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World Solar Programme 1996–2005

Letter dated 14 September 1998 from the Permanent Representative of Zimbabwe to the United Nations addressed to the Secretary-General

In my capacity as representative of the Chairman of the World Solar Commission, I have the honour to transmit to the General Assembly the document entitled "World Solar Programme, 1996–2005" (see annex).

I wish to request that this letter and its annex be circulated as a document of the General Assembly under agenda item 158.

(*Signed*) Machivenyika T. **Mapuranga**
Ambassador and Permanent Representative

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ANNEX

WORLD SOLAR PROGRAMME 1996-2005

World Solar Commission

23 June 1997

FOREWORD

The United Nations Conference on Environment and Development (UNCED), also known as the "Earth Summit", held in Rio de Janeiro in 1992, considered strategies reconciling the imperatives of environmental protection and worldwide development and adopted in Agenda 21 an international programme of action for global sustainable development into the 21st century.

On UNESCO's initiative and with the close support of a group of Heads of State and Government, a World Solar Commission was established in March 1995 to provide high-level leadership aimed at encouraging the wider use of all forms of renewable energy - seen as essential to the reduction of harmful gas emissions in the atmosphere, the promotion of sustainable development, and the eradication of poverty through job creation and income enhancement.

The World Solar Summit held on 16 and 17 September 1996 in Harare, Zimbabwe, launched a programme for global renewable energy activities known as the "World Solar Programme 1996-2005". This Programme, conceived as a concrete follow-up of the recommendations of the Earth Summit and as a major instrument at the service of the international development, has now been prepared.

The purpose of the World Solar Programme 1996-2005 is to sensitize governments, intergovernmental organizations, non-governmental organizations, financial institutions, academia, and private institutions on the need to support the development and utilization of renewable energy for sustainable development. The document contains global, regional and national projects to be implemented under the auspices of the World Solar Programme 1996-2005, including the actions to be taken to ensure effective implementation of the Programme.

This task has been accomplished within the nine-month deadline set up by the World Solar Summit. I wish to acknowledge the co-operation and devotion of many institutions and people around the world. On behalf of the seventeen Heads of State and Government, Members of the World Solar Commission, I wish to express my gratitude, first, to the 104 delegations which attended the World Solar Summit, and approved by acclamation the Harare Declaration on Solar Energy for Sustainable Development and launched the World Solar Programme 1996-2005. My gratitude also goes to my fellow Members of the World Solar Commission and their Personal Representatives who have met regularly during the past months in order to review the successive versions of the draft World Solar Programme 1996-2005.

I must also convey my gratitude to the Secretary-General of the United Nations, the Director-General of UNESCO and the Executive Heads of the other United Nations Organizations and Programmes who have contributed substantially to the preparation of the World Solar Programme 1996-2005.

I have pleasure in inviting governments, intergovernmental and non-governmental organizations, academic and research institutions, the private sector and funding institutions to participate to the fullest extent possible in the implementation of the World Solar Programme 1996-2005.

Robert Mugabe
President of the Republic of Zimbabwe
Chairman of the World Solar Commission

WORLD SOLAR PROGRAMME 1996 - 2005

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INTRODUCTION

1. The World Solar Summit, held in Harare (Zimbabwe) on 16 and 17 September 1996, approved the Harare Declaration on Solar Energy and Sustainable Development and launched the preparation of a ten-year World Solar Programme 1996-2005, on the basis of a detailed outline submitted to it by the World Solar Commission, a high-level body then composed of sixteen Heads of State and Government, chaired by H.E. Robert Mugabe, President of the Republic of Zimbabwe. The composition of the World Solar Commission is at Annex I.

2. The Harare Declaration on Solar Energy and Sustainable Development and the World Solar Programme 1996-2005 lay the foundations for the effective utilization of renewable, environmentally friendly energies, as a major contribution to sustainable development.

3. United Nations statistics indicate that some 2.4 billion people have no access to commercial energy. This means that 40% of the world's population has inadequate energy for cooking, lighting, heating and/or conditioning the homes, clinics, schools and community centres, a situation which acts as a significant brake on the development process. The majority of these people live in rural or remote areas of the developing countries and they have no access to power distribution networks to connect them to large-scale centralized energy supply systems. Neither can they expect to have access to electricity in the short or medium term, as extending the power grid to them is not economically viable and in some cases not practically possible. Population increase and lack of income-generating opportunities in these areas exacerbate the poverty of rural populations and oblige them to migrate to urban areas. The results of this trend include (a) an intolerable pressure on the capacity of urban centres to provide work and public services to this added population, and (b) increased demand of energy that has to be met from the traditional sources for which infrastructure is already in place, i.e. fossil fuels.

4. Fulfilling basic human needs and improving the quality of life are the main objectives of any development process. These objectives must be understood as the capacity to achieve social and economic growth in an environmentally sustainable manner, based on a long-term perspective in order not to jeopardize the interests of future generations.

5. Over the past few decades, scientists and environmentalists have improved their understanding of the impact of conventional energy systems and resources on the world's environment. It is now clear that pollution caused by releases into the atmosphere of greenhouse gases and/or radioactive dust, has no regard for national frontiers, and that the phenomena of acid rain, ozone depletion and global warming have brought to the fore the question whether we are beginning to cause irreversible damage to the world ecosystem. In fact, the way in which the world functions today is upsetting the balances that occur in nature. For example, it is putting carbon dioxide in the atmosphere faster than the oceans

and the flora can remove it, and the rate of extinction of animal and vegetal species far exceeds the rate of their evolution. This is an intolerable situation which cannot continue indefinitely, and, therefore, it is clear that the crucial need of restoring the planet's environmental balance will increasingly influence the evolution of the global economy.

6. The United Nations Conference on Environment and Development (UNCED) - known also as the Earth Summit - which was held in Rio de Janeiro in 1992, was called to focus on the most fundamental and important challenges to the preservation of the natural human environment. At the Earth Summit, it was considered essential to develop environmentally sound technologies and industrial practices and in chapter 9 of Agenda 21 of UNCED, it was agreed and stressed that « Energy is essential to economic and social development and improved quality of life. Much of the world's energy, however, is currently produced and consumed in ways that could not be sustained, if technology were to remain constant and if overall quantities were to increase substantially. The need to control atmospheric emissions of greenhouse and other gases and substances will increasingly need to be based on efficiency in energy production, transmission, distribution and consumption, and on growing reliance on environmentally sound systems, particularly new and renewable sources of energy ». In order to attain the objectives set forth at the Earth Summit, action needs to be taken on three issues : energy savings, cleaner technologies for conventional energy sources and increased utilization of renewable energies.

7. It should also be recalled that the « Nairobi Programme of Action for the Development and Utilization of New and Renewable Sources of Energy » was adopted by consensus at the United Nations Conference on New and Renewable Sources of Energy, held on 10-21 August 1981 in Nairobi (Kenya). This Programme of Action, conceived as a major undertaking of international co-operation for supporting and assisting action at the national level, was intended to help ensure that the energy transition from conventional to renewable sources of energy would take place in a manner that, consistent with the needs of individual countries, was socially equitable, economically and technically viable, and environmentally sustainable. However, falling energy prices in the years that followed the Conference led many governments to believe that the Nairobi Programme had lost at least its sense of urgency, if not its very purpose, and the momentum generated by the Conference was lost; in addition, efforts to support financially the implementation of the Nairobi Programme of Action were insufficient in most countries.

8. Growing environmental and social concerns, both on the part of decision-makers and public opinion, have brought a new perspective to the perception of renewable energy sources as a valid alternative in the long-term, and a useful and practical complement to traditional sources of energy in the short and medium-term. This was confirmed by the High-Level Expert Meeting « The Sun in the Service of Mankind », held at UNESCO Headquarters in Paris (France) on 5-9 July 1993. One of the main recommendations of this Meeting was that in order to secure political support for the development of renewable energies, at the highest possible level, a three-year preparatory process should be initiated, leading to a World Solar Summit. The aim of this three-year process was to increase awareness of the potential of renewable energies, to foster the sharing of knowledge, to promote co-operation in training and research, to forge partnerships with governmental and non-governmental organizations and to demonstrate how wider use of renewable energies is a cost-effective and rapid way for many developing countries to reduce energy costs, save foreign exchange and stretch the energy supply base without heavy investment.

9. In addition, and learning from the lessons of the Nairobi Programme of Action, a new modality of action was applied during the World Solar Summit Process. Prior to the preparatory meetings held in the various regions of the world, participating countries were invited (a) to identify the priority areas where renewable energies could be more useful, and (b) to submit for inclusion in the World Solar Programme 1996-2005 the national renewable energy projects that they considered to have high priority. The nearly 300 projects received by the time of the World Solar Summit demonstrate a clear expression of the interest of governments in both developing and industrialized countries in the enhanced utilization of renewable energies. The fact that the Heads of State and Government and their official representatives gathered together in Harare had before them, in addition to a draft Declaration and the outline of a World Solar Programme 1996-2005, a list of some 300 national high-priority projects whose implementation could begin rapidly, was very much in line with the statements recently made by government representatives at many international fora, in the sense that greater emphasis should now be placed on implementation rather than on analysis and policy making. The World Solar Programme 1996-2005 also contains five major projects of universal value, and a relation of the priorities identified by the various regions at the meetings held for the preparation of the World Solar Summit; these priorities are being translated into concrete projects. This new modality of action was well received as, very often, the modalities followed in the past did not attract sufficient support or achieve good results because of the tardiness with which political support was translated into concrete action and project implementation.

10. It is relevant to underline that the World Solar Programme 1996-2005 is designed to address the concerns of both developing and industrialized countries. While it is recognized that rural electrification in the developing countries is undoubtedly the application of renewable energies that would be of greatest benefit in the short and medium term, on account of its social dimension, many industrialized countries are keen to develop their energy strategies giving a greater share to renewable energies on account of environmental considerations. The growing scarcity of oil and gas which, according to many specialists could become critical towards the middle of the 21st century, will ultimately have an impact on the economies of the developed world. Furthermore, when the hidden costs of environmental and social impacts will be taken fully into consideration, the conventional power projects will become more expensive.

11. Bearing in mind the Declaration and Programme of Action adopted by the World Conference for Social Development, held in Copenhagen (Denmark) on 6-12 March 1995, and the Declaration and Platform for Action adopted by the Fourth World Conference on Women, held in Beijing (China) on 4-15 September 1995, special mention must be made of the contribution that renewable energies can make to give a new lease of life to rural womenfolk, who have hitherto devoted too much of their time and labour collecting water and fuelwood from far-away places and cooking in smoked-filled rooms. Solar pumps, solar cookers, electricity produced by renewable energy equipment (solar, wind, biogas, mini-hydro, etc.) will give them more time for other developmental activities, including more time for their families and for their own development, and the possibility to contribute to remunerative activities. In both rural and urban areas, women who are heads of household face particularly severe difficulties in obtaining suitable energy services, and experience has abundantly shown that there is a definite correlation between access to energy in general,

and to electricity in particular, and literacy and educational attainments among both the rural and urban poor. Furthermore, the negative impact of female illiteracy in adult life is clearly felt in children's health, education, nutrition and welfare in general.

12. The scarcity and low quality of the water available to people in many parts of the world and the estimates showing a considerable increase in water consumption in the near future make it imperative that priority be given to taking remedial action. In areas where water for human consumption and irrigation is scarce, water desalination from the sea or from brackish lakes using renewable energy technology can be a solution. In other areas where water unfit for human consumption can be found, relatively cheap and easy-to-operate solar-powered equipment can improve the health conditions through the provision of decontaminated drinking water. In regions such as the Middle East, where shortage of water could conceivably become a source of conflict, the deployment of renewable energy technologies for water desalination would be a major contribution to peace between nations and to peace between human beings and their environment.

13. It should also be mentioned that current approaches to energy pose major national, regional and global threats to security and, ultimately, to sustainable development. Among the many security issues related to energy, an issue of dominant concern is the growing dependence of the majority of developed and developing countries on imports from a few oil and gas producing countries. This dependence represents one of the significant potential sources of conflict in the world today. Dependence on Middle Eastern oil is likely to persist, since 65% of the world's proven oil reserves are in that region, and oil production costs are especially low there. Security concerns relating to energy also arise in the harnessing of rivers for hydropower in watersheds involving several countries. On the other hand, strong connections between supply sources and markets, such as in the case of natural gas pipelines, can lead to mutual dependence and be a stabilising factor.

14. The development of renewable energies can also bring positive and tangible effects on employment. These energies are, by definition, local energies independent of the existence of infrastructures and, furthermore, many of the less developed regions of the world have a good renewable energy resource potential. Their promotion is therefore a major element in a regional policy and can bring employment to regions which are otherwise deprived of industrial development as well as supply of energy resources necessary for development. Studies show that development, operation and maintenance of renewable sources of energy tend to be much more labour intensive than development of technologies based on conventional fuels. The impact on employment from renewable energy is, according to some European studies, about five times higher than the employment impacts of further development on fossil fuels. Furthermore, the job creation in this sector takes place mostly outside of urban areas where unemployment is often high. The tourism sector offers particularly good opportunities for the increased use of renewable sources of energy. Regions with a tourism industry need, in particular, to be environmentally preserved and at the same time the tourism industry - notably in the case of mass tourism - is characterized by increased energy demand specifically at peak periods. Furthermore, there is a growth in tourism in isolated areas such as on islands and in mountainous regions, where fuel deliveries and grid connections are costly or environmentally unattractive. Overall,

therefore, increased use of renewable sources of energy can be an interesting alternative to conventional energy production in touristic areas. Lastly, the renewable energy industry consists predominantly of small and medium sized enterprises which are generally recognised as being a major source of new job opportunities. Accelerating and strengthening the use of renewable sources of energy and renewable energy technologies should therefore be an important element in the overall strategy for supporting entrepreneurial initiatives and employment.

15. Information on the potential of renewable energies, their technologies and their applications, for the benefit of all actors concerned - decision-makers, investors, industrialists, civil servants, end users, etc. - is extremely important to create a favourable climate for the enhanced exploitation of these energies. For this reason, one of the five strategic projects of universal value aims at establishing an international renewable energy information and communication system.

16. However, it should be emphasized that no strategy, no programme and no project can be successful if they have no provision for training the men and women who have to implement them. Thus, education and training are essential components of any developmental effort, especially in developing countries. The establishment of a culture of maintenance and the early involvement of individuals and community organizations benefiting from renewable energy in the design and implementation of projects are also essential elements for their success.

17. The World Solar Programme 1996-2005 is not conceived as an isolated effort but as a concrete and action-oriented follow-up of the recommendations of the Earth Summit in Agenda 21 concerning energy for sustainable development.

18. The Harare Declaration on Solar Energy and Sustainable Development, reproduced in Part II, is the expression of the political will of the World Solar Summit, which was attended by Heads of State and Government or their official representatives of 104 nations. The Declaration which was approved by acclamation at the closure of the Summit, also provides the basic strategic guidance for the development of the World Solar Programme 1996-2005.

19. The World Solar Programme 1996-2005 was approved by the World Solar Commission at its 2nd session held in New York on 23 June 1997, within the framework of the Special Session of the United Nations General Assembly to review and appraise the implementation of Agenda 21.

HARARE DECLARATION ON SOLAR ENERGY AND SUSTAINABLE DEVELOPMENT

We, the Heads of State and Government, gathered or officially represented in Harare on the occasion of the World Solar Summit, following the invitation by the Government of Zimbabwe and at the initiative of the United Nations Educational, Scientific and Cultural Organization, in collaboration with international organizations and institutions, in order to launch a programme for global solar activities to be known as the World Solar Programme 1996-2005,

1. recognize the significance of the role that solar and other sources of renewable energy such as wind, geothermal, hydro, biomass and ocean, as well as energy efficiency, should play in the provision of energy services and in the sustainable use of environmental resources for the well-being of humanity;

2. reiterate our support for the principles and actions for the promotion of energy systems for sustainable development recommended by the United Nations Conference on Environment and Development, held on 3-14 June 1992 in Rio de Janeiro, Brazil, in particular the Rio Declaration on Environment and Development, Agenda 21, as well as the commitments made in the United Nations Framework Convention on Climate Change;

3. recognize that the provision of sufficient energy services at affordable prices and the adoption of energy conservation measures are essential for the progress of all countries, developed and developing alike, to meet current and expanding needs in ways which minimize environmental degradation and risks, as well as to realize the full potential of renewable energy sources;

4. recognize that there is a need to increase substantially access to energy in developing countries, and that the provision of adequate energy services can improve living conditions, alleviate poverty, improve health and education, promote small scale enterprises and create other income-generating activities especially in rural and isolated areas, thereby reducing rural to urban migration ;

5. recognize that the role of solar energy in each country needs to be integrated and specified in its national energy policy;

6. recognize that the development, deployment and widespread utilization of solar energy face difficulties, particularly with regard to their management, maintenance and financing as well as to the availability and accessibility of relevant data, information, education, training and technology;

7. recognize that increased use of solar energy can reduce environmental degradation caused by adverse human activities, such as industrial pollution and deforestation, and that it is the responsibility of governments and all sectors of civil society to work together to find lasting solutions to problems threatening the sustainable development of humanity;

8. emphasize that the management of atmospheric emissions of greenhouse and other gases and substances will increasingly require efficient and environmentally sound energy systems, including solar energy ones;

9. recognize the important role that relevant non-governmental organizations play in the development and deployment of solar energy;

10. recognize that women have an important role to play in the promotion of solar energy, and that they would benefit significantly from its use;

11 are convinced that sustainable development and utilization of solar energy would be enhanced by local and national capacity building, policy reform and technology sharing among nations, with emphasis on coherent efforts towards technology acquisition and development in the developing countries.

We therefore,

12. commit ourselves to work towards the wider use of solar energy to enhance the economic and social development of all people; support and promotion of these efforts should be very important goals of our governments, the international community and all sectors of society, especially with respect to people living in isolated and underdeveloped rural and island communities;

13. commit ourselves to work towards policies and effective mechanisms that will speed up and facilitate the use of solar energy avoiding duplication and administrative delays, and the encouragement of international co-operation, including participation in regional and international bodies, scientific and technical organizations;

14. commit ourselves to work towards the greater use of solar energy through the provision of adequate technical assistance and funding, the full utilization of existing international funds, and the facilitation of increased participation by both public and private sectors.

In pursuit of these objectives we:

15. call on all nations to join in the development and implementation of the WSP;

16. invite the World Solar Commission to continue to provide high-level leadership and guidance to achieve the objectives of the Summit, and UNESCO to continue to play a leading role in the development of the WSP, in close co-operation with relevant international organizations.

17. invite the Secretary-General and Heads of Specialized Agencies and Programmes of the United Nations, as well as national governments, intergovernmental and non-governmental organizations, academic and research institutions and the private sector, to join in the implementation of the WSP.

HARARE, 17 SEPTEMBER 1996

COMMITMENTS AND ACTIONS

A. Commitment One

We commit ourselves to work towards the wider use of solar energy to enhance the economic and social development of all people; support and promotion of these efforts should be very important goals of our governments, the international community and all sectors of society, especially with respect to people living in isolated and underdeveloped rural and island communities;

The Basis for Action

Energy is an essential component of economic and social development processes and the capacity to meet the basic energy needs of all human beings should be their ultimate objective. These development processes should be sustainable, and this conditions the energy options to be chosen by decision makers. A wrong choice of energy technologies, coupled with excessive consumption, especially in the industrialized countries, will lead to unsustainable models of development; it will result inter alia in unequal access to energy, depletion of precious non-renewable sources of energy (coal, oil, gas, etc.), pollution and ecological imbalances adversely affecting not only the current needs of the population but also those of future generations. On the contrary, an appropriate choice of energy technology, ecologically sustainable, using renewable sources, conserving fossil fuels and focusing on equitable distribution of energy services, local participation and taking into account the social issues, will be a major contribution to sustainable economic and social development.

According to United Nations estimates, there are in the world to-day some 2.4 billion people who have no access to basic energy supplies. This means that their quality of life is very low, that they are excluded from effective participation in the society of the country where they live and that they are condemned to remain in poverty and ignorance unless they uproot themselves in order to find a more favourable environment, an option that too often is nothing short of catastrophic, as many of these rural migrants end up increasing the « ring of poverty » surrounding the urban settlements. It should be underlined that according to the statistics provided to the World Food Summit (Rome, November 1996), every country in the world has vulnerable and disadvantaged individuals, households and groups who cannot meet their own needs, and that seventy percent of all the poor are women.

It is well-known that in many developing countries women are so burdened with domestic tasks that they have little or no time for their personal development or that of their children. Collecting wood for cooking, and carrying water from wooded areas and wells which are often far from the family dwelling, are taxing and time-consuming everyday tasks. Most of these women do their cooking on inefficient stoves that consume too much wood or charcoal and produce abundant smoke. At night, lighting is usually poor and its source contributes to the pollution inside the family dwelling. Rural electrification using renewable energies such as solar, wind, biomass and mini-hydraulic technology; the use of solar pumps to provide water for people and crops; the introduction of solar cookers for domestic use and solar dryers for conservation of agricultural products, or the provision of refrigeration for medical supplies, can go a long way towards improving the quality of life of rural populations,

especially women and children who are the more vulnerable groups. Special mention should be made here of the importance of girls' and women's education as a contribution to sustainable development. Rural electrification should enable the organization of activities such as evening classes for adults, educational radio and television programmes, distance education courses, etc.

The energy-deprived populations live mainly in the rural and/or remote areas of developing countries, where extending national power grids to these sparsely populated, low income communities would be prohibitively expensive. Furthermore, the « beneficiaries » would find themselves paying exorbitant prices for their energy to cover the cost of construction and running of plants that would be used for only the few who could afford to pay. It is clear that the rules of the market, without remedial measures, would hamper any resolute and rapid transition to renewable energy, despite its obvious societal, environmental and economic benefits.

The United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992 did not address fully the important development concerns of the majority of developing countries lacking adequate energy services to support national economic and social development. Yet, it is now well known that energy is not only a crucial factor in the priority problems of these countries, such as poverty, rural-urban migration, climate change, land degradation, desertification, etc. but it can contribute substantially to their alleviation if it is used in a sustainable manner. For example, increasing the use of renewable energies in rural areas of Third World countries can create income-earning opportunities, and the construction, operation and maintenance of renewable energy systems can generate sizeable employment possibilities.

The World Food Summit (Rome, 1996) highlighted the importance of agriculture and food security, an issue on which renewable energies can make a valuable contribution. For instance, agricultural activities and the food production, mechanization, irrigation, fertilization, transport, processing, conservation and ultimately cooking, require one form or another of energy. Renewable energies can contribute substantially to the production of this energy: biomass fuels, solar, wind and other sources can provide the necessary electricity, liquid fuels or mechanical power. It should also be mentioned that the double role of agricultural and forestry, as both consumers and producers of renewable energy in the form of biomass, is still to be promoted to fully benefit rural populations.

The Harare Declaration on Solar Energy and Sustainable Development expressly recognizes that renewable energies are particularly appropriate for the provision of energy services to populations living in remote, isolated and ecologically-fragile areas. In these cases, the development of renewable sources of energy should focus on the few options that hold out the promise of technical, economic and financial viability. The renewable energy technologies and resources that appear to be more promising in the near term are solar photovoltaic-based utilities, particularly for remote islands and villages; large-scale and mini-hydropower plants, where adequate sites and institutional support are available; wind turbine generators, depending on favourable wind regimes; and the enhanced use of biomass fuel, where good sustainable biomass resources exist. It should also be underlined that renewable energies are particularly suitable for providing energy to populations living in environmentally fragile areas such as small islands, deserts, river deltas, high-mountain zones, certain coastal areas, lakes, etc.* People living in these areas, especially in developing countries, meet their energy needs through firewood, charcoal, coal and, in some

* Some of these areas are included in UNESCO's World Heritage List (Ecuador's Galapagos Islands, Australia's Great Barrier Reef and Wet Tropics of Queensland, Uganda's Ruwenzori Mountains, the Russian Federation's Lake Baikal, China's Jinzhaigou Valley Area or Sweden's Laponian Area, for example).

cases, diesel generators. Deforestation, desertification and pollution from oil spills and residues are often the results of their energy consumption pattern. In addition, lack of electricity prevents them from access to better information, education and health services and to certain income-generating activities.

The growing importance of tourism as a source of revenue and foreign exchange in a number of developing countries also needs to be mentioned. Cultural tourism and eco-tourism are two modalities that are on the increase, and renewable energies can be in many cases the right source of energy for the tourist installations, as they do not have adverse effects on the cultural and natural sites and the environment.

Objectives and Actions

Objective 1.1 *To promote at the international and national level a sustainable energy path that will ensure that energy can fulfil its potential role as a key instrument for sustainable human development.*

To this end, concerted efforts should be undertaken by governments, international intergovernmental organizations and institutions, private sector investors, civil society and energy industries, in order to favour the research, development, transfer of knowledge and use of technologies and practices in line with national, sub-regional and regional socio-economic and environment priorities. These efforts should include:

(a) co-operation in identifying and elaborating strategies that can assist decision makers in adopting integrated energy, environment and socio-economic policies for sustainable development; these strategies and the resulting policies should not be based mainly on technico-economic criteria, but take fully into account the interaction between energy and society, including the social and cultural dimensions;
(b) strengthening the energy planning and policy-making capacity for rural development in the third world countries in order to ensure that it is not marginalized in the national energy planning and policy efforts;
(c) giving priority to capital investment in the energy sector to rural and remote/isolated areas and direct it towards the exploitation of renewable energy sources;
(d) promoting the rapid implementation of energy systems based on renewable sources of energy, especially in industrialized countries because of their heavy consumption of fossil fuels, and
(e) carrying out a major drive to improve education on, and understanding of, the potential and wider implications of renewable energies use and its significance for human welfare and the environment, within the framework of sustainable development;

Objective 1.2 *To accelerate rural development through the use of renewable energies, in order to improve the quality of life of the people, notably through better health, education, socio-economic development and local productivity.*

To this end, national governments, in partnership with all actors of civil society concerned, and with the support of international governmental and non-governmental organizations and institutions should, as appropriate:

(a) give high priority to establish and apply policies and implement programmes for the provision of basic energy services to rural and/or isolated communities through the increased utilization of renewable energy technologies;

(b) facilitate access to state-of-the-art technologies, transfer of appropriate technology and information exchange (North-South and South-South) on the application of renewable energy solutions;

(c) strengthen research and development in renewable energy, with emphasis on practical applications with community involvement, and taking into account the social and cultural context in which the relevant technologies are to be produced and utilized;

(d) promote capacity-building, in terms of skilled manpower and in manufacturing and maintenance of renewable energy systems and equipment, and

(e) foresee the active participation of non-governmental organizations and local co-operatives and associations, working closely with governments and the private sector, in the national sustainable energy plans.

B. Commitment Two

We commit ourselves to work towards policies and effective mechanisms that will speed up and facilitate the use of solar energy avoiding duplication and administrative delays, and the encouragement of international co-operation, including participation in regional and international bodies, scientific and technical organizations;

The Basis for Action

On the recommendation of the Committee on New and Renewable Sources of Energy and on Energy for Development, at its second session, the United Nations Economic and Social Council adopted a decision in 1996 recommending, inter alia, that « in view of the slow progress made in removing the barriers that hamper renewable energy development, there is a need to adopt a pro-active approach towards removing such obstacles. In particular, there is a need to continue subsidies and other forms of direct and indirect support. The external costs of using fossil fuels need to be internalized, and a policy environment conducive to the use of renewable energy resources needs to be created ».

As indicated by the United Nations Development Programme in its publication UNDP Initiative for Sustainable Energy, « *in many countries the potential for implementing sustainable energy programmes is limited severely by existing laws, regulations and incentives. For example, energy prices do not reflect the fuel costs of energy, and utilities frequently are not able to buy power from co-generating producers...* ». In many countries, energy produced by fossil fuels is subsidized whereas that produced by renewable sources is not. Current estimates indicate that conventional energy annual subsidies amount to some 300 billion dollars globally. Furthermore, energy prices do not reflect the full costs, as they do not include social and environmental costs; as a result, environmentally and socially sound alternative energies are at a disadvantage in the market as compared with conventional ones. It should also be mentioned that in many cases heavy import duties are a deterrent to the acquisition of renewable energy technology, not to speak of the vested interests of conventional energy producers and distributors.

It is obvious, therefore, that even if in future it is widely recognized that the present path of energy development and consumption is no longer viable, and that a transition to a

sustainable energy system is essential, this transition will not occur by conventional market forces alone. This is why in many instances, such as rural electrification, the social dimension must be emphasized, along with the catalytic role to be played by international multilateral and bilateral assistance funds. Consequently, it is reasonable to envisage that a sustainable energy future would combine the use of market forces to achieve economic efficiency, with governments providing the necessary legal and financial framework for the operations of the private sector.

In developing as well as developed countries, incentives for the wider use of renewable energy technology are insufficient or non-existing. The situation is the same as regards the involvement of the private sector in the development and dissemination of renewable energy technology. Very often, the share of national energy budgets allocated to research and development of renewable energy technology is very low and national energy policies give priority to the development of traditional energy sources.

Objectives and Actions

Objective 2.1 *To establish effective institutional frameworks and improve existing ones that will accelerate and facilitate continued technological advancement and the effective dissemination and utilization of renewable energy.*

To this end, concerted efforts by all the actors involved should be undertaken in order to develop a sustainable global energy system based mainly on renewable energies and requiring economic and institutional changes in industrialized and developing countries, including the planning of new cities and urban environment. Firm political will, international co-operation and active public and private involvement are essential for the success of these efforts, which could include the following actions:

At the national level

(a) the formulation of integrated energy policies and strategies compatible with sustainable development and the promotion of increased investments in renewable energy supplies;

(b) creation or identification of appropriate governmental institutions with the mandate of promoting the utilization of renewable energies, inter alia, through information, education and training programmes including energy/environment coordination and planning and demonstration projects;

(c) adopting new regulatory, fiscal and customs legislation facilitating the enlarged utilization of renewable energies and the full integration of all costs and benefits in the market prices;

(d) promoting appropriate energy efficiency and emission standards or recommendations, aimed at the development and use of technologies that minimize adverse impacts on the environment, and

(e) stimulating the participation of non-governmental organizations, the media and the civil society in general in the promotion of renewable energies as a basic element of a sustainable development for the future;

At the international level

(a) strengthening of international co-operation to promote the utilization of renewable energies, through close collaboration with national and international institutions and non-governmental organizations;

(b) reversing the present trend towards a decline in the investment worldwide on research and development in renewable energies, particularly on the part of utilities in the industrialized countries;

(c) promoting, whenever appropriate, sub-regional and/or regional solutions towards sustainable energy strategies, as energy development and planning require more interdependence and co-operation between countries than ever before;

(d) coordinating the exchange of information and experience on research, development and applications of renewable energy technologies, and

(e) assisting countries and regions to identify the most suitable renewable energy technologies for their specific needs;

C. Commitment Three

We commit ourselves to work towards the greater use of solar energy through the provision of adequate technical assistance and funding, the full utilization of existing international funds, and the facilitation of increased participation by both public and private sectors.

The Basis for Action

At present, a wide range of renewable energy technologies needed for sustainable development are commercially available or could be in a short period of time, especially if there would be strong demand for them and a sustained research and development effort. In the case of developing countries, these technologies should, during the World Solar Programme 1996-2005 and thereafter, make it possible to provide basic energy services to many people living in poverty, more quickly and at a lower cost than traditional energy sources. Developing countries should be able to make use of the technologies commercially available in the industrialized and other countries,, provided they are appropriate to their situations and less costly. Of course, these technology transfers should conform to sustainable development principles and objectives, in which case countries would be able to bypass the unsustainable energy paths of the last two centuries. Better information on the potential and availability of renewable energy technologies is essential, as are advisory services, technical assistance and capacity building at the local level to ensure the success of such a leap-frogging transfer of technology. Other fundamental prerequisites are an appropriate legal and regulatory framework and the rational pricing of energy.

It should be emphasized here that, in developing countries, there is an abundance of indigenous knowledge relating to the use of the sun and other renewable sources of energy that must be taken into account in designing and selecting the technology that is more appropriate to each particular situation. Scientists and engineers must get together with end users to create efficient and affordable products. Also, industrialized countries and

development agencies must abstain from devising, advocating and applying top-down policies which are considered normal in their own context. Successful development and deployment of renewable energy technology involves taking a holistic approach, considering the priorities of each society, its cultural identity and the way in which it functions. It also means finding and applying solutions for particular situations and localities, an approach that contributes to decentralization and to the empowerment of local governance and indigenous cultures.

As the world develops, expenditures to provide the increasing energy demands represent a major economic cost to all countries and a particularly heavy burden to developing countries having no fossil fuel reserves. In the developing world the financial cost of capital, foreign exchange restrictions and the cost of energy subsidies represent very serious obstacles to economic and social development. Accc ding to recent UNDP estimates, the present level of investment world-wide in the energy supply sector is of the order of $450 billion per annum, and is projected to increase to $1,000 billion per year by 2020, with two-thirds of this expenditure going to the power sector. The inescapable conclusion is that such investment level cannot be sustained by traditional sources of energy financing* . Consequently, as subsidies in the energy sector for conventional energy sources and nuclear power tend to hamper the wider application of renewable energies, policy changes that will lead to the full internationalization of environmental costs in prices through the use of economic and fiscal measures, and the removal of permanent subsidies are required if a sustainable energy path is to be pursued.

It should also be recalled that the current trend towards privatization of traditionally public energy suppliers and towards increased participation of private financing of energy projects raises serious concerns and requires adaptation to the new situation and the elaboration of innovative approaches. For example, if one looks at the challenges of financing projects in an increasingly private market, new and imaginative new schemes will have to be applied.

Objectives and Actions

Objective 3.1 *To achieve a substantial increase in the use of renewable energies, particularly for electric power generation, as a major contribution to sustainable development.*

To this end, increased North-North, North-South and South-South co-operation is needed in order to identify the most suitable technology options, facilitate access to them and strengthen the local capacity to install and maintain them. By contributing to implement sustainable energy programmes, this co-operation can result in poverty alleviation, employment creation, the advancement of women and the protection of the environment. Actions to be taken should include:

At the national level

(a) adopting and implementing an integrated action programme for the development of renewable energy sources; renewable energy sources, especially for the production of electricity, including the determination of the specific capacity to be attained through renewable energies, within the framework of the national energy plans;

* "Energy After Rio : Prospects and Challenges", UNDP, New York, 1997.

(b) establishing targets for the share of the various renewable energy sources available to the country's energy supply, bearing in mind future needs, technical and financial feasibility and the relevant links with social and environmental objectives, and

(c) designating a government department or institution as focal point for the development and applications of renewable energies nation-wide.

At the international level

(a) promoting the intensification of research, development and demonstration in the field of renewable energy technologies, stimulate the wide dissemination and application of the technologies, and provide for exchange of information and for manpower training;

(b) assisting developing countries, on request, in preparing their strategies and policies in the area of sustainable energy;

(c) improving the coordination of international activities aimed at promoting the wider use of renewable energies, and

(d) preparing evaluations of key applications of renewable energies and making them widely available to interested parties;

(e) stimulating industry in the developed countries to establish joint ventures with industries in the less developed ones, thus playing a catalytic role in support of local initiatives;

Objective 3.2 *To provide adequate financing for the development and applications of renewable energies through the mobilization of additional resources at the international and national level.*

While national efforts in this respect may represent the largest source of financing the development and utilization of renewable energy sources (especially when large hydropower systems are included), international financial assistance plays an important role, often defined as catalytic. International institutions and programmes such as the World Bank, UNDP, the European Commission or the regional development banks, offer a number of possibilities in this respect, both in the form of loans or grants; these possibilities should be increased.

These international bodies should aim at establishing effective partnerships with all institutions and entities that have a role to play in the development of a sustainable energy system, including of course non-governmental organizations and the private sector. The latter requires attractive conditions to be established that would enable it to exploit fully its ability to mobilize capital, implement and operate projects efficiently and accelerate technology transfer.

At the national level

a) countries should increase the share of energy sector investments devoted to utilizing renewable energy sources;

b) additional funds for this purpose should either be allocated in the form of special credit facilities for the development of the appropriate technology, or of transitional subsidies

for specific types of renewable energy systems, which could gradually be reduced as production costs decrease;*

c) governments could give careful consideration to the possibility of reducing fossil fuel subsidies, and generally lowering or eliminating market barriers to new and renewable energy technologies;

d) utilities, equipment manufacturers and installers should develop, in collaboration with banks and other financial institutions, new attractive financing mechanisms, such as third party financing packages, and

e) national governments and local and municipal authorities could, whenever appropriate, provide fiscal incentives to investors and operators to take account of the distortions in the energy market.

At the international level

(a) financial institutions should increase the share of resources available to finance renewable energy projects and develop mechanisms to mobilize additional funding at the international, regional and national levels;

(b) priority should be given to capital investment on renewables in the rural and/or isolated areas as progress in the exploitation of renewable energy sources in these areas has been hindered by a lack of financial resources for initial energy investments,;

(c) information and/or assistance should be made available to governments for the development of local capabilities, including cooperative ventures and private enterprises, in order to create a local infrastructure that can ensure the sustainability of projects;

(d) new forms of financing, especially micro-financing, should be established, enabling small firms, cooperatives and individuals to purchase the appropriate renewable energy technology; this « seed financing » should be accompanied by training programmes in technical as well as business skills and by appropriate information efforts to familiarize national financing institutions with lending for renewable energy technology.

Objective 3.3 *To progressively secure an increasing participation of industry and the private sector in the development and deployment of renewable energy technology.*

A few days before the World Solar Summit (Harare, Zimbabwe, 16-17 September 1996), a Round-Table on Private/Public Partnership for Renewable Energy Development was held, also in Harare, with the participation, inter alia, of representatives of the E-7 Group (composed of eight major power utilities in Canada, France, Germany, Italy, Japan, United Kingdom and the United States). The message addressed by this Round-Table to the World Solar Summit underlined notably the need to establish a dialogue between public institutions and private enterprises for accelerating market development, the desirability of strengthening public/private sector partnerships, the need to ensure priority access to capital available for renewable energy projects, and the invitation to Governments to establish policy and regulatory frameworks, as well as institutional mechanisms, to address renewable energy issues that would facilitate the greater involvement of industry and the private sector.

* A successful example is the support given by the Government of Denmark to the wind turbine industry through subsidies to buyers: Initially, the Government subsidized 30% of the investment, but this was gradually reduced and eventually discontinued as new wind turbine investments became cost effective.

It is clear that, as the exploitation of the various forms of renewable energy becomes cost-effective and commercially attractive, market forces will ensure an increasing participation of the private sector. In an ideal scenario, public financing of renewable energy applications should diminish drastically in the future and even cease altogether, as the manufacture, sale, installation and maintenance of the relevant technology are taken over by the private sector.

Actions to be taken to stimulate the greater involvement of the private sector could include the following:

At the national level

a) governments should establish a framework that would favour local initiatives, including legislation, fiscal policy and incentives for the greater involvement of the private sector;

b) national energy legislation should reduce the role of state monopolies and establish guaranteed prices for the purchase of electricity from grid-connected independent producers;

c) promotion of voluntary actions to encourage the development of renewable energy, ranging from formalized negotiated agreements between governments and industry or utilities, to more informal approaches;

d) community-based schemes of organization such as cooperatives have proven successful in a variety of situations in both industrialized and developing countries, and should be promoted, and

e) opportunities for domestic manufacturing of the components of renewable energy systems should be encouraged, as they can bring double benefits of increased employment and reduced foreign debt.

At the international level

(a) whenever practical, joint ventures with the participation of private capital, should be established between industrialized and developing countries;

(b) the key role played by supranational schemes at the regional and sub-regional level, together with the fostering of a wide technological and industrial co-operation and partnership between the countries of each region and sub-region should be recognized and developed, involving all related actors, which include industry and the private sector;

(c) international organizations and industrialized countries should assist developing countries in building the organizational infrastructure necessary to deliver renewable energy technologies where they can be more effective, and this includes the establishment of locally-based forms of private ownership, financing, operation and maintenance, as well as viable micro-enterprises and cooperatives, with non-governmental organizations playing a major role in this development;

GLOBAL, REGIONAL AND NATIONAL PRIORITY RENEWABLE ENERGY PROJECTS

As already indicated, the World Solar Programme 1996-2005 includes projects of varying degrees of geographical scope and accruing values. Many have been identified by governments as deserving highest priority; the successful implementation of these High-Priority National Projects will not only be of benefit to the countries concerned but will also provide valuable information to others.

At the various regional consultations that took place in different parts of the world during the last three years, priority areas of activity were identified; they are being gradually translated into concrete high-priority regional projects, the benefits of which will accrue to the entire region.

Finally, there are global projects of universal value, identified and during the regional ministerial-level and high-level expert meetings, as well as during the meetings of the Regional Solar Councils, organized since 1993 within the framework of the World Solar Summit Process, and approved by the World Solar Summit.

A. Global Projects

Five activities of global importance described below were identified and developed during the regional consultations and high-level expert meetings, as well as during the meetings of the regional solar councils, organized in the framework of the World Solar Summit Process since 1993. They are described below.

Global Renewable Energy Education and Training. Of the five strategic and global projects as indicated above, this is the one that was mentioned in the conclusions of all the consultations and uniformly considered as warranting the highest priority. Conscious of the role that renewable energies can play in the overall energy system, particularly in the provision of energy services to rural and isolated populations, many governments have also identified as a national and regional priority the establishment of a programme of education and training in renewable energies. This programme should be based upon the new technologies and teaching methods and should aim at all groups concerned in order to ensure the success of the installation, follow-up and maintenance of the various projects and programmes in this field. Thus, the three groups concerned are the decision-makers (engineers, economists, civil servants, etc.), the local technicians (for maintenance) and the end users.

The objectives of this programme can be summarized as follows :

- the progressive reinforcement in terms of qualified staff and of research and development centres.
- the establishment of a better adequacy between the energy needs and the choice of the appropriate technology.

- the training of maintenance teams capable of assisting rural populations, both in solving technical problems and in providing the information needed to ensure the operation of the equipment.
- the sensitization of end-users to the most effective ways of using the equipment.

This global programme on education and training for the enhanced utilization of renewable energies falls within the competence of UNESCO, which is responsible for its elaboration and implementation. Consequently, a preliminary project document prepared by a group of specialists was submitted to an *ad hoc* meeting held in Harare during the World Solar Summit. The participants, which included government delegates, representatives of governmental and non-governmental international organizations and educationalists, unanimously approved the preliminary project document, and the Global Renewable Education and Training Programme is currently under preparation by UNESCO.

International Renewable Energy Information and Communication System. The World Solar Programme 1996-2005 represents an enormously diverse set of initiatives, projects, tasks and activities. All of these require, to varying degrees, the coordination of efforts, the dissemination of information, the opportunity to communicate, the ability to publish results and analyses and the opportunity to share experiences, difficulties and challenges. At the same time all members of the Programme active in these activities share a need to communicate effectively on issues related to these activities. In addition to this, the project should aim at building awareness among the public at large of the potential of renewable energy activities by providing the necessary information, as well as professional know-how and technology transfer with regard to renewable energy technologies and systems. Availability of unrestricted information and its ease of communication will help to achieve awareness, notably among the rural population regarding their capacity to preserve, maintain and improve their habitat and, in general, their quality of life.

The need for a concerted effort to realize a coherent, global information and communication system to support all facets of the World Solar Programme 1996-2005 is based on a positive evaluation of the proposed benefits, cost and distribution equation. Using proven technologies it is possible to bring together the various members of the Programme into a unified information and communication cooperative that will support a high degree of synergy and ensure timely action on new challenges and opportunities.

The International Solar Energy Society (ISES), together with INTERSOLARCENTER of Russia and other partner organizations has initiated a project to create a global information system to make information available to the renewable energy community. This project is an excellent foundation upon which an International Renewable Energy Information and Communication System may be based.

It should also be mentioned that an ongoing UNESCO activity can be an important element in this project : the International System for Energy Expertise and Knowledge (ISEEK), developed since 1994 on the basis of an earlier UNESCO Energy Database. The objective of ISEEK is to provide information on national governmental organizations, research centres, information centres, professional/trade associations, networks, training and education activities and facilities, databases/data banks, journals and reference publications and audio-visual aids.

Renewable Energy for Rural Electrification. In the remote rural areas of the world, more than 400 million households do not have access to electricity. Renewable energy electrification is possible by taking advantage of the modularity of the solutions mentioned in the general considerations. It would facilitate satisfying the basic needs of these populations

(water pumping, light, audio-visual equipment, rural dispensaries, schools, etc.) and would create or stimulate revenue-generating rural activities (tourism, handicrafts, improvement of agricultural production, etc.)

The strategy aims at promoting research and development for the renewable energy systems used in rural electrification, as well as the feasibility of hybrid systems for the same purpose, in order to achieve higher availability.

The project aims to implement the following four electrification activities designed for people living in the world's remote rural areas:

- *Water*: electricity for drinking water, designed to provide the electricity necessary for pumping existing water from wells in these areas and rendering it potable.
- *Educational Facilities*: designed to provide electricity to existing schools.
- *Health*: designed to provide electricity to existing dispensaries and field hospitals so as to ensure appropriate health care services.
- *Agriculture and Food Security*: electricity for agricultural development and food conservation and processing.

FAO and UNESCO will collaborate in the latter, within the framework of the follow-up of the World Food Summit (Rome, 1996) and the implementation of the World Solar Programme 1996-2005.

Renewable Energy for Water Desalination and Treatment. The scarcity of fresh water resources and the need for potable water will be increasingly important in the future. It is very likely that the water issue will be considered, like fossil energy resources, to be one of the determining factors of world stability.

The objective of this activity is to initiate, on the one hand, research and development programmes in the utilization of renewable energies for water desalination and treatment and, on the other, to set up pilot/demonstration projects to monitor the feasibility and effectiveness of the systems devised.

The world-wide availability of solar and wind resources and the availability of mature technologies in this field makes it possible to consider the coupling of desalination plants with renewable energy production processes, in order to ensure the production of water in a sustainable and environmentally friendly scheme for the regions concerned.

This ultimate goal of this project is to supply energy to produce fresh water for one billion human beings living in isolated areas, securing a minimum of five litres per day as required by the World Health Organization standards, during the period of the WSP.

Industrial Policy, Market Penetration and Technology Transfer for Renewable Energy. The aim is to provide a basis for increasing the use of renewable energies. Presently, the lack of relevant legal, technical and innovative financial mechanisms are hindering the wider use of these environmentally friendly energies. Suggested approaches to overcome existing obstacles include:

- Formulation of regulations for the integration of renewable energies in common planning procedures and project developments. Weaknesses of local infrastructures, including local and regional financial institutions, need to be identified and remedied.

- Establishment of new channels to disseminate appropriate technologies to target groups such as professional associations and marketing specialists, and reinforcement of communication with international and other financing institutions.
- Establishment of mechanisms designed to facilitate and support North-South and South-South technology-sharing initiatives and related actions, in order to develop a strong renewable energy expertise and economic activities at the regional and local levels.
- Mobilization of resources for technical assistance programmes and leveraging of resources to optimize total financing available from seed money, with special emphasis on micro-financing possibilities that can be delivered with precision at the retail level. This innovative seed financing should be accompanied by training in both technical and business skills and by familiarizing local financial institutions with lending in connection with renewable energy.
- Supporting the market with a more intensified research and development effort; identification and stimulation of innovative concepts of commercial viability using a market-driven approach.
- Enhancing the role of the private sector whenever feasible by introducing incentives to stimulate renewable energy technologies and thus encourage participation by all sectors of the market.

The United Nations Industrial Development Organization (UNIDO) has agreed to take the lead responsibility for the formulation and implementation of this project.

B. Regional Priorities and Projects

The African Region

One way of helping ensure that concrete benefits can accrue to Africa from the World Solar Programme 1996-2005 is through the implementation of projects that are strategic to the promotion of renewable energies. The five main projects that are listed below were selected because they were thought not only to be central to the success of the African solar programme which will be drawn up by the African Solar Council, but also general enough to apply to most African countries:

- Renewable Energy Education and Training Programme
- Renewable Energy Information and Communication Network for the Africa Region
- Rural Energy Production (Electrification)
- Capacity Building : human resources development, local industrial capacity for solar energy technologies, as well as capacities for research and development
- Biomass initiative.

The objectives of the priorities identified by the African region can be summarized as follows :

1. To increase substantially the utilization of renewable energy technologies in order to improve the quality of life of rural populations, and to provide energy services for small-scale industries thereby creating employment opportunities;

2. To provide energy services for the improvement of social services such as health and education;
3. To improve the industrial capacities of the African countries to implement sustainable solar programmes for Africa;
4. To demonstrate the cost-effectiveness of wide use of renewable energy;
5. To establish a regional information networking system using state-of-the-art communication technology;
6. To promote and harmonize co-operation in training and research, as well as in the transfer disclosures to the industrial sector at the regional and sub-regional levels, and
7. To encourage preservation of the environment by using benign renewable technologies.

Renewable Energy Education and Training Programme. The education systems in most African countries have followed traditional models based on established technologies. Renewable energy has only been introduced recently as a specialized field outside the conventional school system, in the form of on-the-job training for people already employed in the energy sector but who might not have the necessary background training. The result is that there is a conspicuous scarcity of solar energy expertise. Largely for this reason, the potential benefits and limitations of solar energy are not widely appreciated.

The curricula in most conventional schools systems do not include solar energy. Even at tertiary education level, solar energy is mostly for the enthusiasts, sometimes, the teaching of solar energy is obliquely referred to in various disciplines such as physics, engineering, biological sciences and agriculture, but with no coherent or systematic approach. There is need to popularize solar energy and the proper sensitization of both policy-makers and end users is important in this process. There is also a need to introduce formally solar energy as an optional subject for school examination purposes.

The main objectives of this project are:

1. To develop and implement solar energy curricula for schools, universities and colleges in order to develop and nurture expertise and keen interest in solar energy across the whole education system.
2. To develop and implement awareness programmes on solar energy in the society so as to develop familiarity and positive attitudes towards solar energy.
3. To develop a critical mass of college and high school tutors in solar energy.

Renewable Energy Information and Communication Network. The selection and deployment of appropriate renewable technology options in Africa has been constrained by the scarcity and difficulty of access to up-to-date information on the technologies, as well as on the rural energy sector. Consequently, action should be taken to promote and enhance the flow of information on energy technologies and related matters, and national and regional information networks should be established and/or strengthened. An important component of the project should be the creation of solar energy information centres with facilities for producing materials and disseminating information on solar and other renewable energies (booklets, videos, teaching materials, etc.).

Rural Energy Production (Electrification). Most rural areas in Africa are not connected to electricity grids and the prospect of this to happening in some areas is very remote. The energy needs of these off-grid communities can be met through small stand-alone systems powered from renewable energies. The aim of the rural electrification project would be to exploit those renewable energy technologies amenable to conversion to electric energy which are versatile and most convenient to use.

In devising a strategy to develop a comprehensive rural electrification policy that can be applied by countries of the African region, the conflict between efficiency and equity has to be addressed. The efficiency argument concerns the need to protect the financial health of the energy distributors. The danger is that poor, rural and low consumption communities will be left out in the meantime and, if resources run out, possibly forever. However, the alternative danger is to create an unsustainable financial burden and thus threaten the entire programme.

Taking into consideration the high investment costs (and the comparatively low running costs) of remote energy supply, governments need massive financial assistance in the form of loans at low interest rates, to employ renewable energy systems from the beginning. The funding is to compensate for the advantage of subsidized traditional energy supply (either grid connection or diesel systems). It should be related to a formula « of benefit », including the number of people benefiting and service provided. This funding scheme makes sure that only economically feasible application of solar systems will be considered, but overcomes the unfair competition of highly subsidized central grid connection with self-financing off-grid solutions.

The activities included in the project would be: (a) drawing up a master plan for rural electrification; (b) development of an appropriate energy supply policy, including relative pricing of various energy sources; (c) assessment of renewable energy technology options for rural electrification; (d) financial support for rural energy technologies, and (e) manpower development.

Capacity Building: human resources development, local industrial capacity for solar energy technologies, as well as capacities for research and development. There is need for Africa to develop local capacity in renewable energy technologies. This capacity building should be across the whole range from research through manufacture to marketing. The project on capacity building will focus on the enabling elements necessary for the success of the solar programme. A multidisciplinary approach is strongly recommended.

This project should see to the revival and strengthening of existing and sustainable research centres for renewable energy technologies. New ones should also be established and developed to meet national and regional needs. This may be achieved through the training of research personnel, financial support for research and development programmes, twinning with centres in developed countries and information networking. Another method of ensuring sustainability of the centres would be to adopt an approach where a country identifies and establishes a centre to specialize in one area of renewable energy for its own benefits. The same country takes responsibility to secure funding to establish and run the centre. If other countries in the Africa region want to have access to the facilities offered by the centre, then they will be required to pay a fee which will go towards meeting the cost of maintaining and

operating the centre. The training should be targeted to cover the whole spectrum of relevant personnel as well as end users.

Training centres should establish good links with the industrial sector and seek support from it; they would need to keep in mind the needs of the industrial sector when developing their training curricula.

Local manufacture, installation and maintenance of solar equipment through technology transfer, training and temporary work assignments are essential components for a sustainable solar programme. Solar industry capacity building takes a variety of forms: (a) development of expertise in installation and manufacturing of solar systems; (b) transfer of technology for repair and maintenance personnel; (c) on-site training, and (d) development of quality assurance standards and specifications.

Popularization of solar energy applications will naturally lead to strengthening of industrial expertise. Hence, new and novel applications of renewable energies need to be explored and exploited: lighting, radio/TV, fans, videos, poultry incubation, telecommunications, refrigeration, irrigation, sewing machines and small DC motors are among many examples.

In the field of industry build-up, especially in rural areas, this should be spearheaded by the establishment of Rural Energy Centres (RECs) whose tasks will be to identify energy needs of end users, evaluate economic and financial constraints to solar energy dissemination, advise on training in equipment, operation and maintenance and train/orient end users and the public in its efficient utilization.

Biomass Initiative. The project recognizes that among non-hydro renewables, only biomass has played a significant role during the last quarter-century in meeting energy needs, particularly in developing countries with large forest or agricultural resources, and that it constitutes and will continue to be a major source of energy for rural and urban Africa.

In order to put the brakes on the present trend in some African countries where exclusive exploitation of biomass leads to desertification, the preservation of existing biomass resources and the application of management practices to allow regeneration should be a part of the biomass production.

Recognizing the dominant role of wood as the major fuel, along with certain crop residues for the overwhelming majority Africa's population, and the arid to semi-arid nature of much of the land, steps need to be taken to: (a) find acceptable alternative fuels to firewood, such as biogas, agricultural residues and plant oil; (b) improve the efficiency of current rural energy devices; and (c) adapt woodstove designs to match local cooking habits and preferences.

The Americas and the Caribbean Region

At the preparatory meeting for the World Solar Summit, held in San José, Costa Rica in May 1996, participants agreed on the need to develop and implement projects based upon the exploitation of renewable energies, that would place emphasis on economic and social development, and would be oriented towards improving the quality of life, the educational development and

the cultural identity of people in the American Hemisphere. It was also recognized that, in keeping with the great variety of situations existing within the region, a number of sub-regional institutions, treaties and other instruments of integration and co-operation already exist, which should be fully taken into account in the preparation and implementation of regional projects.

The priorities identified for the region were as follows:

Assessment of Renewable Energy Resources. While practically all countries of the American continent and the Caribbean area have rather good renewable energy resources, the majority of them do not have sufficient basic information (for example on solar radiation, wind patterns or geothermal potential) to take meaningful decisions on the selection and deployment of the appropriate technology.

Standardization and Certification of Renewable Energy Technology. Examples are plentiful in the region of projects that failed because the equipment bought from manufacturers in industrialized countries in other parts of the world turned out to be inadequate, either because they had been conceived to meet other requirements or due to problems of compatibility or of acceptance on the part of the users. Therefore, any project of regional scope should take into account the need to verify that the technology proposed is appropriate to meet the purposes of the project and that the relevant equipment is reliable and user-friendly.

Training and Organization to Promote and to Operate Renewable Energy Systems. In order to ensure the success of renewable energy projects the training of engineers, technicians and end-users is essential. This project foresees the creation of a regional centre for the support of the transfer of renewable energy technology and the development of a methodology for the massive deployment of rural electrification systems using solar energy. For the latter, specific training in devising and operating large renewable energy systems is necessary. In order to prepare training courses of various levels that can be as effective as possible, a systematic analysis of past experiences of solar rural electrification projects in the region will be conducted, notably in Argentina, Bolivia, Brazil, Colombia, Chile, Cuba, Ecuador, Peru and some island countries in the Caribbean.

Evaluation and Management for the Development of Projects. This priority activity for the region is closely related to the preceding one on training. Experience shows that evaluation and management skills are very important factors for the success of a project, from its conception to its implementation and follow-up. The training should include the preparation, initially in Spanish, of principles and guidelines for project preparation, as well as systems design and implementation methodologies of relevant technologies. These materials will be distributed through the Iberoamerican Network of Rural Electrification with Renewable Energies (RIER) and the documentation unit of the proposed regional centre to support technology transfer.

Preparation of Decentralized Community-type Renewable Energy Projects. This project aims at improving the quality of life in rural communities located far away from the power grid through the utilization of photovoltaic

systems for the production of electricity. Rural electrification requires an appropriate infrastructure, including the development of a local industry, not only to manufacture the equipment or some of its components, but also to provide engineering, installation and maintenance services. The involvement of the local cooperatives, associations and population in general, at all stages of the project preparation and subsequent implementation and operation, is crucial to ensure its acceptance and ulterior success.

The Arab Region

The priorities for the Arab region were identified following several consultations held at the national and regional level, with the contribution of Arab organizations and institutions active in the field of energies, notably the Arab League, the Arab League Educational, Cultural and Scientific Organization, the Arab Atomic Energy Agency and the Islamic Organization for Education, Science and Culture.

The High-Level Expert Meeting "Solar Energy for Fresh Water, Culture and Environment", held in Muscat, Oman, from 23 to 26 March 1996, within the framework of the preparation of the World Solar Summit, endorsed the preparation of an Arab Plan of Action in renewable energies that would take into account the specificities of the region; this Plan should be supported by a financing mechanism for the implementation of projects in the Arab States.

The High-Level Expert Meeting recognized that large-scale utilization of solar energy in the Arab region could assist in : (a) the establishment of small-scale industries in rural areas that would create job and education opportunities and income-generating activities, thus reducing migration; (b) the improvement of living standards and the increase of productivity in remote rural areas, and (c) curbing deforestation and desertification and preserving soil fertility and the ecosystem.

The High-Level Expert Meeting approved the following priorities to become regional projects within the above-mentioned Plan of Action :

Rural Electrification. The project aims at providing electricity to the large sector of population living far away from the power grid. Among the expected results of this project the following can be mentioned : (a) overall increase in the rate of electrification in the Arab region; (b) effective transfer of knowledge and technology; (c) creation of employment opportunities in rural and isolated areas and reduction of rural migration; (d) contribution to conventional energy savings and to the improvement of sanitation and health; (e) creation of local industries of small and middle size for the production of equipment and parts, and (f) installation of pilot projects to stimulate a wider-scale deployment of renewable energy technology.

In more concrete terms, the project includes the following actions :

- electrification of 50.000 rural homes with 100 W power per unit, for an overall power of 5 MW.
- construction of 600 surface wells using photovoltaic pumping stations.
- installation of 10.000 to 15.000 refrigeration units for the conservation of foodstuffs and medical supplies.
- installation of 5.000 to 6.000 telecommunication units of 300 W each.

Water Desalination for Development. The primary objective is to improve the regional economic development through the increase of both energy services and water supply by the exploitation of solar and other renewable energies.

The project would include four phases : (a) evaluation of existing technologies and centres of excellence, and the present and future demand of water in the region; (b) assessment of the adaptation of these technologies to the needs of the region and identification of the major industries concerned; (c) selection of certain sites for the installation of pilot units and support of local laboratories and research centres that can provide a continuous technical support to these pilot units, and (d) socio-economic evaluation of the impact of the implementation of pilot projects and development of partnerships for the creation of joint industrial projects for assembling and producing equipment on a commercial scale.

For practical reasons, it is envisaged that the first and second phase will initially be addressed to certain Arab countries suffering from the scarcity of water resources, such as Algeria, Egypt and Tunisia.

Development and Installation of Solar Refrigeration for Domestic Use in **Dry Hot Areas.** Cold production is one of the biggest energy consuming activities in the Arab world. In some regions such as the Arabian Peninsula, air-conditioning accounts for more than 70% of peak demand, with an annual electricity consumption of over 40% of the annual production. The importance of energy consumption for refrigeration and air-conditioning in the hot desert belt of the Arab region, stretching from the Atlantic shores in the West to the Arab Gulf in the East, makes solar cooling an attractive application, especially with the added advantage of having the cooling requirements and solar energy availability running in phase, i.e. when cooling is most needed the solar energy sustainability is at its highest.

The objective of this project is to develop a solar-powered absorption system for cold production, using endothermic salts, that can meet the cooling needs of remote rural communities in hot and dry areas. It is envisaged to manufacture a simple and reliable refrigeration unit suitable for applications in these areas, thus contributing to their energy independence from conventional fuels; this unit would be powered by photovoltaics and solar thermal collectors.

The implementation of this project will contribute to the ongoing efforts in the region towards the improvement of the preservation of foodstuffs (animal and agricultural) from remote hot and isolated areas by storing them on site. In addition, it will encourage the farming communities in these areas to stay on their land by providing them with sufficient energy to have a better standard of living and hence avoid migrating to the cities.

Renewable Energy Education and Training Programme. The objective of this project is, first of all, to define the actions to be taken in order to establish a basis for integrating renewable energy education and training as one of the key elements in the development of renewable energy programmes. It should be noted that there exists at present no specialized university course on renewable energies recognizing this specialization as a subject in its own right; equally, there exist in the Arab region as well as the other world regions no institutions for coordination and advice in renewable energy education.

Efforts to meet the education and training needs of the Arab region must be targeted towards three different but complementary activities, i.e. :

- General knowledge to inform decision-makers to be provided by universities and other institutions of similar standing through short seminars, workshops, conferences or summer schools.
- Essentially practical, but also some elementary theoretical knowledge for the training of technicians and operators to be provided over weeks or months by vocational and technical school.
- Advanced theoretical and practical training for researchers, planners and designers to be provided by a year postgraduate degree diploma by universities and engineering schools.

Among the actions proposed within the project, the following can be mentioned:

a) To conduct a survey essentially designed to identify existing courses on renewable energies in each country in the Arab States. The report resulting from this survey will be published.
b) To carry out a study (on the basis of a preliminary survey) in order to define the type of training to be undertaken, and to propose and organize a teaching programme for each target audience :
    - higher education students,
    - decision-makers,
    - technicians,
    - secondary education pupils,
    - industrialists and users.
c) To create a generation of modern educational packages on renewable energies, comprising technical and practical documents, slides, videos, dimensioning software and CD-ROM etc. Different areas of the renewable energy use should be covered such as :
    - solar photovoltaic conversion,
    - wind energy,
    - biomass energy,
    - small hydro energy,
    - water desalination by renewable energy,
    - maintenance of the renewable energy equipment:
        - photovoltaic equipment for lighting and water pumping,
        - wind energy equipment,
        - biogas equipment.
d) To prepare educational documentation for the general public that could influence public opinion and subsequently overcome existing barriers.
e) To initiate the creation of an Arab Institute for Renewable Energy Education and Training (AIRE) under the auspices of an Arab Solar Commission and UNESCO, as one of the strategic actions of the World Solar Programme 1996-2005; this institute would be the framework within which could be implemented the different initiatives of the Solar Education Programme.

Renewable Energy Information and Communication Network. The main objective of this project is to utilize the modern communication technologies in order to facilitate the exchanges of information, knowledge and skills between specialists and institutions concerned in the Arab world. This project should, inter alia : (a) promote the regional, inter-regional and international co-operation in the field of renewable energies; (b) contribute to sensitize the Arab world on the importance of environmental preservation and to increase the quality of life of many population groups through a reduction of the level of pollution; (c) achieve, through increased

pooling, a better utilization of human, material and financial resources, thus facilitating the implementation of mobilizing renewal energy projects.

The development of this Arab information and communication network in renewable energy should be a joint venture with the participation of all Arab countries, and will entail the following stages :

- phase 1 (1997-1998) : identifying of national focal centres;
- phase 2 (1998-1999) : setting up of national networks;
- phase 3 (1999-2000) : connecting up of the Arab region network;
- phase 4 (2000-2002) : connecting up with the global renewable energy network.

The Asia and Pacific Region

The objectives of the regional priorities proposed by Asia and the Pacific region are as follows:

- to enhance the understanding of the role that renewable sources of energy could pay in preserving the environment, in providing energy services - particularly for rural and remote areas - and in contributing towards a solution to unemployment,
- to urge non-governmental organizations to form partnerships and make available their knowledge and experience to global and regional inter-governmental bodies, as well as introduce and establish innovative programmes for promoting the use of renewable energies,
- to establish a global information networking system using state-of-the-art communication technology,
- to promote and harmonize co-operation in training and research, as well as in the transfer disclosures to the industrial sector at the regional, inter-regional and international levels,
- to demonstrate the cost-effectiveness of the wide use of renewable energy.

Centre for Education and Training in Renewable Energy for the Asia and Pacific Region. Renewable energy is a growing reality. This is because energy is required to sustain development and advancement in the region. Population growth and energy demand will necessitate the use of clean and safe energy, clean environment and sustainable energy. All these can be achieved by using renewable energy. In order to coordinate and accelerate the use of proven technologies in this area, a centre of excellence is required to serve the region.

The objectives of the regional centre are: (1) to act as an open institution in the region to demonstrate, educate and train essential human resources at various levels; and (2) to execute renewable energy projects throughout the region. The centre will demonstrate the viability and practicability of various renewable energy applications.

The centre will act as a focal point for information gathering and information dissemination throughout the region. It will also be linked to all existing centres by various means such as Internet and E-mail. The centre will also

produce bulletins periodically; highlighting various renewable energy projects and ideas to update the state of the art. Various news from around the world will also be included.

The centre should take a major role in educating policy-makers, governmental agencies and the public about the role and the need for renewable energy. The centre should host various seminars and short courses on a regular basis as part of its role to serve the region. It will develop instructional materials and guidelines for the design, implementation, experimentation, installation, testing and monitoring of renewable energy systems.

Part of the centre should be a solar park in a real-life setting having all types of experiments and demonstrations of various levels for the public and researchers in the region. The design of the building should take into consideration bio-climatic architecture. The capital cost of the centre, including annual operational costs, is approximately US$ 3 million.

Electrification of Demonstration Village by Renewable Energy in each Member Country. A model village that will consume no more than 500 kW of electricity generated either by wind or solar energy will be set up. The electricity will be used in households, schools, community centres, places of worship and health centres. The national authority in each country will present a full proposal consisting of planning, equipment selection, installation, operating and maintenance procedures.

The training of personnel and villagers on the use of renewable energy and the minor maintenance required in each home should be an integral part of the package. Ownership and the tariff structures of the electrification system will be subjected to the requirements of the country concerned.

The objective of this pilot project is to demonstrate the feasibility and the reliability of renewable energy-driven rural electrification. The project will be widely replicated in each member country. In order to share their experience, there should be an annual meeting of the representatives of each village. The approximate project cost is US$ 0.75 million for each member country.

Pilot Project for Production of Drinking Water for a Remote Community. To produce 5,000 litres of potable water per day, a hybrid system, i.e. wind/PV system, will be used by a small village community in each country. The system can entail either water pumping from underground or desalination using reverse osmosis method. The capacity of the system will be of the order of 50 kW.

The objective of this project will be to demonstrate the feasibility and the reliability of renewable energy technology for safe drinking water systems. The water sources will be under a local management system as decided by the member country. A training and dissemination arrangement will be a part of each pilot project. The training of personnel and villagers in minor maintenance and in the use of renewable energy should be an integral part of the package. The approximate project cost is US$ 100,000 for each country.

Grid Connected Solar Power Station. A model power generation station using PV/wind/biomass/micro hydro hybrid system connected to the national/local grid is proposed. The capacity of this station will be one megawatt and there will be one such station in every member country.

The objective of the project will be to demonstrate and publicize the feasibility and reliability of Renewable Energy Power for the grid. This will enhance collaboration between conventional and renewable power generation systems.

The management of such a station will be decided by the country concerned. Training of personnel in Renewable Energy electrification and in maintenance should be an integral part of the package. The approximate project cost is US$ 1.5 million for each member country.

Commonwealth of Independent States

At the Moscow Solar Summit, held on 8-12 June 1996, within the framework of the preparation of the World Solar Summit, a Declaration was adopted and two regional projects were identified by specialist participants from the Commonwealth of Independent States.

The features of the existing energy supply system in the CIS are rather different from those of other regions. For example, the hydro-electric energy potential has already been substantially exploited, and the present coal, oil and natural gas production and distribution installations require very important investments to maintain their capacity. Furthermore, nuclear power development is faced by opposition from public opinion and the existing energy supply system creates serious environmental problems.

In the light of this situation, the specialists attending the Moscow Solar Summit concluded that, given the fact that the potential of renewable energies in the countries of the CIS is very large, their applications in rural and/or remote areas have an outstanding social dimension and can dramatically improve the living standards of the populations concerned. They also recognized that, despite the low prices of conventional energies still prevailing, in certain areas of the CIS renewable energies are already competitive and that they are perfectly adaptable to the recent trends towards energy supply decentralization.

The following two projects of regional scope were agreed upon, to be followed by others during the decade covered by the World Solar Programme 1996-2005.

Regional Renewable Energy Education and Training Programme. The objective of this project is the creation of integrated programmes for the training of engineers in renewable energy, including appropriate elements of scientific, educational, information and organizational nature. The issue of energy conservation and savings will also be included in the curricula, on the basis of experience gained in other regions of the world.

In addition to the establishment of a UNESCO Chair in the Academy of Chemical Engineering, the creation of two training centres is foreseen, one in the Altai region and another in the Republic of Dagestan.

The project calls for the following measures, among others : (a) creation of training centres for engineers in the field of energy conservation and renewable energies; (b) creation of training, scientific and testing facilities on the basis of hands-on conservation technologies and facilities; (c) development of integrated education plans for training of engineers and technicians on the issues of energy conservation and renewable energies; (d) organization of lectures for students of different specialities, given by foreign professors; (e) preparation and publication of training literature and packages; (f) creation of specialized courses and training laboratories for the upgrading of skills and retraining of engineers, and (g) establishment of educational and scientific databases, connected to the global information system.

Energy Efficient Demonstratior Zone in the Territories Contaminated as a Result of the Chernobyl Accident. Following the Chernobyl accident, thousands of hectares of woods and productive agricultural land were contaminated, and the latter have since been withdrawn from active use. In order to compensate for this loss of resources, the project aims at using forest biomass and fast rotation crops in the affected zones as sources of energy to be used, *inter alia*, as fuel for power plants of small and medium capacity. At the same time, the feasibility of decontaminating the agricultural land through the use of special, fast rotating crops, will be tested.

The project includes research and development of technology and equipment for the thermal processing of wood, woodwaste and other biomass. In addition, the construction and operation of biomass valorization facilities, including technologies for growing and harvesting the appropriate biomass resources, are foreseen.

The basic phases of the project include the following : (a) estimation of the further evolution of renewable energy values in the contaminated areas; (b) determination of the socio-economic background and assessment of the availability and reliability of existing utilities; (c) evaluation of health effects and other waste management and radiation issues; (d) setting up of a forestry development programme for contaminated areas; (e) formulation of a biomass power concept; (f) cost-benefit analysis of the proposed actions; (g) design and manufacture of the main elements of the special energy development zone, including pilot plants and other facilities, and (h) creation of the special zone (legislation and regulations, licensing, etc.).

The following three projects were also identified as regicnal priorities:

Biomass Energy Conversion.
Renewable Energy Supply Systems for Northern Territories.
Utilization of High Potential Geothermal Energy for Power Supply of Pacific Coast Territories.

The Mediterranean Region

A Mediterranean Solar Programme 1996-2005 has been prepared as a result of several regional consultations held since 1995 within the framework of the Mediterranean Solar Council. This Programme has been drawn up in collaboration and with the participation of representatives of all countries of the region. It was submitted to, and approved by, the following meetings :

- the Meeting of Ministers (members of sponsoring committee of the Mediterranean Solar Council) held in Sousse, Tunisia, on 19 January 1995;
- the Mediterranean Solar Summit (of Ministers concerned, governmental representatives and experts of the region) held in Malta, on 20-24 May 1996.

The Mediterranean Solar Programme 1996-2005 has the following objectives :

- identify the programmes and projects of high national and regional priority;
- promote and harmonize the regional, inter-regional and international co-operation, notably in the fields of training, research, technology transfer and industrial partnership;
- develop sensitization actions aiming at strengthening the role that renewable energy sources can play in the provision of energy and the protection of the environment;
- facilitate the preparation and implementation of national projects considered as national priorities;
- establish the appropriate financial mechanisms and institutional and legislative reforms.

On the basis of an analysis of the specificities of the Mediterranean region (socio-economic needs, climate and natural conditions, and scientific and technological infrastructures), as well as the policies and programmes of each of the region's countries, it has been possible to prepare a first list of strategic projects deserving to be labelled as priorities. They are the following :

1. Desalination of salt and brackish waters
2. Rural electrification
3. Education and training
4. Information and communication network
5. Regional industrial policy

*1. **Desalination of Salt and Brackish Waters.*** The objectives of this project are : (a) to ensure a transfer and mastery of technology in the use of renewable energies for desalination, and (b) to install water desalination stations of small, middle and large capacity in certain rural and coastal areas of the region.

The project will include the following components :

- Use of the international data bank on institutions and individuals concerned with desalination (Desalination Directory and Electronic Network).
- Use of the international inventory of desalination plants.
- Technico-economic evaluation of desalination technologies.
- Identification of better adapted and more efficient techniques, in the light of the characteristics of each sub-region.
- Strengthening of scientific and technical training in order to facilitate the technological transfer and mastery of the various desalination systems.

- Equipment of selected villages with desalination stations of small and middle capacity (2 to 25 cubic metres per day). The participation of beneficiary countries in the conception, manufacturing and installation of these stations should be strongly encouraged, in order to develop national know-how in the field.
- Carrying out a limited number of industrial pilot projects in countries with the severe problems of water availability and quality.
- Evaluation of these pilot projects and preparation of a regional master plan for salt and brackish water desalination using solar energy.

The expected results are : (a) increased availability of water, for both drinking and irrigation purposes, in areas of the region facing shortages; (b) technological and skills exchanges within countries of the Mediterranean region; (c) reduction of rural emigration and creation of employment in the agricultural and handicrafts sectors through the installation of desalination plants; (d) contribution to energy savings, to environmental protection and improvement of sanitation and health through the use of safe and renewable energies, and (e) creation of local industries to produce desalination equipment of small, medium and large capacity and the related parts.

2. ***Rural Electrification.*** The objective of this project is to promote industrial research and development for the conception and manufacturing of photovoltaic systems and wind turbines in order to improve efficiency in the rural electrification.

In parallel with measures already taken by countries for the installation of renewable energy systems within the framework of national plans, this project aims at an enhanced deployment of these technologies for the electrification of rural areas, thus responding to their needs in lighting, audio-visual applications, refrigeration, water pumping and telecommunications. The provision of electricity will facilitate the establishment of the primary schools, dispensaries and cultural and recreational centres that are necessary for the socio-economic development of the populations concerned.

The actions to be taken will include, among others, the following :

- Inventory and social, technical and economic evaluation of the installations and technologies of rural electrification existing in the various countries of the region.
- Definition and quantification of needs by type of application (lighting, refrigeration, pumping, telecommunications, etc.), by category of utilization (domestic, school, dispensary, drinking water supply, etc.) and by country.
- Selection of the more appropriate and performing techniques in the light of the characteristics of each sub-region.
- Strengthening scientific and technical training in order to achieve technological transfer and mastery in the various techniques of rural electrification.
- Carrying out selected pilot experiences in rural electrification in countries having a great number of rural households not connected to the national power grid.
- Stimulating existing industries and supporting the creation of new national ones for the manufacturing, installation and maintenance of equipment (photovoltaic systems, wind turbines).

The expected results are : (a) increase of the rate of rural electrification in countries of the Mediterranean region; (b) transfer of technology and know-how between countries of the region; (c) reduction of rural emigration and creation of employment in the agricultural and handicraft sectors by providing electricity to rural populations; (d) contribution to energy savings, environmental protection and improvement of sanitation and health through the utilization of safe and renewable sources of energy,

and (e) creation of local industries for the manufacture of rural electrification equipment of small, middle and large capacity, and the related parts.

3. Education and Training. The Mediterranean Solar Council has defined the objectives of this project as follows : (a) support and guide existing institutions of scientific and technical education in the development of specialized curricula in the field of renewable energies; (b) assist in the creation of centres specialized in the training of technicians in this field, and strengthen existing centres; (c) facilitate exchanges of trainers and of training programmes between countries of the Mediterranean region, and (d) support and develop specialized training actions, of the "summer school" type, such as those implemented by UNESCO concerning photovoltaics and biomass.

Among the actions to be included in the project are the following :

- Preparation of a reference higher education programme defining the level of a specialized master's degree, and of a specialized graduate degree at the M.Sc. level on renewable energies.
- Preparation of an inventory of existing training opportunities in each country of the region; the report of this effort will be published.
- Carrying out a study - based on a preliminary investigation - in order to determine the type of training to be undertaken and to propose an educational programme for each target group : university students, high school students, technicians, decision-makers, local authorities, industrialists and end-users.
- Creation of a new generation of learning packages on renewable energies, composed of technical documentation, exercises, transparencies, video-cassettes and state-of-the-art software.
- Initiation of the establishment of a Training Institute for Renewable Energies (TIRE) under the auspices of UNESCO, in order to provide a framework for the implementation of various initiatives.
- Creation of a network of Mediterranean centres and/or universities linked to the TIRE; membership of this network will be open to educational institutions providing training on renewable energies and/or awarding degrees in the subject.
- Promotion of the co-operation between countries of the region on education and training, harmonizing and developing existing training opportunities in renewable energies.
- Organization of permanent training and upgrading sessions (for example, summer schools) and support of existing ones, on the various aspects of renewable energies.

4. Information and Communication Network. Lack of information and sensitization on the part of decision-makers and end users is one of the main obstacles to the development of solar and other renewable energies. Actions in the field of information and communication will be targeted on these two categories, i.e. decision-makers and potential users of renewable energies. It is understood that information for the other groups (researchers, trainers, industrialists, etc.) will be provided through the actions already described (research and development, education and training, industrial development and technological deployment).

The objectives of this project can be summarized as follows : (a) strengthen the "cultural image" of solar and other renewable energies; (b) make known to decision-makers the advantages of renewable energy compared with fossil energies; (c) stimulate the establishment of a larger renewable energy market, and (d) support the efforts made in this field by Mediterranean countries.

This project will include, among others, the following actions :

- Creation and broadcasting of reports and information and sensitization spots, in co-operation with television stations.
- Organization of colloquia, seminars, workshops and site visits for decision-makers in public administrations and agencies, as well as private enterprises, in order to inform them about the quality and performance of the various applications.
- Publication of a newsletter for decision-makers with condensed articles and news about the renewable energy applications of solar and other renewable energies in the Mediterranean basin, with a brief survey of the situation in other regions.
- Preparation of audio-visual pedagogical materials on concrete experiences of renewable energy applications, underlining their social and economic impact.
- Invite and encourage industrialists and specialists in the field to actively participate in the main specialized events, particularly those of global and regional scope (agriculture, automobile, appliance shows and exhibitions, for example).
- Publication, in the main magazines, of popularizing articles on the advantages of renewable energies and their social, economic and environmental impacts.

5. Regional Industrial Policy. For the promotion of renewable energy industry and technology in the Mediterranean region, the objectives are as follows : (a) facilitate the exchanges and promote industrial and technological partnership between countries of the region; (b) assist in the establishment of renewable energy industries adapted to the needs and the infrastructures of the region, and (c) encourage the development of renewable energy projects through financial, fiscal and legislative measures.

Among the actions to be taken are the following :

- Development of a technological database on existing renewable energy applications in the Mediterranean basin.
- Production of a yearbook/directory of renewable energy industries in the region.
- Creation of a partnership and subcontracting exchange of renewable energy industries, open to industrialists and developers from both within and outside the region.
- Organization of specialized meetings of Mediterranean business people interested in renewable energy industries.
- Creation of a Mediterranean association of renewable energy industrialists, which, in the future, could take charge of specific professional issues.
- Preparation of a guide to investment and financing opportunities in renewable energy industrial projects.
- Organization of meetings between industrialists and funding sources (public, private, national, multinational, etc.)

C. High-Priority National Projects

Since the landmark High-level Expert Meeting «The Sun in the Service of Mankind», held at UNESCO Headquarters on 5-9 july 1993, and throughout the ensuing World Solar Summit Process (WSSP), all of the many governments that participated were invited to submit to the WSSP International Organizing Committee high-priority project proposals worthy of strong national and international support in fields of renewable energy. They were also asked to identify areas of regional co-operation that might ultimately result in additional project proposals. The World Solar Summit, while recognizing that the list of projects was open-ended, decided that all these projects should be an integral part of the World Solar Programme 1996-2005.

More than 300 national projects have been received from 75 countries from Africa, the Americas and the Caribbean, the Arab States, Asia and the Pacific, the Commonwealth of Independent States, Europe, and the Mediterranean region. Most of these projects concern the utilization of various renewable energy sources such as solar, hydro, wind, geothermal, biomass, wood and woodwaste, for application in rural electrification schemes, especially for the benefit of people living in isolated and underprivileged rural and island communities, for heating and cooling purposes, for water pumping and desalination plants, as well as for domestic use and small-scale industry. A significant number of projects deal with information and communication, research, education and training issues, and the marketing and commercialization of renewable energy technologies.

The list of these projects, broken down by country, is given in the Annex II. A summary description of the same projects can be found in a separate reference document entitled "High Priority National Projects of the World Solar Programme 1996-2005".

STRATEGY FOR THE DEVELOPMENT AND IMPLEMENTATION OF THE WORLD SOLAR PROGRAMME 1996 - 2005

As a general remark, it should be pointed out that the Harare Declaration on Solar Energy and Sustainable Development is a strategic document that has guided the elaboration of the World Solar Programme 1996-2005. It is clear from the text of the Declaration that the WSP should become a major contribution to sustainable development, both on its own and as a key element of any overall energy strategy that could be agreed upon at the international level in order to promote a balanced and reinforced approach to economic, social and environmental aspects of sustainable energy development. Decision-makers at the national level are increasingly aware of the fact that the wider-scale use of renewable energies can have a very important impact on two key issues confronting them : environmental protection and social development. This understanding alone would bring the issue of renewable energies to the forefront of their policy-making and become a national priority.

The basic strategy for the implementation of the World Solar Programme 1996-2005 can be summarized as follows :

- The main thrust should be applied to the mobilization of public and private national efforts; as without serious commitment from nations, there can be no progress in the development and deployment of renewable energies.
- International governmental and non-governmental institutions should be mobilized to complement the national efforts in the implementation of national renewable energy programmes.
- Major competent regional organizations should be mobilized to create concerted actions by groups of countries to favour large-scale use of renewable energies, including the preparation of regional action plans and setting up of indicative target figures.
- The identification of few global projects of universal value to be implemented jointly by all countries should be made.
- Existing funding institutions should be persuaded to increase the share that they currently devote to finance renewable energy projects.
- Appropriate incentives should be created by the Governments to encourage private and public investments in the production and use of energy from renewable sources.
- Legal, socio-economic and administrative measures should be taken to create the necessary conditions for the implementation of the World Solar Programme 1996-2005.

On a more concrete level, it is perhaps relevant to recall experience from the series of regional preparatory meetings leading to the World Solar Summit, and the subsequent consultations for the preparation of the World Solar Programme 1996-2005. This process has revealed that, the exploitation of renewable energies has become increasingly familiar to decision-makers and the general public in many industrialized countries. However, this is not always the case in a number of developing countries, where the relevant knowledge is still limited to a restricted circle of specialists and government officials. The preparatory meetings also revealed that several regions have planned that the share of renewables in the overall energy production should be in the range of 8 to 15% by the year 2005,

depending on the situation in each region. Yet experience shows that the research and development work on these technologies can only be widely applied when the potential of renewable energies has been demonstrated and has become commercially attractive. Of course, information, education and training on renewable energies are essential, and this is particularly true in many developing countries, where both users and investors will be reluctant to enter into the world of renewables unless they are properly informed and convinced of the benefits they can derive from the exploitation of these energies. Another important element for the wider use of renewable energy technology is the elaboration of global product and system standards for manufacturers.

Yet another element to be taken into account when devising a strategy for implementation is the need to carefully assess the type of equipment that is best suited for a given situation. The impression that renewable energy systems are less reliable than those based upon traditional energies is still widespread; for example, in certain countries rural populations prefer to await a hypothetical future extension of the power grid rather than immediate installation of solar electricity equipment. Designers of renewable energy systems should not hesitate to propose hybrid systems (solar/wind or solar/diesel generator, for example) in order to meet the needs of a given situation requiring a steady supply of electric power.

Therefore, education and training, pilot and demonstration projects, and establishment of product and system standards should be recognized as key components in the implementation of renewable energy programmes.

A. Global Renewable Energy Education and Training Programme

As outlined in Section IV above, the creation of a Global Renewable Energy Education and Training Programme is one of the five strategic projects of universal scope and value endorsed by the World Solar Summit. The value of similar programmes at the regional level has also been recognized by participants in the preparatory meetings for the Summit, held in the various regions.

The first steps in the preparation of such a programme have to concern an assessment of the overall needs and existing facilities. Thus, an inventory of present education and training possibilities in the countries and regions concerned is foreseen. On the basis of this inventory, a needs analysis will be undertaken, in order to define the appropriate type of education and training required and to propose the corresponding curricula. Then, an identification will be made of the national correspondents of the Global Renewable Energy Education and Training Programme.

In order to provide a useful framework for the elaboration and implementation of the various initiatives that are and will be taken in the field of education and training, the creation of an "Open Institute" under the auspices of UNESCO has been envisaged. The potential of modern communications technology will be fully utilized for the setting up of a wide-ranging programme (videocassettes, films, teleconferences, documentation on various electronic supports, etc.). The Institute will have the support of the specialized groups of the different regional solar councils and of the regional research centres and institutions that would also be responsible for disseminating the logistics utilized.

Among the activities to be undertaken by the Institute, the following can be listed :

a) preparation of reference curricula for training of high and middle-level technicians, including special model training programmes for maintenance technicians;
b) preparation of learning packages covering the various kinds of renewable energies, as well as energy management, water desalination and equipment maintenance;

c) development and dissemination of educational materials for the public at large that can inform and influence public opinion, thus contributing to the process of overcoming institutional barriers;
d) creation of a network, initially of a limited number of centres and universities linked with the Open Institute that offer training and/or deliver degrees in renewable energy;
e) promote North-South and South-South co-operation, notably through a harmonization of existing curricula in the field;
f) develop training opportunities for engineers and technicians to upgrade their skills in the different specializations of renewable energies.
g) promote the introduction of the principles of renewable energy exploitation in secondary school curricula, and advise on the preparation of relevant documentation, and
h) assist national education systems in setting up a higher education programme leading to a master's degree in renewable energies; initially and on an experimental basis the centres and universities linked with the Open Institute might be chosen to offer this type of training.

It should also be mentioned that, within the framework of this Programme, UNESCO is developing a Renewable Energy Engineering Learning Package specifically devised for advanced undergraduates and postgraduate students, as well as practising power and energy engineers in industry. This Learning Package is designed as a unique set of multimedia tools comprised of written texts, CD-ROMs and self-training software, each prepared by recognized experts. It is expected that the learning packages will be disseminated widely and accessed through both modern state-of-the-art and low-cost information and communication technologies.

B. Desirability of Pilot/Demonstration Projects

During the various meetings held for the preparation the draft World Solar Programme 1996-2005, participants coming generally from developing countries emphasized the importance of pilot and/or demonstration projects for the enhanced utilization of renewable energies. They referred to the fact that, in their countries and regions, there is little knowledge on the potential and applications of these energies and that the dissemination of the relevant information is not always easy or affordable. Consequently, decision-makers and end-users alike hesitate to adopt the relevant technology and investors are reluctant to enter the field.

Another positive aspect of pilot and/or demonstration projects was highlighted at an important conference organized on 10-11 October 1996 in Brussels by the European Commission. This conference, entitled "Improving Market Penetration for New Energy Technology : Prospects for Pre-Competitive Support" reached the conclusion that, over the short to medium-term, initiatives such as demonstration projects and activities are the most cost-effective and environmentally acceptable response to help increase market penetration of new technologies. The usefulness of supporting dissemination projects beyond demonstration was also underlined, notably by experts in the field of renewable energy sources.

It can, of course, be argued that a wealth of experience exists in many parts of the world on the operation of renewable energy systems and that, in places where these systems function, there is no need for demonstration projects. There is, however, a need to provide the relevant information - on both successes and failures - to those who have had no access to such information, and this is a task which could better be performed at the regional level, ideally by the regional solar councils that were created during the World Solar Summit Process (WSSP). Pilot and demonstration projects are still needed in many parts of the

world, as nothing can fully replace hands-on experience. Lastly, it is important to underline the need to devise mechanisms for the repair and maintenance of projects after their installation. In fact, every renewable energy project, especially in developing countries, should contain provision for users' training in its operation and maintenance.

It is well recognized that the full integration on a large-scale of renewable energies in national economies, requires strengthening the linkages of industry with the investment opportunities. As investors are only providing funds for well-defined projects, from which they may benefit commercially, good demonstration projects with full commercial value should be identified and implemented, within the framework of the World Solar Programme 1996-2005. If investors in the private sector, financial institutions and governments can select some of this type of project for implementation, they would serve as examples for the decentralized production of energy and stimulate national and regional development through job creation and environmental protection.

C. Setting of Product and Systems Standards

In many countries around the world examples can be found of projects that failed because the technology utilized did not meet the needs due to inadequate performance. This was particularly true in the case of photovoltaics (PV), used for direct conversion of light into electricity. Inconsistencies and flaws have appeared in recent years in some off-grid rural electrification programmes as regards the quality of components, systems, installations and maintenance of renewable energy equipment.

One of the main causes of this situation was identified as lack of standards : there are very few product standards and no systems standards, which means that very often manufacturers have no guidelines on how to fabricate a reliable product. Furthermore, the lack of accredited testing laboratories makes the task even more difficult for producers, especially in the less developed countries. It was also realized that installers of renewable energy systems needed a reference manual to ensure quality installations.

The renewable energy community, including national and regional industry associations, supported by funding institutions (such as the World Bank, UNDP and others) should set up programmes to remedy the situation through the promotion and maintenance of a set of quality standards and certification procedures for the performance of products and systems, in order to ensure high quality and reliability. In addition, a list of globally accepted testing laboratories in all parts of the world should be compiled and a globally accepted reference manual should be prepared. This could be supplemented with an accreditation and certification programme and the creation of quality seals for both systems and components.

D. Preparation of the World Solar Programme 1996-2005

Following the launching of the World Solar Programme 1996-2005 on the basis of the outline approved by the World Solar Summit, and with a view to its preparation, the actions described below have been or are about to be taken as from June 1997.

H.E. Robert Mugabe, President of the Republic of Zimbabwe and Chairman of the World Solar Commission, has transmitted the text of the Harare Declaration on Solar Energy and Sustainable Development to all Heads of State and Government around the world, emphasizing that the time has come to translate into concrete action the unanimous endorsement given by the World Solar Summit to the development and deployment of solar and other renewable energies. President Mugabe has also stressed the importance of

preparing and implementing the World Solar Programme 1996-2005 and has expressed the hope that Heads of State and Government would assist the World Solar Commission in the successful completion of this venture.

For his part, the Director-General of UNESCO has written to the UN Secretary-General and to the Executive Heads of the concerned agencies and programmes of the UN system transmitting the Harare Declaration on Solar Energy and Sustainable Development and the outline of the WSP, and inviting them to participate actively in the design and development of the WSP. The Director-General has also reported on the World Solar Summit and its follow-up to the meeting of the Administrative Committee on Coordination, held at United Nations Headquarters on 26 October 1996.

The World Solar Commission was invited by the WSS to continue to provide high-level leadership and guidance to achieve the objectives of the Summit. The WSC Secretariat is, therefore, taking a series of actions to ensure appropriate follow-up to the WSS. Among These actions include the following tasks:

a) prepare, publish and distribute the final report on the preparatory process and results of the WSS;

b) undertake a major effort to disseminate world-wide the results of the WSS;

c) set up mechanisms involving a number of partners - UN system organizations, financial institutions, personal representatives of Members of the World Solar Commission, bilateral assistance agencies, other donors, NGOs, etc. - in the preparation of the WSP;

d) organize at least one inter-agency consultation meeting, two workshops of Personal Representatives of Members of the World Solar Commission and two experts' consultations on the preparation of the WSP;

e) simultaneously, and in order to maintain the momentum generated by the high-level political support for the development of renewable energies, begin the implementation of high-priority national and regional projects already received by the Secretariat that are ready for submission to international financing institutions and bilateral assistance agencies, and

f) secure the approval of the World Solar Commission once the WSP draft document is completed.

From 23-27 June 1997, the UN General Assembly will hold a special session devoted to the overall review and appraisal of the implementation of Agenda 21, adopted by the United Nations Conference on Environment and Development in Rio de Janeiro, in June 1992. The preparations for the special session have been assigned to the Division of Sustainable Development of the UN Secretariat. In February 1997, the Ad-Hoc Open-ended Inter-sessional Working Group of the Commission for Sustainable Development met in New York in order to assist the Commission in undertaking the review for the special session. The Commission itself devoted its fifth session, in April 1997, to the final preparations for the special session, including, of course, the working documents.

It is relevant to mention that several international intergovernmental organizations within and outside the United Nations System have ongoing activities sharing the same goal of promoting renewable energies for environmental preservation and social development. A description of these activities in the United Nations System can be found in the report submitted by the UN Secretary-General to the Commission on Sustainable Development at its fifth session.*

* " Inventory of ongoing energy-related programmes and activities of entities within the United Nations system, on coordination of such activities and on arrangements needed to foster the linkage between energy and sustainable development within the system ". (E/CN.17/1997/7), United Nations, New York, 1997.

All through the process of preparation of the World Solar Programme 1996-2005 special attention has been given to the participation and co-operation of international organizations and programmes, and a series of consultation meetings were organized and joint actions were undertaken. It is important to mention in this respect the exemplary co-operation of the Division of Sustainable Development of the UN Secretariat, FAO, UNDP, UNIDO, UPU, WHO and, last but not least, the European Commission.

The World Solar Summit and the World Solar Programme 1996-2005 are major contributions to sustainable development and constitute a concrete, pragmatic and action-oriented response to the recommendations of the Rio Conference as expressed in its Agenda 21. Therefore, information on both events should constitute an important input to the debates of the above-mentioned special session of the UN General Assembly, and delegates attending the session should ensure that participants are made aware of it.

FUNDING FOR THE WORLD SOLAR PROGRAMME 1996 - 2005

Various regional consultations on this issue have revealed that in some countries today, budgetary provision already exists in the areas of research, education, training and development on renewable energies. However, it has become increasingly evident that for the development of renewable energies, the funding windows from government and private sources as well as financial and developmental institutions should be augmented. Furthermore, innovative new financing opportunities including micro-financing, and the need to attract private capital to supplement the insufficient public resources should be created. It is expected that national governments, international, and regional development banks will accord high priority to finance renewable energy projects identified in the WSP.

It has become evident that lack of adequate resources for large-scale government supported programmes is one of the main constraints for most of the developing countries. Additional resources may have to be mobilized through international funding arrangements and projects based on bilateral co-operation between industrialized and developing countries, Technical Co-operation between Developing Countries (TCDC) and enhanced funding of projects in developing countries by international funding agencies.

A. National Infrastructure, Funding and Policy

As a prerequisite to sourcing of additional international funding, national governments should create an independent national infrastructure for development and growth of their own national renewable energy programmes.

An independent organizational structure should be set up in the governments of participating countries which is fully committed and empowered to formulate conducive policies, mobilize internal and external resources for effective implementation of **their own High-Priority National Programmes** and coordinate with other national and international agencies for this purpose. Proposed institutional arrangements can ensure effective utilization of limited resources available with most of the developing nations and fully absorb the technical and financial inputs available from other sources including the international funding agencies. Mobilization of resources should be one of the important responsibilities of this organizational structure.

Many of the developing countries where independent institutional arrangements for development and financing of renewable energy projects do not exist today, might wish to undertake bilateral and multilateral consultations in order to benefit from the experience of other developing countries. This can be done through TCDC. At the same time existing institutional structures in the developing countries may have to be augmented.

It is recommended that the participating countries of the World Solar Programme 1996-2005 should make separate budgetary allocations for their own High-Priority National Projects. Funding of independent national infrastructure, research and education, training and awareness programmes, pilot plant manufacturing, technology demonstration and utilization programmes are some of the activities which can be partially supported with these funds. Creation of a revolving fund to extend soft loans and establish linkages with private sector

and financial institutions may also be considered. The national funds should be utilized to meet the local costs of internationally supported projects, including those High-Priority National Projects which are covered under the World Solar Programme 1996-2005.

Adequate policy support is very essential for mobilization of additional internal resources from the private sector and the local financial institutions, required to ensure the success of national programmes. As a part of the policy support some fiscal and financial benefits should be provided to manufacturers of renewable energy systems, local financial institutions and the actual users of renewable energy systems. Some of the proposed benefits, and recommendations on possible actions, include:

- Low import tariffs on capital equipment, raw materials, components and renewable energy systems.
- Exemption from all local taxes applicable for domestic manufacture of renewable energy systems.
- Soft loans with low annual interest rates should be made available through local banks and financial intermediaries to the manufacturers and actual users of renewable energy systems. The repayment period of such loans may vary from 3-10 years, depending upon the cost of the systems.
- The manufacturers and the actual users should be allowed to deduct a percentage of the cost of renewable energy systems from their profits during the first year of the installation of the systems. This will help in mobilization of additional resources from both the private sector and the financial institutions.
- Utilities should provide remunerative prices for purchase of grid quality power generated through renewable energy systems. In return, utilities should be offered generous amortization provisions (under national tax laws) and benefit from whatever soft loan facilities are available, both nationally and internationally.
- Renewable energy power generating companies should be allowed to bank power with the utilities for one year and permitted to draw that power from the grid at any other place of actual use.

B. Funding of International Projects

In the case of projects to be executed internationally, consortia might be created consisting of international funding organizations, commercial and business entities, international organizations and governments directly benefiting from such projects. These consortia may then contribute to both the funding and execution of international projects, providing direct financing, services and infrastructure, and expertise to those projects. The acquisition of funding and creation of consortia for international projects remains a high priority of the World Solar Commission.

C. International Support for National Projects

The FAO,UNDP, UNIDO, UNICEF, GEF, World Bank, European Commission, European Investment Bank, Asian Development Bank and a number of other regional funding agencies are already supporting projects on various aspects of development of renewable energy technologies. This is especially the case of the European Commission, whose programmes of technical assistance, transfer of know-how and investment support are among the more important at the world level. The strategic projects approved by the World Solar Summit

should be accorded high priority by these funding agencies for providing enhanced allocation of funds to the developing countries for timely implementation of National Projects of the World Solar Programme 1996-2005. Indeed, it would be highly desirable, for example, that the various programmes of the European Commission take into account the priorities of the World Solar Programme 1996-2005, and that they could devote a greater share of their resources to the renewable energies. Lastly, it should be recalled that, within the framework of the international financing of national projects, a very important role is played by bilateral assistance.

D. Coordination of National Projects under the World Solar Programme 1996 - 2005

The success of the World Solar Programme 1996-2005 will largely depend on timely availability of external inputs, both technical and financial, to the participating developing countries. The World Solar Commission should mobilize assistance to the developing countries in implementation of their High-Priority National Projects. Some of the specific aspects are as follows:

- Guidance in the preparation of detailed project documents on their High-Priority National Projects.
- Guidance in organizing technical co-operation among developing countries (TCDC).
- Follow up of the detailed proposals with the international funding agencies.
- Coordination, monitoring and feedback on approved projects.

The World Solar Commission will have to work closely with major international funding agencies to ensure that they agree to commit sufficient funds for the implementation of High-Priority National Project covered under the World Solar Programme 1996-2005.

E. Proposed Manner of International Funding

The international funding organizations will have to closely coordinate their efforts to approve and fund various High-Priority National Projects covered under the World Solar Programme 1996-2005. The funding mechanism to implement the High-Priority National Projects of the World Solar Programme 1996-2005 will have to be based on a combination of grants, interest-free long-term loans and concessional funds to the developing countries.

It is recognized that a number of problems faced by many of the developing countries have certain commonality and that the experience generated in one of the developing countries may be of great interest to other developing countries. The funding agencies, therefore, should consider priority funding of those National Projects, which are based on technical co-operation among developing countries. This may be through transfer of technology, sharing of expertise and experience in implementation of projects in rural areas. Such TCDC projects deserve higher levels of grant support. This approach will encourage development of appropriate technologies and national/regional experience, which is very essential for long-term growth of local and regional applications of renewable energy products and services.

In view of the environmental benefits of renewable energy technologies, international funding agencies should adopt a policy of softer lending terms for renewables than for conventional

power projects and provide sufficient funds for rapid diffusion of renewable energy technologies. If necessary this might entail cross subsidy between the interest rates for conventional power and for non-conventional power sector lending.

The High-Priority National Projects under the World Solar Programme 1996-2005 may have to be considered for funding with the following broad approaches :

- National Projects on research, technology demonstration at pilot scale, education, training, information, communication network, should be considered for grant support provided the national government is able to commit required funds for the local costs of the projects.
- Rural energy and rural electrification projects and other renewable energy projects with social obligations deserve a large share of grant support and interest-free long-term loans. The contribution of national governments may be only a fraction of the local costs. Among others, renewable energy technologies based on decentralized applications of biogas, biomass, improved wood stoves, solar photovoltaics and solar thermal should be considered in this category.
- National Projects on grid power generation through wind and small hydro technologies may be funded on a grant-cum-soft loan arrangement. Such projects should receive grant support for environmental credit for avoiding carbon dioxide emission and also for the technical support required for implementation of the projects. The other costs of such projects may be met through a low interest bearing long-term soft loans.
- National Projects on grid power generation through solar power, geothermal, fuel cells and other emerging technologies which have relatively higher costs and high degree of risk, should be considered for a higher share of grant support when compared with wind power or hydro power generation projects, combined with interest free loans.

The above-mentioned approach will facilitate the smooth channelling of funds for effective implementation of High-Priority National Projects under the World Solar Programme 1996-2005.

F. Actions Required

To sum up, following actions are required to mobilize sufficient funds for the National Projects:

- Creation by national governments of the necessary mechanisms for the development and funding of renewable energy projects, including High-Priority National Projects;
- Elaboration of suitable national policies for promotion and resource mobilization.
- Provision of budgetary support for local costs of National Projects.
- Mobilization of assistance by the World Solar Commission in the preparation of detailed project documents, follow up with funding organizations and coordination and monitoring in the process of implementation of projects.
- Review by international funding agencies of their present methods of funding of projects and adoption of a more flexible approach.
- Recognition is the criteria for the funding of National Projects of the importance of project effectiveness in meeting the objectives of World Solar Programme 1996-2005.

CONCLUDING REMARKS

The World Solar Programme 1996-2005 has been conceived as an action-oriented instrument at the service of the international community for the promotion of renewable, environmentally friendly energies in the interests of industrialized and developing countries alike. It is a concrete follow-up to the recommendations of the UN Conference on Environment and Development concerning energy for sustainable development and, as such, requires the active involvement of all players concerned in the field of energy.

The successful implementation during the period covered by the programme of many of the renewable energy projects contained therein will result in an important contribution to the overall strategy towards sustainable development and to the ultimate goal of the pursuit of peace in the world.

APPENDIX I

WORLD SOLAR COMMISSION

COMPOSITION AT THE WORLD SOLAR SUMMIT
16-17 September 1996

CHAIRMAN:

His Excellency Mr. Robert Gabriel Mugabe
President of the Republic of Zimbabwe
Chairman of the World Solar Commission

MEMBERS:

His Excellency Mr. Soeharto
President of the Republic of Indonesia

His Majesty Juan Carlos I
King of Spain

His Excellency Mr. Abdou Diouf
President of the Republic of Senegal

His Excellency Mr. Zine El Abidine Ben Ali
President of the Republic of Tunisia

His Excellency Mr. Eduard Shevardnadze
President of Georgia

His Excellency Mr. Jiang Zemin
President of the People's Republic of China

His Excellency Mr. Sardar Farooq Ahmad Khan Leghari
President of the Islamic Republic of Pakistan

His Excellency Mr. José Maria Figueres Olsen
President of the Republic of Costa Rica

His Excellency Mr. Nelson Mandela
President of the Republic of South Africa

The Honourable Dato' Seri Dr. Mahathir bin Mohamad
Prime Minister of Malaysia

The Right Honourable Percival James Patterson
Prime Minister and Minister of Defence of Jamaica

His Excellency Mr. H. D. Deve Gowda
Prime Minister of the Republic of India

His Excellency Mr. Franz Vranitzky
Federal Chancellor of the Republic of Austria

His Excellency Mr. Benjamin Netanyahu
Prime Minister of the State of Israel

His Excellency Mr. Yasser Arafat
President of the Palestinian Authority

The following changes have taken place as from September 1996:

New Members

His Excellency General Ibrahim Barré Mainassara
President of the Republic of the Niger

His Excellency Mr. Romano Prodi
President of the Council of Ministers of Italy

Replacements

His Excellency Mr. Victor Klima replaced His Excellency Mr Franz Vranitzky as Federal Chancellor of the Republic of Austria and Member of the World Solar Commission

The Honourable Mr Inder Kumar Gujral replaced His Excellency Mr H. D. Deve Gowda as Prime Minister of India and Member of the World Solar Commission

SECRETARY-GENERAL

B. Berkovski
Director
Engineering and Technology Division
UNESCO

APPENDIX II

High-Priority National Projects

The projects are listed by country and intergovernmental organization, following the English alphabetical order according to United Nations rules.*

Albania .....

1. Renovation of Mini and Small-scale Hydropower Plants

Algeria .....

1. Cooling through Different Renewable Energy Technologies
2. Mediterranean Institute for Renewable Energy
3. Solar Photovoltaic Electrification of 20 Villages
4. Contribution of Photovoltaic to the Improvement of the Environment

Angola .....

1. Angola's Solar Energy Market Assessment Project

Argentina .....

1. Firewood in Home Consumption
2. Solar Village, Woman Integrated Approach for Sustainable Eco- Village Development

Armenia .....

1. Creation of the Demonstrative Complex System of Water Supply with the Use of Renewable Energy Sources
2. High-Efficient Cascade Solar Cells
3. Experimental Complex System of Autonomous Energy Supply of Public and Dwelling Houses
4. Autonomous Solar Power Supply for National Survey of Seismic Protection and National Meteorological Station Network
5. Thin-Film Heterojunction Solar Cells on the Base of Copper and Indium Diselenide
6. Wind-Solar Energy Resource Assessment and Site Evolution Project
7. Solar-Hydrogen Pilot Plant for Direct Dissolution of Water onto Hydrogen and Oxygen
8. Solar Heating Baths for Refugees Campuses
9. 10 MW Solar Thermal Power Plant
10. Photovoltaic Converters and Solar Stations for Solar Energy

Barbados .....

1. Uso de un Sistema Solar Fotovoltáico para la Producción Comercial de Hielo

Belarus .....

1. National Educational Programme on Energy Conservation and Renewable Energies

* These projects have been drawn up under the sole responsibility of national governments and intergovernmental organizations.

2. The Energy Efficient Demonstration Zone in the Territories Contaminated as a Result of the Chernobyl Accident
3. Construction of Two Experimental Industrial Wind Electric Plants Capacity of 1.5 MWt Each)
4. Cascade Construction of Four Low Head Hydropower Stations Total Capacity 132 MWt) on Zapadnaya Dvina River with the Development of Special Measures Minimizing Flood
5. Decentralized Energy Supply and Efficient Environment Friendly Rural
6. Know-How
7. Valorization of Contaminated Biomass Resources to provide direct, on-going restoration of radioactively contaminated territories

Belize .....

1. Electrificación Rural con Sistemas Fotovoltáicos

Benin .....

1. Ganvié, cité solaire lacustre
2. Projet d'électrification des villages lacustres par système solaire photovoltaïque
3. Détermination du gisement biomasse
4. Le séchage solaire
5. Evaluation du gisement solaire et éolien
6. Mise au point d'un four de carbonisation des déchets agricoles
7. Mise au point de méthodes de carbonisation du bois pour l'amélioration du rendement
8. Production du froid par voie solaire

Bolivia.....

1. Programme for Energy Supply with Renewable Sources in Rural Areas

Botswana.....

1. Education Training and Manpower Development in Renewable Energy Development
2. Design, Construction and Evaluation of Prototype Rural School
3. Solar Energy Product Development
4. Establishment of a National Data Bank on Renewable Energy
5. Solar Thermal Power Plant for a Reverse Osmosis Plant

Brazil .....

1. Programa de Desarrollo Energético de Estados y Municipios

Bulgaria .....

1. Stand-Alone Photovoltaic Water Pumping Systems for Irrigation and Household Needs

Cameroon .....

1. Projet pilote de village solaire à Ngaoundéré
2. Villages solaires pour sites isolés

People's Republic of China .....

1. 21st Century Solar Schools in Rural Areas
2. Large-scale Implementation of Renewable Energy
3. Energy Services for Rural Development

Colombia .....

1. Abastecimiento de Energía por Medio de Celdas Solares

Costa Rica .....

1. Programa de Uso de Energía Solar para la Electrificación Rural
2. Electrificación de la Isla Caballo con Sistemas Fotovoltáicos
3. Electrificación Península de Osa con Sistemas Independientes
4. Instalación de un Laboratorio para Comprobación de Colectores y otros Dispositivos Térmicos Solares y Medición de Propiedades Termo-ópticas de Materiales
5. Tratamiento de la Fracción Sólida de Desechos Orgánicos Domésticos por Medio de Tecnologías Solares Integradas

Côte d'Ivoire .....

1. Journées énergies solaires et renouvelables
2. 1500 Centres de convivialité en milieu rural alimentés en énergie photovoltaïque
3. Programme de microcentrales hydroélectriques
4. Projet bois-énergie des zones urbaines
5. Plan National de Maîtrise de l'Energie
6. Etude faisabilité du recyclage énergétique des résidus agro-industriels pour la génération de biocarburants et d'électricité

Cuba .....

1. Central Termoeléctrica de 5 MW en la Isla de la Juventud
2. Fuente de Energía para la Industria Arrocera
3. Producción de Biodiesel con Jatropha Curca
4. Producción de Aerogeneradores de Baja Potencia y su Empleo en el Sector Agropecuario
5 Parque Eólico de Punta Granado
6. Electrificación de Zonas Rurales Montañosas con Energía Solar
7. Fabricación de Celdas Solares de Silicio Monocristalino con Eficiencia de Conversión al 14%
8. Solución Hidroenergética a Asentamientos Ecológicos de Montañas
9. Cogeneración de Energía Eléctrica a Partir de la Remodelación de la Base Energética de una Central Azucarera
10. Producción de Biogas a Partir de Residuales Alcoholeros para Generar Electricidad
11. Centro Regional para la formación de Recursos Humanos la Investigación y la Formación Científico-Técnica para las Energías Renovables

Cyprus .....

1. Individual Solar Water Heaters
2. Collective Solar Water Heaters
3. Solar Desalination
4. Solar Cooling
5. Solar Water Pumping

Democratic People's Republic of Korea .....

1. Setting Up of a Model Village Powered by Solar Energy
2. Setting Up of a School Powered by Solar Energy

Ecuador .....

1. Proyecto Piloto de Generación Fotovoltáica para las Islas Galápagos
2. Sistema híbrido fotovoltaico para el abastecimiento eléctrico de la Isla Floreana, del Archipiélago de Galápagos

Egypt .....

1. The Bulk Renewable Energy Electricity Production Projects Study (BREEPP) (Stage I)

2. Development and Construction of a 80-100 MW BREEPP Plant (Stage II)
3. The BREEPP Dissemination Programme (Stage III)
4. Photovoltaic Village Electrification in Remote Areas

El Salvador .....

1. Proyecto de Iluminación Rural para El Salvador Mediante Celdas Solares
2. Centro Regional de Investigaciones; de Aplicaciones de la Energía Solar : Radiometría, Simulación de Aplicaciones; Laboratorio de Pruebas de Estandares; Investigación (Potabilización de Agua de Mar), Centro de Capacitación Regional en Aplicaciones de la Energía Solar

Ethiopia .....

1. Windmill Bore Hole Pumps
2. Rural Electrification using Solar Photovoltaic Systems
3. Solar Photovoltaic Powered Bore Hole Pumps
4. Solar Water Heating System
5. Solar Energy Resources Studies and Capacity Development

France .....

1. Programme « Eole 2005 » de 500 MW raccordés au réseau électrique
2. Plan Bois-Energie et Développement Local (65.000 TEP - 1994/1998)
3. Programme chauffe-eau solaire thermique dans les Départements d'Outre-Mer et en Corse (20.000 CES - 1996/1999)
4. Programme bio-carburants
5. Programme d'électrification des écarts (PV et éolien) - 5.000 sites isolés
6. Coopération internationale pour le développement de l'Electrification Rurale Décentralisée, en référence à l'Agenda 21 et aux résolutions de la Commission du Développement Durable

Gabon .....

1. Electrification rurale: Village solaire
2. Hydraulique villageoise
3. Valorisation énergétique de la biomasse lignocellulosique

Gambia .....

1. Popularize the Use of Solar Cookers

Georgia .....

1. Solar Schools for Remote Mountainous Areas
2. Small Hydropower Plant on Sulori River, Vani
3. Wind Power Station in Mta-Sabueti
4. Wind Power Station in Poti
5. Mountainous Solar Village in Aspindza

Ghana .....

1. Off-Grid Solar Photovoltaic Electrification Pilot Project : Wechiau
2. 30-50 MW Solar Thermal Power Plant

Greece .....

1. National Programme for the Development of Wind Energy
2. Development of Active Solar Energy Systems
3. Development of Geothermal Energy
4. Development of Energy from Biomass
5. Development of Small Hydro Systems
6. Programme of PPC for the Development of Photovoltaic Energy
7. Development of Passive Solar Systems
8. Development of Hydro Units

9. Development of Solar Refrigeration System for Food Storage, based on Endothermic Salts Powered by Photovoltaics

Guatemala .....

1. La Energía Rural y las Perspetivas Fotovoltáicas en Guatemala
2. Propuesta de Asistencia Técnica para Institucionalizar Proyectos de Energía Renovable

Guinea .....

1. Evaluation du potentiel solaire et éolien
2. Examen des politiques, stratégies et programmes du secteur des énergies traditionelles
3. Construction de 100 digesteurs à biogaz
4. Valorisation de l'huile de Pourghère à des fins énergétiques et de fabrication de savon
5. Vulgarisation des foyers améliorés en zone urbaine
6. Aménagement de 28 sites de béliers hydrauliques et de 10 pompes solaires
7. Télécommunication par radio solaire VHF au niveau des 303 Communautés Rurales de Développement
8. Equipement d'un Laboratoire d'Energie Solaire
9. Etude de faisabilité de 3 micro centrales et réalisation de l'une d'entre elles en Guinée Forestière
10. Création d'un Centre d'Information en Matière d'Energies Renouvelables

Haiti .....

1. Electrification des centres communautaires des villages du pays
2. Utilisation de pompes à énergie solaire pour l'irrigation
3. Etablissement de bibliothèques utilisant l'énergie solaire
4. Energie éolienne. Evaluation des ressources - détermination des sites potentiels
5. Electrification rurale avec l'énergie hydro-électrique en utilisant les micro-systèmes
6. Création de Centres de Formation et d'Information en Matière d'Energies Renouvelables
7. Création de Centres communautaires de réfrigération pour la conservation des produits de pêche
8. Téléphonie rurale alimentée par l'énergie solaire

Honduras .....

1. Proyecto Piloto con Energía Solar. Plan del Rancho. Departamento de Ocotepeque
2. Creación Centro de Promoción y Capacitación de Energías Alternativas

India .....

1. Upgrading the Solar Energy Centre at Gwalpahari to International Renewable Energy Institute
2. Developing a Comprehensive Training Programme in Renewable Energy Technologies for Trainees from Developing Countries
3. Generation of Grid Quality Power from Renewable Energy Sources
4. Decentralized Use of Renewable Energy Sources to Meet Rural Energy Requirement
5. Renewable Energy for Sustainable Development of Tribals
6. Proposal for 200 kW Solar Power Plants for Leh and 100 kW Solar Power Plants for Nyomo

7. The Solar Nexus, Wardha
8. National Institute of Renewable Energy (NIRE) Centre of International Excellence in Renewable Energy

Indonesia .....

1. Grid Interconnected Photovoltaic Electricity System for High and Medium Income Housing
2. Productivity Enhancement through Photovoltaic Rural Electrification Programme
3. 50 MW Peak Photovoltaic Electrification (Phase I)
4. One Million Home Photovoltaic Rural Electrification in Indonesia
5. F/S of Hybrid Power System Development in Rural Areas of Maluku and Iran Jaya
6. Establishment of Wind Energy based on Electricity Generating System for Rural Electrification
7. Feasibility Study for Small-scale Geothermal Power Plants Outside Java
8. Provision of Solar Energy for Improvement of Community Health Services in Remote Areas
9. Renewable Energy Systems in Indonesia

Iran .....

1. Pilot Project for Solar Building

Israel .....

1. Joint Israeli-Jordani Wind Farm in the Southern Wadi Arava Region
2. Arava Solar Project: Integrated Solar Energy with Combined Cycle
3. Survey of Conditions for Sea and Brackish Water Desalination Using Renewable Energy Sources
4. Solar Pond Water Desalination
5. Solar Photochemical Detoxification of Water
6. Improved System of Concentrated Solar Radiation and Photovoltaics for Electricity Generation
7. Utilization of Highly Concentrated Solar Energy for Energy Production
8. Energy Towers
9. Joint Project for Red Sea Water Desalination

Italy .....

1. Utilization of Desalination Plants fed through Solar Energy and Waste Energy. Preparation of a Masters-Degree Learning Package
2. Training Courses on Photovoltaic Technology and Applications
3. International Network of Centres of Excellence on Renewable Energy
4. Project for the Decentralized Rural Electrification with Photovoltaic Technology in Algeria

Jamaica .....

1. Solar Energy Policy and Planning
2. Incorporation of a 15 kW Stand Alone Photovoltaic Power Plant in the Existing Rural Electrification Programme to Undertake a Study of the Comparative Efficacy of this System as compared to Existing Grid Extension System for Deep Rural Communities
3. Solar Water Pumping with Major Emphasis on the Production of Potable Water and Solar Irrigation in Small Farming Communities
4. Development of a Commercial Forest to Reduce Deforestation
5. Micro-Hydro Project
6. Development and Application of Solar Drying Technology as an Appropriate Technique for Preserving Agricultural Produce

7. The Integration of Renewable Energy Sources in Urban and Rural Communities - Biomass Conversion to Biogas
8. A Comprehensive Islandwide Assessment for Commercial Wind Energy Farms
9. Upgrading the Solar Water Heating Test Laboratory at the Jamaica Bureau of Standards
10. Renewable Energy System Located at Pedro Caysm
11. Photovoltaic System for Negril Coral Reef Preservation
12. Photovoltaic System for Residential Boys' Home
13. Photovoltaic System for Islandwide Earthquake Monitoring System

Jordan .....

1. Exploration for Geothermal Energy
2. Uses of Geothermal Energy in Jordan for Heating Greenhouses
3. Gradient Solar Pond Pilot Plant
4. Energy Conservation and Improvement of Thermal Comfort of Existing and Future Buildings
5. Reduction of Methane Emissions and Utilization of Municipal Wastes for Energy in Amman
6. Future Large PV Applications for the Electrification of Remote Villages and Grid Connection System
7. Biomass - Environmentally Sound Energy Source for Sustainable Rural Development (Family-size Biogas Plants)
8. 5 MW Wind Farm in Jordan
9. Desalination of Red Sea and Brackish Water Using Photovoltaic Power Generation System
10. Regional Training Centre in the Field of Renewable Energy

Kenya .....

1. Human Resource Capacity Building for Utilization of Renewable Energy Resources
2. Promotion of University-Industry Co-operation for the Development and Utilization of Solar Technology in Africa

Latvia .....

1. Renewable Energies for Fishermen's Villages

Lebanon .....

1. Le développement du chauffe-eau solaire pour la production d'eau chaude sanitaire
   - Mécanismes financiers et/ou réglementaires pour le développement du chauffe-eau solaire pour la production d'eau chaude sanitaire
   - Etablissement de normes pour les chauffe-eau solaires
   - Technologie du chauffe-eau solaire

Libyan Arab Jamahiriya .....

1. Water Desalination using Solar Ponds
2. Enhancement of the Testing Facilities of the Centre for Solar Energy Studies
3. North African Advanced Solar Water Heaters Manufacturing and Marketing Programme
4. An Integrated Project for the Demonstration, Field Test and the Transfer of Solar Water Heating Technology
5. Wind Turbine Test Station
6. Demonstration Wind Farm
7. Installation of Solar Electric Power Stations for Microwave Repeater Stations

8. Meteorological Stations Development Project

Madagascar

1. Renforcement des Programmes de Formation et de Recherche-Développement dans le domaine des Energies Renouvelables de l'Institut pour la Maîtrise de l'Energie
2. Séchage solaire des produits agro-alimentaires et industriels
3. Froid solaire pour la conservation des vaccins et des denrées périssables dans les fermes
4. Energie solaire photovoltaïque au service des populations rurales
5. Dessalement par l'énergie solaire des eaux sauvâtres et de l'eau de mer
6. Thermique de l'Habitat (amélioration du confort des locaux d'habitation)
7. Diagnostic énergétique (économie d'énergie, promotion d'énergies alternatives)
8. Energie éolienne (pompage en vue de l'irrigation et de l'alimentation en eau potable)
9. Equipement du Laboratoire d'Energétique de l'Institut pour la Maîtrise de l'Energie

Malawi

1. Promotion of Solar Energy Utilization in Rural and Peri Urban Areas
2. Establishment of a Solar Village
3. Research in Solar Energy Usage by the University of Malawi and by the Malawi Industrial and Technology Research Development Centre
4. Research in Wind and Biogas Energy Usage

Malaysia

1. Solar and Mini-Hydro Systems for Rural Electrification
2. Research and Development in New and Renewable Sources of Energy
3. Commercialization of New and Renewable Energy Projects
4. Establishment of a National Energy Centre with New and Renewable Energy as One of its Main Units
5. Education and Training in New and Renewable Energies
6. Development of a National Renewable Energy Policy and Masterplan

Maldives

1. Clean Renewable Electricity for an Island Community

Mali

1. Villages solaires avec une gestion améliorée de l'environnement et le renforcement du rôle des femmes dans le cadre de la promotion des énergies solaires
2. Micro-Electrification et approvisionnement en eau du monde rural par les énergies solaires
3. Unité de carbonisation et de production de briquettes des déchets végétaux
4. Projet de valorisation de la plante Pourghère (Jatropha curcas L.)
5. Relance des activités du Centre Régional d'Energie Solaire à Bamako

Malta

1. Widespread Application of Solar Water Heating
2. Solar Photovoltaic Grid-connected SystemsPP/PG
3. A Small Grid-connected Wind Farm
4. Training the Trainers
5. Solar Energy for Peace in the Mediterranean Region

Mauritania .....

1. General Plan for Solar Energy
2. Study of Solar Potential
3. Solar Programme for Water Pumping
4. Rural Electrification
5. Manufacturing and Maintenance Unit for Small Equipment
6. Energy Management Study
7. Solar Education Programme
8. Mass Media Diffusion Programme

Mexico .....

1. Electrificación de Comunidades Rurales Alejadas de la Red Eléctrica con Sistemas Fotovoltáicos Dispersos

Mongolia .....

1. Setting Up a Solar PV Module Assembling Line
2. Electrification of Secondary School and Medical Control Areas using Solar and Wind Energy
3. Utilization of a Mobile Photovoltaic Power Generation System for Nomadic Families

Morocco .....

1. Programme of Integration of Wind Parcs in the Electricity Production System
2. Decentralized Rural Electrification Programme
3. « Electricity Booth » for Rural Electrification
4. Thermosolar Power Station in Ouarzazate
5. Construction d'une Ecole de la Nature et de l'Environnement

Mozambique .....

1. Provision of Basic Energy Services in Rural Health Centres using Solar Energy
2. Improvement of Combustion Aerodynamics and Heat Transfer Process in Existing Wood Fired Small-scale Furnaces (Bakery Ovens and Ceramic Kilns)

Namibia .....

1. Solar Thermal Power Plant
2. Wind Energy Power Plant
3. Pilot Project on the Application of Renewable Energies to Enhance Social, Economic and Cultural Development in Rural Areas of Namibia and with Reference to Application in One or Two Other Countries of Southern Africa
4. Establishment of a Revolving Fund for Rural Electrication by Photovoltaic Systems

Nepal .....

1. Utilization of Geothermal Energy

Nicaragua .....

1. Zonas Rurales y Aplicación de Energías Fotovoltáicas

Niger .....

1. Village solaire intégré - Première Phase
2. Informatisation de l'ONERSOL
3. Lutte contre la désertification par le pompage solaire
4. Eclairage et sonorisation photovoltaïque des mosquées situées en zones rurales
5. Eclairage solaire des centres d'alphabétisation des adultes
6. Extraction du sel à l'aide d'un concentrateur solaire

7. Recherche sur la production de froid
8. Pompage solaire pour le maraîchage
9. Vulgarisation de digesteurs pour la production de biogaz
10. Village solaire intégré de Bossey-Bangou
11. Trois villages solaires intégrés
12. Vulgarisation de Séchoirs Solaires

Nigeria .....

1. Solar Photovoltaic Village Electrification/Refrigeration
2. Solar Refrigeration
3. Mini- and Micro-Hydro Schemes for Rural Electricity Production
4. Wind Technology for Electricity Supply to Rural Communities
5. Manufacturing and Maintenance Units for Solar Cells
6. Briquetting Technology for Sawdust and Agrowastes
7. Biomass - Environmentally Sound Energy for Sustainable Rural Development
8. Installation of Solar Electric Power Stations for Microwave Repeater Stations
9. Regional Training Centre in the Field of Renewable Energy
10. Updating and Enhancement of the Testing Facilities of the Centres for Solar Energy Studies
11. Improvement of Combustion and Heat Transfer Process in Wood Fired Small-scale Furnaces (Bakery Ovens and Ceramic Kilns)
12. Solar Dryers for Remote Rural Communities

Oman .....

1. Project for using Renewable Energy in Water Pumping
2. Development of Solar Energy Technologies for Use in Agriculture
3. Project for the Use of Solar Energy in Desalination
4. Solar Powered Water Pumps for Remote Areas
5. Development and Application of Refrigeration and Air Coolers and Conditioners
6. Installation of Solar Water Heating Systems for Domestic/Industrial Use
7. Lighting Al-Quron Village-Sharqlya Region By Dual Generation (Diesel/Penumatic Turbune)
8. Renewable Energy Education Package

Pakistan .....

1. Biogas Plants for Meeting Domestic Fuel Needs of Rural Areas
2. Installation of a 1 MW Solar Thermal Power Plant in Desert Area of Pakistan
3. Energy Self-sufficient Model Houses
4. Rural Area Electrification
5. PV Telecommunication Systems
6. Biomass Plants Using Agricultural and Municipal Waste
7. Solar Desalination Pilot Project
8. Development of Micro-Hydropower Plants in Remote Areas
9. Community Solar Dryers for Drying Grains, Fruit and Vegetables etc.
10. Development of Low Cost Wind Mill for Water Pumping
11. Solar Hydrogen Production Pilot Project
12. Integrated Renewable Energy Community Project

Palestine .....

1. Desalination of Brackish Water by Solar Photovoltaic

2. Solar Photovoltaic Electrification of Small Remote Villages in the West Bank

3. Water Pumping by Photovoltaic
4. Photovoltaics for Transport, Tourism and Security Aids
5. The « Peace » Joint Research and Training Station between Israel and the Palestinian National Authority
6. Solar Water Desalination Plant for Gaza Strip
7. Laboratory for Improving the Performance and Efficiency of Solar Flat Collectors for Water Heating

Paraguay .....

1. Programa para el Desarrollo, la Aplicación y la Difusión de Energías Renovables en la Región Occidental o Chaco

Portugal .....

1. Treatment of Urban Waste

Republic of Moldova.....

1. Autonomous Energy Provisioning of One Farmer Housework by Joint Utilization of Renewable Energy Source Installations (Solar, Wind, Biomass)
2. National Centre for the Elaboration and Testing of Renewable Energy Sources Installations
3. Irrigation System on the Base of Solar Energy
4. Construction of Two Demonstrative Bioenergetical Installations of Modern Production for Implementation in Agricultural Enterprises

Russian Federation .....

1. Renewable Energy for Experimental Self-Sufficient Solar House
2. Moscow « Ecopark-Phili » - Zone for Demonstration of Ecologically Clean Technologies, using Renewable Energy
3. The Complex of using Vegetable Biomass for Gas Generator Stations (Heat and Electricity Supply)
4. Bioenergy System for Processing Liquid Wastes of a Poultry Farm
5. Block Geothermal Electrical Stations of 4 MW Capacity for Kamchatka
6. Bioenergy Complex for Utilization of Waste Heat of Pskov' for the Purposes of Intensification of Agricultural Production
7. Hybrid Wind-Diesel Installations of 8 and 16 kW Capacity
8. Bioenergy Installation for Processing Wastes of Animal Industries based on Three-stage Technology of Methane Generation using Animal Wastes
9. New Generation Solar Stations with Concentrators
10. Renewable Energy Education and Training
11. Revewable Energy for Rural Electrification
12. Biomass Energy Conversion
13. Renewable Evergy Supply Systems for Northern Russian Rural Territories
14. Business plan for the serial production of individual biogas plants for farmers and their selling on credit on the domestic market
15. New Technologies and Foundation of Specialized Production of the solar Grade Raw Silicon
16. High Efficient Production of Silicon Plate and Photovoltaic Modules
17. Karasovo Lake Recreation Zone with Renewable Energy Systems
18. Electrical Power Plant Developmental Using High Potential Geothermal Energy in Kamchatka

Saint Lucia.....

1. Assessment of the Wind Energy Potential for Grid Connection
2. Specialized Application of PV Technologies at Remote Sites
3. Energy Efficiency, Conservation and Demand-side Management Studies to Support Project Preparation and Implementation

4. Solar Irrigation System for Hill Side Farms
5. Assessment of the Island Geothermal Potential
6. Expansion of Fuelwood Farms through the Establishment of Additional Farm Sites

Senegal .....

1. Des postes de santé ruraux au centre d'une dynamique d'électrification solaire
2. Production de froid pour la conservation des denrées alimentaires
3. Eclairage solaire des Centres Scolaires et d'Alphabétisation
4. Séchage solaire pour la conservation des légumes et fruits
5. Eclairage et sonorisation par système photovoltaïque des lieux de culte situés en milieu rural
6. Alimentation énergétique de l'habitat par Energie Renouvelable
7. Pompage solaire photovoltaïque pour l'irrigation
8. Pompage éolien pour l'irrigation
9. Alimentation en eau potable par énergie éolienne
10. Mise au point et vulgarisation de réfrigérateur solaire par absorption
11. Dessalement de l'eau de mer par voie solaire photovoltaïque
12. Promotion de l'utilisation des cuiseurs solaires
13. Electrification de 750 centres ruraux dans le cadre du Programme national d'électrification décentralisée (1998-2002)
14. Electrification solaire décentralisée de 350 localités rurales : composante nationale du Programme d'électrification rurale de l'Union Economique et Monétaire Ouest-Africaine (1998-2002)
15. Projet de Module d'Animation Sociale Solaire Rurale
16. Projet Solaire Sénégal 2000

South Africa .....

1. Supply of Non-Grid (i.e. solar) Power to Rural Communities in South African Provinces
2. Biomass and Recycled Burnable Materials for Use as Home Fuel
3. Solar Energy Project for Schools and Clinics in Rural Areas and in Small Towns
4. Renewable Energy Education and Training Programme for the Broad Community and for Schools
5. Development of an International Renewable Energy Database Communication Link with Selected Countries
6. Capacity Building and Personnel Skills Training for Government Renewable Energy for South Africa (REFSA) Project
7. Restructuring of REFSA as an Efficient and Leading Renewable Energy Development Organization in Southern Africa
8. Individual Solar Heaters and Cookers for Rural Areas and Small Towns
9. Solar Power Plant
10. Wind Energy Pilot Plant

Spain .....

1. Urban Planning with Bioclimatic Criteria: Ciudad Jardín Puerta de los Pirineos
2. Implementation of Two Pilot Forest Line for the Improvement of Forest Management in the Ripolles and Valles Areas
3. Water Oxygenation with Photovoltaic Energy in the Natural Park of the Albufera (Valencia)
4. Electric Grid-connected Supply to Camping Site by Means of an Hybrid Solar-Wind System (50 kW)
5. Prosol Programme (Phase II)
6. Demonstration Power Plant based on the European Concentrated Light Intensity Development of Energy Sources Prototype
7. Seawater Desalination Plants connected to an Autonomous Wind Energy System

8. La Teixeta Enderrocada Wind Farm
9. Ceuta Municipal Solid Waste Incineration Plant
10. Combustibles Ecológicos Catalanes and El Tejar Biodiesel Plants
11. Ecocarburantes Españoles, S.A. Biothanol Production Plants
12. Bioclimatic Dwellings for Tenerife Island
13. Solar Thermal in the Mediterranean: Pilot Project for Solar Market Development in Catalonia and Morocco
14. Mediterranean Energy and Environment WEB
15. Solar Energy Management in the Mediterranean Area
16. 40 MW Wind Park in the Canary Islands
17. Concentrarion PV Plant of 2 MW in the Canary Islands
18. Urban Waste Incineration Plant of 250,000 ton/year in the Canary Islands
19. Solmad: Solar Energy Management in the Mediterranean Area

Sudan .....

1. Solar Home System
2. PV Vaccine Refrigerators
3. Photovoltaic and Wind Pump Systems Project
4. Radio Power Systems
5. Solar Energy Resource Assessment and Establishing Solar Information System
6. Solar Cookstove Dissemination Project
7. Solar Passive Cooling

Swaziland .....

1. Woodwaste Briquetting Viability Study
2. Solar and Wind Measurements
3. Biomass Energy Technology for the Betterment of Women

Syrian Arab Republic .....

1. Technical Assistance for Photovoltaic Subsystems Manufacturing
2. Technical Assistance for the Establishment of a Solar Heating and Cooling Laboratory
3. Technical Assistance for the Establishment of a National Energy Conservation Management Unit
4. Technical Assistance for Pilot Production of Solar Collector Absorbers
5. Technical Assistance for Pilot Production of Mechanical Wind Pumps

The former Yugoslav Republic of Macedonia .....

1. Feasibility Study for Application of Solar Energy in a Macedonian Village

Togo.....

1. Les énergies renouvelables aux services du développement socio-économique
2. Equipement en énergie renouvelable dans le secteur de la santé

Tunisia .....

1. Solar Photovoltaic Energy in the Service of Rural Population (Education, Health and Water)
2. Dessalement des eaux saumâtres et de l'eau de mer par l'énergie solaire
3. Ecole rurale du 21ème siècle
4. Villages Solaires dans le Sud Tunisien
5. Réalisation d'un Projet Pilote dans le Domaine de l'Utitisation de l'Energie Géothermique

Turkey .....

1. Energy Production from Biomass
2. Solar-Powered Absorption Refrigeration Systems for the Storage of Agricultural Products

Turkmenistan .....

1. Solar Village for Turkmenistan Arid Zones
2. Sanitation Centre with Renewable Resources of Energy Utilization on the Caspian Seashore

Tuvalu .....

1. Compact solar pumping and desalination system
2. Hybrid Solar-Diesel for rural areas electrification (one 100 kw and seven 50 kw capacity)
3. Grid Connected Solar Power Station

Ukraine .....

1. Black Sea Regional Co-operation in the Field of Renewable Energy Resources
2. Heat Supply System of Industrial, Public and Agricultural Objects using Local Geothermal Water
3. Bioenergetic Complex on the Base of the Poultry Factory « Berezanskaya »
4. Development and Introduction in Practice the Technology of Fuel Ethanol Manufacture at the Spirit Plants
5. Development of a Production and Technological Base of the Small Wind Power Engineering
6. Reconstruction of Micro Hydropower Station in the Cherkassy Region
7. Demonstration Project of Energy Heating Supply System for Agriculture with Complex using of Renewable Energy Sources
8. Demonstration Project of Solar Village with Complex using of Renewable Energy Sources
9. The Energy Efficient Demonstration Zone in the Territories Contaminated as a Result of the Chernobyl Accident
10. Alacksea regional Cooperation in the field of Renewable Energy

United Republic of Tanzania .....

1. Solar Energy Programme
2. Village Level Solar Power Supply
3. Small Islands Solar Power Supply
4. Isolated Townships Solar Power Supply
5. Solar Power Supply for Dedicated Systems
6. Research and Development on Biofuels: Utilization of Agro-wastes for the Generation of Biogas
7. Research and Development on Biofuels: Power-alcohol as a Biofuel from Biomass Resources

Uruguay .....

1. Estudio de la Biomasa Forestal
2. Arquitectura Bioclimática

Venezuela .....

1. Aplicaciones térmicas de la energía solar en zonas rurales
2. Sistemas eolo-solares en la zona insular y costera del Caribe venezolano
3. Sistemas hidroenergéticos en zonas rurales y aisladas terrestres
4. Bionergía en zonas rurales y en zonas marino-costeras e insulares
5. Aplicaciones geotérmicas en zonas agricolas y países vecinos
6. Proyectos Prioritarios en Energía Solar y Otras Energías Renovables

7. Normalización de equipos de generación de energía eléctrica y/o calor que utilizan energías renovables

Yugoslavia .....

1. National Information and Technology Transfer Network on New and Renewable Energy Sources
2. Energy Autonomous and environmentally Clean Farm
3. The Mediterranean Demonstration Centre for Energy and Ecology

Zambia .....

1. Application of Photovoltaic Systems in Rural Communities
2. Mini and Micro Hydropower Development
3. Upgrading the Energy Resource in the School of Natural Sciences, University of Zambia into a Renewable Energy Institute
4. Solar Dryers for Drying Crops, Fish and Other Food Stuffs
5. Solar Water Heaters for Household, Institutional and Industrial Use
6. Training of Women and Youth in income generating ventures and Public Health at Lubwe Mission

Zimbabwe .....

1. Building the Capacity for Training and Research in Renewable Energy Resources in Schools, Technical Colleges and Universities
2. Solar Energy Projects
3. Biomass Utilization Projects
4. Mini-Hydro Electrification Projects
5. Use of Photovoltaic Systems
6. Electric Power Supplying Kit
7. Accelerated Promotion of Solar Water Heaters
8. Solar Photovoltaic Grid Connected Utility in a Semi rural Setting

European Community .....

The list below refers to some demonstration projects proposed under the JOULE-THERMIE Programme and to be realized in the different EU countries.

Austria

1. Matrix Turbine for using the Filling or Discharge Flow in Navigation Lock Operation (5000 kW)

Belgium

1. A Sawdust Fluidized Bed Gasifier with an Externally Fired Evaporative Gas Turbine Cycle (0.6 MWe; 1.3 MWth)

Denmark

1. Low Energy Design and Bioclimatic, Innovative Building Envelope for a Science and Experience Centre receiving 140,000 Visitors per year

Finland

1. Targeted Project on Power Production from Biomass Gasification in Combined Cycle (7MWe).

France

1. Innovative Direct Drive Variable Speed Wind Turbines (6 x 750 kW)
2. Drilling Valorization in Lamazere for Low Temperature Greenhouses Heating (650 toe/y)
3. 150 Small Grid Connected PV Stations for a Total of 200 kWp.

Germany

1. Cross-border Geothermal Energy Utilisation for District Heating Network in Braunau (Austria) and Simbach (Germany) (2,700 toe/y).
2. Installation of Standardized 100 Grid Connected Small PV Generators (200 kWp)

Greece

1. 5 MW Wind Farm on Complex Terrain in Sitia-Crete
2. First Phases of 2 Solar Power Plants of Different Design (heliostats with central solar receiver and parabolic through collector field)
3. Installation for a Total of 60 kWp of a New Type of Modular PV System in the Greek Island of Sifnos
4. Public Social Housing Retrofitting with the Integration of Solar Techniques in the Municipality of Tavros

Ireland

1. Demonstration of Two Units of 1 MW Wind Turbine of German-Irish Coproduction in the Irish Wind Regime

Italy

1. Electricity Generation by recovering Pressure Energy from Non-condensable Gases in the Latera Geothermal Plant (420 toe/y)
2. Pilot Project for Passive Solar Energy and PV Applications in a Scientific High School
3. Targeted Project on Power Production from Biomass Gasification in Combined Cycle (12 MWe)

Luxembourg

1. Cost Effective Reactivation and Modernization of 16 Small Hydropower Sites

Netherlands

1. Demonstration of a 30 MWe Atmospheric Gasification combined Cycle Power Plant fuelled with Several Biomass Wastes
2. Application of a Doubly Fed Generator with Rotor Frequency Control in a 600 kW Wind Turbine
3. AC Modules into Noise Barrier near Amsterdam (220 kWp)
4. Multifunctional PV Facades in the Netherlands, Germany and Spain (102 kWp)

Portugal

1. Optimized Use of PV Rural Electrification in Ourique (40 kWp)

Spain

1. 25 MW Straw Fired Fluidized Bed, High Efficiency District Heating Power Plant in Pamplona
2. Integral Use of the Energy and Irrigation Potential of an Irrigation Canal in the Catalan Pyrenees (1760 kW)
3. 3 MW Wind Farm composed of 6 Wind Turbines optimized for low Wind Speed on the Island of Menorca
4. PV Stand Alone and Grid Connected in Integrated Regional Rural Energy Planning (95 kWp)
5. First Phases of Solar Power Plant with Heliostats and Central Solar Receiver.

Sweden

1. Demonstration of Two 1 MW Swedish Wind Turbines

United Kingdom

1. Generation of Electricity (5 MWe) by the Gasification of Dried Undigested Sewage Sludge
2. Biomass Power Station (11 MWe) based on Poultry Litter
3. Variable speed Ultra-low Head Hydropower Installation for Windsor Castle (260 kW)
4. Construction of a 37.5 MW Scroby Sands Offshore Wind Farm in East Anglia
5. Targeted Project on Power Production from Biomass Gasification in Combined Cycle (8 MWe).

Renewable Energy Strategies and Applications for Regenerating Towns (8 cities in various European Countries)

UN Economic Commission for Europe .....

1. Construction and Operation of a Large (100 MW) Solar Power Plant

APPENDIX III

WORLD SOLAR PROGRAMME 1996-2005

The General Conference,

Recalling that the World Solar Summit held in Harare (Zimbabwe) in September 1996 adopted Declaration on Solar Energy and Sustainable Development and approved the preparation of a World Solar Programme 1996-2005 aimed at improving people's quality of life, notably the rural areas of developing countries.

Recalling also

(a) 150 EX/Decision 5.1, paragraph 36 (Major Programme II), which considered the following to the World Solar Summit as a high priority for UNESCO and the conclusion of Audie Africa concerning renewable sources of energy as an important facet of development.

(b) the recommendations of the High-level Expert Meeting on Africa (HEMA) held in Harare in March 1995, on the implementation of the African solar projects to the amount of US$550 million for 1996-2005.

Taking into account the mission assigned to UNESCO as a lead agency within the framework of United Nation System-wide Special Initiative on Africa, coupled with the commitment of African nations to determine their own destiny.

Considering the need to put in place all the mechanisms essential for achieving the goals set out by the World Solar Summit.

Noting with appreciation the support shown and commitments made so far by certain donor Member States.

1. *Expresses appreciation* to the Director-General of UNESCO for his efforts in implementing the World Solar Summit Process;
2. *Also expresses its appreciation* to the Heads of State and Government who have agreed to serve on the World Solar Commission and especially to its Chairman, H.E. Dr. Robert G. Mugabe, President of the Republic of Zimbabwe.
3. *Calls upon* all UNESCO Member States to contribute to the success of the implementation of World Solar Programme 1996-2005;
4. *Confirms* the emphasis placed by the Executive Board, in its Recommendations on the Draft Programme and Budget for 1998-1999 (29 C/6), on the priority nature of the World Solar Programme 1996-2005, and particularly the implementation of the global renewable energy, education and training programme;
5. *Invites* the Director-General;
   (a) to undertake further consultations with the World Solar Commission, Member States and interested partner organizations with a view to defining the steps, ways and means of transforming the World Solar Programme into an interdisciplinary undertaking in the framework of document 30 C/5;

(b) to mobilize extra budgetary resources and technical assistance for the effective implementation of the World Solar Programme;

(c) to continue to sensitize all Member States and international financial institutions, both public and private, to the strategic importance of this programme for achieving world developmental needs.
