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**A Global Network
of
CENTRES FOR THE APPLICATION OF SOLAR ENERGY (CASE)
within UNIDO/COSERA Framework**

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Hari Sharan

Executive Summary

The report presents the conceptual and operational framework of a global network of "Centres for the Application of Solar Energy, CASE". The proposal to establish a CASE NETWORK is one of the most significant initiatives taken by UNIDO/COSERA to support the efforts of developing countries to effectively harness solar energy for their economic development.

Over the last few years UNIDO's Technology Development and Promotion Division has been promoting the Consultative Group on Solar Energy Research and Applications (COSERA) which held its first meeting in 1986. This is a high-level forum composed of those working on solar energy research and applications and representatives of donors, both countries and institutions. The primary objective of COSERA is to identify, through the collective interaction of its members, the priority needs in research and application to promote the widespread use of solar, in particular for the benefit of developing countries, as well as possible donor sources for the financing of such activities. COSERA is a mechanism for mobilizing international cooperation for enhancing the effectiveness of solar energy research, development and application in developing countries, and for carrying its results up to the stage of industrial production, commercialization and everyday use.

The draft feasibility report on "The Establishment of a Centre for Applications of Solar Energy (CASE)" by O.A. El Kholly and H. Sharan was presented at the meeting of COSERA in Marrakech in December 1991. While the need of establishing CASE and its objectives and goals were fully endorsed, alternative solutions about its institutional form were discussed in Marrakech. This was followed up by discussions on the proposal with a number of experts and institutions active in the field of solar energy. Subsequently, the meeting of COSERA in Perth, Australia in December 1992

discussed the CASE NETWORK and "..... fully endorsed the concept of CASE and called for its urgent realization".

The consensus which has emerged envisages a decentralized network of CENTRES for the APPLICATION OF SOLAR ENERGY, CASE, which under the auspices of UNIDO/COSERA will pursue the goal of helping solar energy achieve a commercial breakthrough in a coordinated manner.

It is recognized that while the CASE NETWORK will function within a set of common objectives and framework, the structure and operational modalities of each CASE will have to be adapted to the local situation in the country where it will be located and the region which it will serve.

The objectives and the common elements of the CASE network has been elaborated in the report. It lists and discusses the features which will have an overall validity for all CASEs but also identifies those elements which will have to be tailor-made to suit the local conditions. Examples to illustrate areas which will require differentiated solutions have been presented along with solutions which may be applicable. Issues such as the criteria for choosing the location, structure, organization, activities, programmes, linkages and financing of individual CASEs have also been covered.

The continuing role of UNIDO as the initiator and promoter of the CASE network, and of COSERA, which plays a catalytic role in promoting solar energy in developing countries, as the consultative and coordinating organ have been elaborated. The importance of CASE NETWORK in keeping solar technologies at the focus of global energy activities, and in providing marketing and technical support to the fledgling industry have been highlighted. Various types of CASEs which can be established as a regional centre, a specialized centre, a North-South centre, or a South-South centre, have been identified. Linkages and cooperation amongst CASEs in the network, and between a CASE and other existing institutions working in the field of solar energy have been discussed.

Ways to keep CASE lean, cost-effective and ultimately able to cover substantial parts of its costs from its own earnings have been emphasized. While each case will set its own priorities, issues such as avoiding duplication, maximizing the utilization of available specialists and expertise, establishing a close association with the industry, and selling high quality services have been discussed in this context.

The critical problem of financing a CASE has been examined and possible ways of finding 'core-funding' and 'programme/project funding' discussed. The potential role of CASE NETWORK in accelerating the application of clean energy technologies as a part of the post-Rio activities to promote sustainable development has been highlighted in the context of global funding of CASE projects.

The first CASE, planned to be set up in Perth, Australia, has been used as a concrete illustration of how to go about establishing a CENTRE for the APPLICATION of SOLAR ENERGY.

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1. **Introduction**

UNIDO, through its IPCT/TDP/TP/NT Unit, commissioned a report in July 1991 to analyse the problem of bringing the results of solar R&D to the market place and other issues connected with large scale application and commercialization of solar energy technologies. The conclusions and recommendations of this study by El-Kholy and Sharan resulted in a draft feasibility report in which a proposal was made to establish Centres for the Application of Solar Energy, CASE, under the auspices of UNIDO's high-level forum COSERA, the "Consultative Group on Solar Energy Research and Application" to bridge the gap between R&D activities and the market place.

The proposal was presented at the meeting of COSERA in Marrakech in December 1991. The need of establishing CASE and its objectives and goals were fully endorsed by the meeting. Alternative solutions about the institutional form of CASE were discussed in Marrakech, and subsequently with a number of experts and institutions active in the field of solar energy. The emerging concept of CASE as a decentralized NETWORK was discussed at the last meeting of COSERA in Perth, W. Australia, in December 1992 which "..... fully endorsed the concept of CASE and called for its urgent realization".

Considering that the vast potential of solar energy has, as yet, contributed very little to meeting the energy needs of developing countries and that the major applications, albeit on quite a modest scale, have all been in the developed countries, this initiative of UNIDO/COSERA is of very high significance to developing countries. Its success will be of great advantage to them, especially for promoting the economic development of rural communities and remote areas.

The initiative has taken on an urgency in the context of the risks of climate change and the post-Rio efforts to accelerate the promotion of sustainable development in developed as well as developing countries. Large scale application of solar energy

technologies in various forms can be a major instrument for reducing the CO₂-intensities of energy services: in developing countries where energy consumption has to be increased very significantly to ensure development and in developed countries where energy consumption and emissions have to be drastically reduced during the next two decades.

2 Objectives and Goals of the CASE NETWORK

The main objectives of a decentralized network of CASEs are as follows:

- To identify technologies ready for commercialization in R&D institutions and international markets and promote their adaptation and large scale application in developing countries.
- To foster a two-way linkage with R&D institutions and technology development centres engaged in solar energy.
- To act as a "broker" between the technological and business communities, and between developing and developed countries, for commercializing solar technologies, and establish industrial, financial, marketing and trade relationships with the industry, business and banking communities for that purpose.
- To emerge as one of the important "spokespersons" for solar energy, and interact with governments, international organizations, funding agencies, and other solar organizations on issues of energy policies and their implementation.

In order to achieve these objectives, CASE will have to undertake the following:

- Identification of mature technologies appropriate for local applications in developing countries
- Quantification of potential demands and market requirements in regions and/or individual countries
- Promotion of standards, testing and certification, and specifications
- Promotion of N-S, S-S, and N-S-S industrial cooperation, joint ventures, technology transfer and business partnerships
- Utilizing the expertise and facilities of existing institutions in developing countries for implementing its programmes
- Promoting and supporting the development of human resources at various levels.

3. Proposed Structure of the CASE NETWORK and Types of CASEs

The CASE network is envisaged to have a decentralized structure with a large number of independent CASEs located around the world and working under the auspices of UNIDO/COSERA for the common objectives and activities mentioned under section 2 above. Flexibility within the broad parameters defined by these objectives will be the key to the successful setting up of the CASE network.

A CASE may be set up

- by a national government (developing or developed)
- by a national and one or more state governments
- by governments of a developing and a developed country
- by a government(s) and international funding agency(ies)
- jointly by a government and the industry
- or a combination of one or more of the above.

As far as the location is concerned, it is important that the developing countries in a certain region get easy access to a CASE. While the first CASE is likely to be set up in Western Australia, it is hoped that ultimately a large number of CASEs will be located in developing countries. While each CASE should preferably be directed towards a region and concentrate on its needs, there should be nothing to stop a CASE being established for a single country which can afford to finance its core-funding.

While CASEs will generally work for the commercialization of all solar technologies, there will also be a place in the network for specialized CASEs, e.g., a CASE may be set up to devote itself exclusively to the commercialization of a single technology on a regional basis.

As will be discussed later in this report, two types of funding have been envisaged for CASE:

- Core Funding for the infrastructure and the operational cost of initial, start-up, years.
- Programme Funding for implementing projects.

Each CASE will find its own sources and form of funding from governments, foundations, industry and funding agencies. In order to reduce the demand for fresh capital for core funding it may be possible in many cases to convert existing institutions or parts thereof into a CASE and join the network. Under such

circumstances, though experience of other CASEs will be useful, each CASE will establish its own infrastructure and management systems.

A common link between all CASEs in the network should, however, be maintained by institutionalizing in an appropriate form the presence of UNIDO/COSERA in the management organs responsible for policy making and reviewing the activities of CASE. Linkages at the management level with other CASEs in the network and with organizations dealing with solar energy, energy policies, financing, etc. should also be examined at the time of setting up a CASE.

4. Activities and Facilities

In order to achieve its objectives, the activities of CASE should concentrate on market penetration, financing, large-scale applications and commercialization. For new technologies, many of which are not yet considered commercially viable by conventional methods of comparison, experience shows that these are very difficult tasks. One of the essential requirements for success will be, therefore, to establish close cooperation with local government agencies and existing solar R&D organizations and forge linkages with the local industries. Innovative, market-oriented solutions and motivated local implementation organizations will be the key to success.

The following is a list of the important functional activities of CASE. Many of them are closely interlinked and a plan of action would initially require working on many of them simultaneously.

- Assessment of the Market: methodologies to determine local potential
- Assessment of local capabilities and infrastructure
- Sources of finance: for manufacturers and for users
- Financing conditions: size of the market and financing conditions are closely interlinked
- Choice of technologies
- Strategies for commercialization:
 - Build up of local manufacturing base: technology transfer, joint ventures, etc.
 - Marketing strategy: sales network
- After sales service and spare parts supply
- Testing and certification
- Engineering services: standardization, specifications, procurement, quality control

- Services: to policy planners, manufacturers, business houses and marketing organizations
- Training and courses: CASE should be in a position to offer training and refresher courses for different levels of personnel. While it may be advantageous to organize some specialized courses at CASE premises (utilizing experts from developing countries where ever possible), greater emphasis should be given to providing the development of training packages using low-cost simulators and other state of the art tools which can be used by trainers locally.

Specifically for solar technologies adequate experience is not available any where in many of the areas of activities listed above. While the experience is even less in many of the developing countries, the experience from developed countries has often proven inapplicable in many developing countries without considerable modification. A great deal of effort will therefore be required in the beginning to establish methodologies and working procedure jointly with experts from developing countries. The activities themselves will in any case have to be undertaken by local organizations and it will be essential to work closely with them right from the beginning.

As far as facilities for CASE is concerned, new installations and equipment should be kept to the minimum, giving priority to facilities for testing and certification, and for development of software and training packages which can be used by the total network. The availability of similar facilities in existing institutions in the region should be critically examined before decisions for new investments are made for a new CASE.

5. Linkages

The success of CASE Network will depend largely on the extent and quality of the linkages established within the network and with important organizations and institutions outside the network. These will be briefly discussed below.

5.1 Linkage with UNIDO and COSERA

As already mentioned earlier, the CASE NETWORK will function under the auspices of UNIDO/COSERA. While UNIDO will not provide any part of the funding for CASEs, it will promote the commercialization of solar energy in developing countries

through CASE and provide continuing help, support and guidance to the individual CASEs through COSERA and other international forum.

UNIDO/COSERA will also be the main link which will ensure that all CASEs in the network work towards the same objectives and profit from each others experience. UNIDO will also be of great help to the CASE network in getting access to international organizations and funding mechanisms as well for disseminating information through their industrial promotion channels.

It is therefore important that each CASE institutionalizes the representation of UNIDO/COSERA in its top-level management organs which decide on policies and conduct performance reviews.

5.2 Linkage with the Host Government

The linkage of CASE with the host government must of necessity be very close and cordial. No commercialization effort will be successful without their full support and active participation. At the same time, no matter where the core funding comes from, it will be important that CASE maintains an autonomous status and an international character. The statutes should therefore ensure that representatives of UNIDO/COSERA, other CASEs in the network, other regional and international organizations, national solar organizations, and the industry can be members of the top management bodies of CASE.

These and other details should be agreed at the time of setting up a CASE.

5.3 Linkage within the CASE NETWORK

The linkages between CASEs within the network should be established in ways which will maximize mutual benefits and accelerate the progress of commercialization of solar energy in developing countries.

This can be done by establishing channels for the effective exchange of experience, information, and data. To start with, the experience of setting up a CASE should be available to the promoters of a new CASE. Then, of course, the most effective way to cooperate would be to exchange people on short and long term assignments and on each other's projects. Exchange of methodologies, software, training tools, etc. will also be useful. The use of specialized facilities should be encouraged by offering their

use under special conditions to CASE networks. Close cooperation should also be maintained to promote industrial and business partnership between companies covered by CASE networks, especially in the process of selection of technologies and companies for technology transfer and joint ventures.

All the services exchanged should, of course, be on mutually favourable commercial terms.

5.4 Linkage with Industry

The criteria for the success of a CASE will be extent and effectiveness of its linkage with the industry. The industry will be partners of CASE for productionizing and selling technologies offered by CASE, for technology transfer and joint venture arrangements, and for buying a variety of services from CASE.

However, CASE will also have to play an important part in convincing the industry about the longterm advantages of promoting and marketing solar technologies. The motivation of the industry will of course depend upon the success of CASE in organizing funds for investments by the industry and for the users. The success will, however, also depend upon establishing a joint industry-CASE approach and thrust.

It is therefore essential that as many industrial companies as possible should be involved during the planning phases of establishing CASE. Their representatives should be taken on the policy making bodies of CASE and their experts should be involved in establishing some of the industry oriented activities of CASE.

The linkages with the industry should, however, be established in such a manner that the neutrality of CASE is not compromised in any way.

6. Organization and Management

As mentioned earlier, the management and organizational structure of a CASE will depend largely upon the arrangements for Core Funding and the decision of the local government about its relationship with CASE.

In general, during the period of its establishment, a CASE should have a steering committee with representatives of the promoters, the government and the industry

to finalize local arrangements, do the fund-raising, and coordinate the founding with UNIDO.

Once it is established, it should have a technically and managerially strong management, with the top manager having some international experience, preferably with a developing country. The executive management should be guided by a board which should have representatives of UNIDO/COSERA, at least one from another CASE, in solar R&D, from a developing country of the relevant region, if possible one from other international and funding organizations, and from the industry.

There should be persons with experience in marketing and industry in the top executive team.

7. **Financing**

As mentioned earlier, the concept for funding CASE is based on a two-component formula which separates the costs of basic infrastructure and administration during the initial period of operation of CASE from direct costs of programme implementation and projects.

7.1 Core Funding

The cost of land, buildings, offices, computers and furnishings, and some essential engineering and technical facilities are to be covered by the core funding. In addition, the cost of non-project managerial and administrative staff are also expected to be covered by the core funding for a minimum period, e.g. of the first five years.

7.2 Programme and Project Funding

The funds for programmes and projects are planned to be obtained from a variety of sources such as bilateral and multi-lateral aid agencies, international development funding agencies like the World Bank, IFC, and the regional banks, climate funds such as the GEF, research organizations and foundations, industry organizations, and private sector industries.

The advantage of separating the funding of programmes and projects from the infrastructural and administrative costs is that the aid and financing agencies will get the maximum output for their investment without paying for indirect overheads.

Some of the initial programmes will be of a generic nature and sources of funds for them may come from UN agencies such as the UNDP. Other project-oriented activities will have to be taken up jointly by CASE and a promoting/implementing agency in a country of the region covered by CASE. In such situations the funding will depend upon the country-specific situation and a variety of sources will be involved. Solutions will therefore have to be on individual basis.

7.3 Funding by Industry

In many of the project-oriented cases, industry may also be involved and will have to share in the cost according to the norms of the funding agencies.

In cases where industry is involved, commercial banks and venture capital firms may also be a source of funds. In such cases, CASE will also have to learn to produce innovative financial packages in which commercialization will be done by a combination of equity, debt, grant and venture capital.

7.4 Selling CASE Services

The financial planning of a CASE should aim to make it financially self-supporting after the initial period when the core-funding pays for the administrative costs.

Selling of a variety of services, based on experience and expertise built up from successful commercialization of new technologies, should play an important role in this plan. The prospective customers should be the other CASEs in the network, R&D organizations, governments, international funding organizations, and the industry.

Care should be taken that the neutrality of CASE is not compromised by any service paid for by outsiders.

8. Establishment of CASE Perth: Beginning of a Network

The proposal to establish an Australian CASE is based on a decision of the West Australian government to respond to the UNIDO/COSERA proposal and provide financial and infrastructural support jointly with the Federal government and the local universities to set up a CASE in Perth.

This decision is based on the long years of support given to solar energy R&D and application by the Federal and Western Australian governments. Many of the technologies developed have been commercialized and the growth of a market has lead to substantial investments being made in manufacturing facilities by the private sector. There are now a large number of solar, wind and hybrid installations for decentralized power generation in grid-connected as well stand alone modes. Solar thermal hot water systems are widely used and the combination of a continuing strong R&D base with expertise in design, production, service and marketing makes Australia one of the world leaders in the low temperature solar thermal field.

Australia is geographically near to a large number of developing countries in the Pacific, S-E. and S. Asia who have high potential for the application of solar energy for meeting parts of their energy needs, especially in rural and remote locations. Many of these countries have substantial solar energy R&D programmes and are in the process of establishing strategies and projects to commercialize mature solar technologies. As the Australian report says, "Australia is unusual in that it offers the rare combination of industrial and research infrastructure of a developed country together with many of the circumstances of a developing country."

A synergy thus exists between the experience, capabilities and location of Australia, and the potential, developmental needs and capabilities of developing countries in the Pacific, S-E and S. Asia. Properly structured, supported and managed, an Australian CASE in Perth can become a powerful instrument to help these countries make solar energy an important part of their economic development. This can also be very significant for the success of the concept of CASE NETWORK, in which a large number of CASEs should provide some of the critical inputs essential for large scale application and commercialization of solar energy in developing countries in other regions.

The proposal of the Western Australian government includes a funding of 5 million Adollars jointly with the Federal government for a period of five years, and the cost of the initial building; grant of land by Murdoch University for the CASE, PERTH complex on the campus of Murdoch University in Perth; access to R&D facilities of Murdoch and Curtin Universities; linkage to other Australian solar R&D programmes; support from the Australian industry; linkage to local and national training facilities; and linkage to Federal government technical and economic cooperation programmes with developing countries.

The Australian funding is planned to be used to establish CASE, PERTH, and provide the basic infrastructure and running costs for the first five years. This may be considered as "core-funding" to enable CASE, PERTH to take up concrete projects and implementation programmes jointly with partners in developing countries of this region and funded by other sources.

Government contribution to the running cost will be gradually reduced as CASE, PERTH starts to generate its own revenues by providing expert and specialized services to the industry, government agencies, and R&D institutions, as well as from the sale of patents, know-how and licenses.

The cost of the projects and implementation programmes themselves are not planned to be paid out of the core funds. Project and/or programme promoters from developing countries and CASE, PERTH have to jointly find finance for specific activities from a variety of sources: global, regional and national funding agencies; international financing mechanisms; contracts from government R&D and development funding agencies; contracts, loans and grants from the industry; venture capital; private sector investment; and grants from foundations and trusts.

The organizational character of CASE, PERTH, Perth will reflect its UNIDO/COSERA linkage, international character, national base, joint programmes and projects with developing countries, and linkages to other institutions working in various fields of solar energy in industrialized and developing countries.

9. Other CASEs in the Network

Apart from Perth recommended as the location of the first CASE, there are ideas to set up several other CASEs, for example in Marrakech, Morocco; Hangzhou, China; San Paulo, Brazil; and New Delhi, India. While some of these initiatives are still rather tentative, it is planned to undertake a follow up by providing the promoting agencies with information about the concept of the Global Network of CASE, the role and responsibilities of UNIDO/COSERA, the framework under which CASEs are expected to function, and the inputs which will be required from the host country.

10. Conclusions

The setting up of other CASEs should be promoted actively by UNIDO/COSERA on the lines proposed in this report. The experience of current activities for establishing the Australian CASE in Perth, the documents prepared for it at various stages, the alternative solutions examined, and those finally approved, will be of great help in establishing other CASEs in the network.

As a guidance to promoters of CASE, a list of major activities which will have to be undertaken for establishing other CASEs is given below. This list, along with relevant documents generated for the establishment of the first CASE in Perth, should be provided by UNIDO/COSERA to all governments and lead agencies which are interested in promoting the establishment of other CASEs.

Some of the critical activities are:

- Preparation of a concept document by the national agency promoting CASE.
This concept document should define:
The type of CASE proposed (regional or specialized).
National R&D and commercialization programmes.
R&D, testing and certification facilities available.
Market potential and the status of industrial activities.
Proposed location, structure and linkages of CASE.
Funds and facilities being offered by national / local or neighbouring governments.
 - Review of the proposal by UNIDO/COSERA. Response and views of neighbouring countries, regional institutions, existing CASEs, and funding/financing agencies.
 - Preparation of a Project Report under the responsibility of a national lead agency.
 - Review and approval of the Project Report by UNIDO/COSERA.
 - Approval of governments/UNIDO and core-funding agencies.
-