purpose, if solar energy is to make a significant contribution to a clean, safe and economical energy supply in the near future. Hopefully, the Workshop would also address this issue.

13. On behalf of Mr. J.M. Sers, European Commission, Directorate-General XVII (Energy), who was unable to attend, Mr. J. Matthies, General Manager of ICEU and Senior Adviser, Central Asia Energy Advisory Group/EU Synergy Programme, conveyed greetings to the Workshop organizers and participants and best wishes for a successful meeting. He thanked the Uzbek host

organizations and the other sponsors for their valuable contributions to this cooperative event, which was the first of its kind in region since the countries of Central Asia became politically independent. The region was well chosen because along with the restructuring of the energy sector, a substantial demand and opportunities for international cooperation are expected to develop for sustainable energy technologies. The presentation about the European Union's policy on international cooperation in renewable energy, which Mr. Sers had prepared and planned to present to the Workshop, was read by Mr. A. Kuxenko, Manager of ICEU.

VII. WORKING SESSIONS

Session I. Overview of the current marketable solar energy technologies in the world and the prospects for their use

Chairmen: J. Bonda (EPIA), M. Saidov and R. Zakhidov (Uzbekistan)

14. The following presentations were made and discussed: J. Matthies/A. Kuxenko, ICEU, Germany: Assessment of the market potential for solar energy technologies in Central Asia; J. Bonda, EPIA: Photovoltaics - Market access and international cooperation possibilities; J.R. Frisch, World Energy Council: Renewable energy resources - Opportunities and constraints 1990-2020; L. Jesch, The Franklin Company, UK: Solar thermal power generation projects in Europe; D. Mayer, Centre for Energy Studies, France: Sustainable development of rural areas - Decentralized electrification; O. Popel, IVTAN, Russian Federation: Development and utilization of solar energy in the Russian Federation; M. Saidov, Academy of Sciences, Uzbekistan: Priorities of R&D in applied solar energy in Uzbekistan; Y. Vikhorev, National Committee on Renewable Energy, Ukraine: The use of solar energy in Ukraine; C. Tantareanu, RENEL Research Centre, Romania: Romanian efforts to develop applied solar energy technologies; D. Danailov, Committee of Energy, Bulgaria: Renewable energy use in Bulgaria; U.A. Tajiev, Institute of Power Engineering, Uzbekistan: Prospects of ecologically safe energy supply based on renewable sources in Uzbekistan; A. Marjanyan, Ministry of Energy, Armenia: Prospects of solar power development in Armenia; L.A. Dubovik, Committee on Energy Saving, Belarus: National programme on energy saving and the role of solar and other renewable energy sources; A. Shimashkevich, Institute of Applied Physics, Republic of Moldova: R&D of solar energy in the Republic of Moldova; N. Meladze, Green Earth Foundation, Republic of Georgia: Development and prospects of renewable energy in Georgia; F. Aliyev, Ecoenergy Academy, Azerbaijan: Non-traditional renewable energy resources in Azerbaijan. Two papers were distributed to the participants since the authors were unable to attend, namely K. Touryan, National Renewable Energy Laboratory, USA: Status of marketable solar energy technologies; and M. Macias, CIEMAT, Spain: Renewable Energy in Spain.

Main conclusions

15. A variety of marketable solar and other renewable energy technologies exists and experience has been gained with their use in many parts of the world, but several factors are hindering their wider use. Many of the factors influencing the market access of these technologies are the same throughout Western Europe and the CIS including the Central Asian region, while others are specific to certain countries and subregions. Shortage of financing for new technologies such as solar energy is considered to be one of the major constraints for their marketing. Moreover, in eastern Europe and the CIS, the fundamental economic reforms and restructuring have led to a disruption and reduction in industrial activity, which affected solar energy development and utilization.

16. With strengthened international cooperation, promotion of subregional collaboration schemes and the creation of an attractive investment climate, local production and use of solar energy technologies, for which many eastern European and CIS countries have a good potential and urgent need, could be revitalized. Energy shortages, inefficiencies and import dependencies could be mitigated through the use of solar and other domestic renewable energy sources. Renewable energies should be used also in combination with conventional energies and energy efficiency measures. This would enhance their market penetration, the same as large-scale and large size use such as solar power plants. With financial and technical cooperation from foreign investors under consortia, joint ventures and other forms of partnerships with local participation, new production facilities could be set up in the CIS including Central Asian region for solar photovoltaic cells, modules or raw materials and for solar thermal collectors and other components for solar technologies. Local production would engage local labour and other skills and represent an economical and effective solution for entering the domestic and neighbouring markets.

17. Most speakers stressed the need for supportive Government policies and favourable public and private financing mechanisms for getting the new renewable technologies into the market. International studies and scenarios such as those of the World Energy Council, have been pointing out too, that without a strong driving force or motivation, the penetration of the new renewables such as solar energy into the energy mix will only be very slow. Currently, supplies from renewable sources amount to about 20% of the 8 billion tons of oil equivalent of primary energy use in the world and 10% in the UN/ECE region, which accounts for half of the global primary energy consumption. The renewables share is mainly accounted for by large hydropower and biomass. The combined share of solar and wind energy is in the order of 2% and under business as usual, the growth rate will be low. However, with a determined and vigorous effort throughout the world, the global share of solar and other new renewable energies in primary energy and electricity could be increased to 10%.

18. The United Nations Framework Convention on Climate Change (UNFCCC) is expected to become a powerful instrument for environmental and climate protection throughout the world. Protection measures required under the Convention would increase the costs of conventional fuels and energy. This and the CO₂ reduction aim would improve the competitive position of solar and other CO₂ benign energy sources. Growing pressure for implementation of the Convention and other international environmental agreements will have to be accompanied by reinforced international technical and financial cooperation. Since solar energy could make a significant contribution to environmental and climate protection, promoting its use should form part of the global efforts for sustainable development.

Session II. Financing schemes, subsidies and other incentives for solar energy projects

Chairmen: P.G. Gutermuth (Germany), O. Popel (Russian Federation) and T. Riskiev (Uzbekistan)

19. The following presentations were made and discussed: P. Palinkas, European Parliament: European Community action plan for renewable energy; J. Andorfer, UN/ECE: Overview of incentives for the use of renewable energy sources in the ECE region; P.G. Gutermuth, Federal Ministry of Economics, Germany: Policies and programmes of the German Government to encourage the use of renewable energies; D. Strack, Financial Engineering and Consulting SA.: Public and private co-financing of renewable energy projects; W. Hein, Federal Chancellery, Austria: Promotion of solar energy in Austria; E. Hido/B. Islami, Energy Efficiency Centre, Albania: Strategy for the promotion of solar heating in Albania.

Main conclusions

20. New renewable energy sources such as solar energy are facing many constraints on their way to the market. Their lack of competitiveness with conventional fuels and energy because of inherent as well as extraneous reasons was regarded as a main obstacle. Other major hindrances for the market penetration of renewable energies include insufficient political support, administrative hurdles, inadequate sources of financing, insufficient information, education and training as well as deficiencies in international cooperation. This unfavourable situation would not change through the market forces alone. Active intervention and support by Governments and other public and private sector entities is and will be needed to help overcome the obstacles for the use of solar and other renewable energies. This has been recognized by national Governments and international organizations. Therefore, most countries in the ECE region have incentive schemes and in many member countries a great variety of support measures is available for R&D, production and use of renewable energy technologies.

21. A new strategy for promoting renewable energy sources is being launched in the European Union (EU) where the use and support of these resources varies enormously among the member countries. A Green Paper was prepared to initiate a discussion on the strategy. The Green Paper says that increasing renewable energy use could lessen the EU's dependence on energy imports, help to reduce CO₂ emissions, encourage regional development and provide export opportunities in renewable energy technologies. It also examines policies and programmes, including financial support and harmonization of measures to promote renewables. After a consultation period, a comprehensive strategy (White Paper) and an action plan are planned to be adopted by the European Commission in 1997.

22. The most promising new renewable energy technologies in Western Europe are solar thermal, solar photovoltaic and wind energy for heating, cooling and electricity generation. However, without substantial support measures, they would not have entered the market so rapidly. The speakers gave examples of incentives and the results obtained. Very effective measures are subsidies, legal requirements, tax holidays and reductions, favourable loans and R&D leading to lower renewable energy costs. Renewable energy promotion agencies, information centres, advisory services, equipment directories, quality standards, training courses, fairs, exhibitions, special campaigns and many other initiatives had contributed to the success stories and increased use of renewable energies. The participants from eastern Europe and the CIS considered the information about the incentives employed in western Europe useful examples for their Governments in designing frameworks and strategies for renewable energy promotion.

23. Although Governments had to provide the framework needed to encourage and safeguard economic activities, private investments are an essential component of economically viable business ventures. In many countries, there is still no legal framework for international joint ventures and foreign direct investments. This is hampering private investments in small and large projects. Often, the private sector is not granted the same rights and opportunities as the State as entrepreneur. Some speakers shared the view that financing for solar energy projects, including large solar power plants, is available but what is lacking are good projects and risk guarantees. Moreover, subsidies for conventional fuel and electricity prices are putting new renewables such as solar energy at a disadvantage in many countries. There are now strong driving forces for solar and other renewable energy use and international financing arrangements are becoming increasingly innovative and sophisticated. The joint implementation scheme to meet the commitments under the UNFCCC, which is already used by several countries, is likely to boost the creation of international consortia for large projects which help to mitigate CO₂ emissions and climate change. Large solar power plants would fall into this category and the World Bank,

GEF and EBRD which are institutions administering joint implementation funds are expected to give increasing consideration to solar energy projects.

Session III. Networks and programmes for promoting multilateral cooperation in solar energy research, demonstration and utilization

Chairmen: M. Becker (Germany) and D. Mayer (France)

24. The following presentations were made and discussed: W. Grasse, Executive Secretary, IEA SolarPACES Programme: The SolarPACES network for worldwide cooperation; M. Becker, DLR, Germany: Cooperation in solar thermal technologies and applications within the SolarPACES Programme/Task III; V.S. Trukhov, Scientific Association "Physics-Sun", Uzbekistan: Solar energy units with Stirling engine; T. Salikhov, Scientific Association "Physics-Sun", Uzbekistan: Methods of measurement of temperature for solar furnaces; N. Korpeev, Academy of Sciences, Turkmenistan: Solar energy utilization in Turkmenistan and prospects for multilateral cooperation; L. Kulyuk, Institute of Applied Physics, Republic of Moldova: Solar energy semiconductor materials and solar cells; A. Obozov, KUN, Kyrgyzstan: Renewable energy resources in Kyrgyzstan; Z.A. Mansurov, Al-Farabi Kazak State National University, Kazakhstan: State of art of R&D on solar cells in Kazakhstan; J.S. Olias, CSIC, Spain: High power solar concentration with large Fresnel lenses. The paper by J.M. Sers, European Commission DG XVII: European Union Policy on international cooperation in renewable energy was distributed to the participants for information since the author was unable to attend.

Main conclusions

25. International cooperation already exists in all the countries participating in the Workshop. However, since the creation of the Commonwealth of Independent States, many former links had been discontinued and new professional contacts and cooperation had to be established. In many countries of eastern Europe and the CIS, there is an excellent availability of renewable energy resources such as solar and wind, and systematic R&D of solar energy conversion has been carried out since the 1960s. Therefore, the know-how for possible applications widely exists. What is mainly lacking for achieving technical improvements and practical utilization of the various renewable energy options is access to international cooperative programmes and networks, and financial support.

26. Several experts presented information about their activities and achievements in research, development, demonstration and utilization of solar energy technologies. Examples included development of semiconductor materials and solar cells using new methods, development of hybrid use like solar PV and wind, approaches for high concentration of light and experiences in high temperature investigations. A main objective of this work was to raise the efficiency and lower the unit cost of solar energy. Research institutes had a role to play in getting solar energy out of the laboratory and into the marketplace. As a result of the reforms, the countries of eastern Europe and the CIS including the Central Asian region are now laying more emphasis on applied research and promoting the practical use of the research results.

27. The information given by specialists from different countries and fields of R&D was evidence of the potential of universities and institutes in eastern Europe and the CIS for participation in multinational collaborative programmes such as those of the International Energy Agency (e.g. IEA SolarPACES, INTAS, IEA-PV, IEA Programme on Heating and Cooling) and the European Union (e.g. THERMIE, INCO, SYNERGY, etc.). Among other benefits, this would enable participation in research and testing

facilities, advanced technologies, international task forces, studies, publications, meetings and special campaigns. There was a need to facilitate the participation of eastern European and CIS countries in international collaborative programmes and networks. The present Workshop was making a welcome contribution in this direction.

28. Immediately following Working Session III, a one-hour Poster Session was held under the chairmanship of Mr. T. Salikhov (Uzbekistan) during which a large number of specialists from Uzbekistan provided information and discussed their research and development work and results in the field of solar energy with the foreign participants. The Poster Session provided an excellent and comprehensive overview of the large range of solar energy R&D issues dealt with by the science and technology community in Uzbekistan. Among the projects displayed at the session were the various facilities, activities and potential uses of the 1 MW solar furnace, which is the largest in the world.

Session IV: Presentation of project proposals and assessment of their potential to attract financing for implementation

Chairmen: L. Jesch (UK) and B. Mukashov (Kazakhstan)

29. The project outlines presented at the session and the names and addresses of the presenters are listed in the annex to this report. Persons interested in any of these projects should contact the presenters directly for further information.

Main conclusions

30. This workshop session brought to the fore the difficulties which entrepreneurs in the countries in transition to market economy structures are facing in their efforts to produce and market renewable energy technologies and services. Many constraints are similar to those encountered in western Europe such as lower conventional energy prices, shortage of equity funds and loans, inadequate marketing infrastructure and scarcity of information. Moreover, in most eastern European and CIS countries, the policy, legal, financial and institutional framework necessary to encourage the production and use of solar and other renewable energy technologies is still in its infancy.

31. Nonetheless, public and private enterprises have become active in the renewable energy business in these countries and are seeking foreign partners for technical and financial cooperation. This has become evident too in the project outlines presented during this workshop session. The problems are lack of investment capital and modern technology, but often also an unrealistic concept and wrong approach. As has been mentioned earlier, good projects are finding investors. A good project is a project from which all partners have a benefit. The forms of partnerships, joint ventures and business relations has to be suited to the individual project. The discussion emphasized the importance of local commitments, local contributions and a favourable investment climate for projects to be successful.

32. Studies of the markets, such as that carried out by ICEU for the Central Asian region, reveal that in many countries of eastern Europe and the CIS there is a general interest of potential consumers and a need for renewable energy application, especially for domestic and industrial water heating, water pumping and for electric power in remote areas for lighting and telecommunications. With the break-up of the Soviet Union, the independent countries have to adjust to a new energy situation and a major goal of energy policy is to reach as much energy self-sufficiency as possible. Domestically available renewable energy as a contribution to the energy supply and reduction of energy imports is gaining importance therefore.

33. Solving ecological problems has become a further important motivation for research institutes and industrial enterprises in the newly independent countries in jointly engaging in a local production of renewable energy equipment and components such as solar thermal collectors, solar photovoltaic cells and modules, solar houses to capture a share in the emerging and promising market. As conventional energy prices are expected to rise, renewable energy should become more competitive, especially in certain applications. An ecologically driven energy development with supportive Government policies and strengthened international financial support and technical cooperation for meeting environmental and climate protection commitments would lead to improved joint venture opportunities in the field of solar and other renewable energies throughout the world.

**Session V. Technical visit to the solar furnace near Tashkent
Round Table Discussion.**

Chairmen: K. Gulamov (Uzbekistan) and W. Grasse (IEA SolarPACES Programme)

34. During an extensive visit of the facilities of the 1 MW solar furnace, Mr. K. Gulamov, Mr. A. Abdurakhmanov and other Uzbek specialists informed the participants of the general characteristics, technical specifications, range of activities, buildings and installations comprising this large and impressive complex for multipurpose high temperature materials science. The complex started operations in 1987 and is now used mainly for the development, production and testing of new materials under concentrated solar radiation at high temperatures. Its peak concentration reaches 763 W/cm² or 11000 suns, corresponding to about 2700 ° C. Alongside with fundamental investigations of physical-chemical phenomena and superpure materials production, work is carried out on high temperature oxides technology. These materials, which possess unique exploitation and physical-chemical characteristics, such as small coefficient of thermal expansion, high refractory and thermotolerance to aggressive media, are useful, among other things, for space research and wide industrial applications. On their basis, a large variety of ceramics has been developed for construction, high refractory, optical, superconducting, electronics, chemistry and other uses.

35. After the visit, presentations were made by Mr. W. Roider, Acting Chief of Mission, The World Bank Resident Mission in Uzbekistan, on the World Bank's Activities in Renewable Energy Development; and by Mr. Kadyr Gulamov, Chief Scientific Secretary, Academy of Sciences of Uzbekistan, on the project of a Regional Centre for Solar Energy Development and Promotion. The presentations were followed by a round table discussion.

36. The participants were informed of the major technical assistance and financing initiatives of the World Bank and its affiliated institutions for renewable sources of energy. In the Central Asian countries, the World Bank has only just started to become active in the field of renewable energy development and deployment. A report has been prepared about opportunities for renewable energy development in Kazakhstan and Kyrgyzstan, which is to be discussed at a Regional Workshop in Almaty in September 1997. The report identifies the most promising renewables and makes a number of recommendations for getting them into the market.

37. The main recommendations applicable for both countries are the need for strengthening the institutional and promotional infrastructure, including the creation of an independent promotion agency for renewable energy sources and the improvement of the legal framework and investment conditions, to attract participation of the private sector. Further, the study recommends technical assistance in investment promotion and financing and in the enhancement of entrepreneurial skills through, for example, assistance in the development of incentive packages, design of investment projects, identification of financing mechanisms for viable projects, training of cadre personnel in the financial sector management, creation of a special fund dedicated for renewable energy projects, development of local

skills to carry out feasibility studies and provide a range of management consulting services, such as assistance in the preparation of a business plan, carrying out contract negotiations and other activities.

38. The project of turning the complex of the solar furnace in Uzbekistan into a Regional Centre for Solar Energy Development and Promotion stems from the advantages and economies that can be gained in concentrating individual efforts, carrying out activities jointly, sharing the use of facilities and meeting to exchange experiences. The Scientific Association "Physics-Sun" which is responsible for the operation of the solar furnace, is interested in broadening the cooperation with research institutes, industrial enterprises and solar energy users in Asia, Europe and other parts of the world. The buildings, laboratories and installations of the complex are suitable for research, testing, simulation, production, training activities, meetings, conferences, joint projects, task forces and other activities. The complex comprises a hostel and restaurant and has a good transport and communications infrastructure. It would be ideally suited to become a multipurpose Regional Centre for applied research, development, design, manufacturing, component assembly, industrial testing, equipment certification, training, information dissemination, organization of seminars and support to the solar industry and users in general. Technical and financial assistance from various donors will be necessary for the establishment and management of such a Centre.

39. The round table discussion focussed on the subjects of availability of funds and access to financing for renewable energy projects. The World Bank had several facilities including special grants such as the Global Environmental Facility (GEF), lines of credit and loans are available to public and private entrepreneurs from international financial institutions such as the IFC, EBRD, Asian Development Bank, Islamic Development Bank and other sources of funds. A major financing instrument for renewable energy projects was considered to become the financing of trade in emissions under the so-called joint implementation of the commitments under the Climate Convention. Other important funding programmes are those of UNDP and the European Union as well as a large number of bilateral aid and technical assistance schemes. Innovative financing mechanisms and incentive schemes are offered in many countries to encourage the production and use of renewable energy technologies, including tax holidays, lower import duties for selected components and accelerated depreciation of renewable energy investments. It is generally estimated that the loss of income to the state from such concessions is lower than the benefits derived from such projects.

40. After the discussion, the Chairmen of the working sessions I to IV (J. Bonda, P.G. Gutermuth, M. Becker and B. Mukashov) summed-up the main conclusions and recommendations of their sessions. For practical purposes, the conclusions have been reported under each working session above.

VIII. RECOMMENDATIONS OF THE WORKSHOP

41. The principal recommendations of the Workshop were as follows:

(1) The Workshop has been valuable for raising the awareness of Government representatives, policy-makers, financing institutions and the scientific and business community regarding the potential and benefits that exist for the use of solar and other renewable energy sources in eastern Europe and the CIS including Central Asia. Moreover, the Workshop has been useful for strengthening cooperation among the newly independent Central Asian countries. Therefore, international organizations like the United Nations, the European Commission and others should continue to organize international meetings and pay special attention to the Central Asian region when promoting solar and other renewable energies.

(2) The UN/ECE secretariat is requested to disseminate the report on the Workshop, draw particular attention to the recommendations and project outlines listed therein and encourage the participation of organizations within and outside the United Nations in the recommended follow-up activities.

(3) The study prepared by ICEU on the market potential for solar energy technologies in Central Asia and the report prepared by the World Bank on opportunities for renewable energy development in Kazakhstan and Kyrgyzstan should be made available on request to interested parties to promote joint ventures and other forms of international cooperation for the implementation of renewable energy projects in the Central Asian countries.

(4) Governments should provide a supportive legal and policy framework for renewable energy development and utilization to create the stable basis and motivation required to attract private investments. The experience gained with incentive packages in many countries could be useful in this regard.

(5) International banks such as the World Bank should make available credit lines to local development financing institutions in the CIS countries to enable them to give credits at favourable conditions for the start-up of local manufacturing enterprises in the renewable energy sector.

(6) The Scientific Association "Physics-Sun", Uzbekistan, should prepare a project description for the proposed Regional Centre for Solar Energy Development and Promotion and be invited to present and discuss it with potential financiers and investors at Regional Workshop on renewable energy scheduled to be organized by the World Bank in Almaty in September 1997.

(7) A workshop or seminar should be organized in the Central Asian region with participation of financial institutions and the presentation of case studies, to disseminate information and experiences on financing mechanisms and incentive packages available for renewable energy technology promotion and how to access them.

(8) Large solar power plants should be built and solar energy should be integrated in conventional power plants in countries with suitable conditions to demonstrate the technical and economic feasibility, and show that such plants can be financially viable and make a significant contribution to a clean and safe energy mix for the future.

(9) International cooperative programmes such as those financed and administered by the World Bank, United Nations, European Commission, International Energy Agency and other organizations are important for advancing the use of solar and other renewable energy technologies in eastern Europe and the CIS. They should be strengthened and focused in particular on facilitating project identification, formulation, financing and implementation issues.

IX. CLOSING SESSION

42. After the expressions of votes of thanks by the representatives of international organizations, host country officials and a participant from the Republic of Moldova on behalf of all the participants in the Workshop, the Chairman declared the Workshop closed.

43. A short report on the Workshop will be submitted to the UN/ECE Committee on Energy at its session in November 1997 and widely disseminated by the UN/ECE secretariat. The proceedings will be published by the host country in cooperation with the European Union INCO Programme.

ANNEX

LIST OF PROJECT OUTLINES PRESENTED AT THE WORKSHOP

Solar energy project for hot water supply of a hotel in Gyumri and a hospital in Sissian.

A. Marjanyan, Ministry of Energy, Moskovia Street 8/26, 375009 Yerevan, Armenia, Phone (3742)566755, Fax (3742)151630, e-mail: piuesc@arminco.com

Energy efficient house with utilization of solar energy.
Education, Training and Information Centre on Renewable Energy.
N. Meladze, Green Earth Foundation, 4-v Mazniashvili Street, 38007 Tbilisi, Republic of Georgia, Phone (995 32)951616, Fax (951 32)958420, e-mail: nugzari@kheta.ge

Utilization of heliosystems in power supply to the International Kazak-Turkish University.
Establishment of three training and scientific research centres in Almaty City, Turkestan City and Akmola City.
Development of scientific basis and technology for silicon production from the wastes of phosphorous industry.
"The Sun to the People" - Development of high efficiency module plastic helio collector.
B. Nurzhanov, Ministry of Energy, Bogenbay Batyra Street 142, 480091 Almaty, Kazakstan, Phone (7 3272)626480, Fax (7 3272)626630

Production of solar heat collectors.
Organization of production of silicon solar celles and modules.
Solar houses.
Microhydro stations.
A. Obozov, State Project KUN, 7, Elebaev Street, 720005 Bishkek, Kyrgyz Republic, Phone (7 3312)449822, Fax (7 3312)449187, e-mail: obozob@kun.bishkek.su

Production of solar energy semiconductor materials and solar cells.
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Construction of a combined solar and clean coal power plant in the Crimea.
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