G 1031

GEO-PROC-95-01

Workshop Proceedings on

Financing the Development and Deployment of Renewable Energy Technologies

MAY 15-16, 1995

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

The Workshop Proceedings on Financing the Development and Deployment of Renewable Energy Technologies was produced by the Oak Ridge Institute for Science and Education (ORISE). ORISE is managed by Oak Ridge Associated Universities (ORAU) for the U. S. Department of Energy under contract DE-AC05-76OR00033.

Table of Contents

Note: Many speakers provided additional information that they were unable to present in the workshop due to time limitations. In many cases, these materials provide context or extend the points made at the workshop; therefore, they are included in Appendix B of this volume — The Editors

Acknowledgments	iii
Summary	1
Introduction	6
Workshop Presentations	
<i>Panel 1: Status of Technologies and Markets</i>	8
Doug Barnes (World Bank), <i>Renewable Technologies in Household Applications</i> Jerome Weingart (J. Weingart Associates), <i>Renewable Technologies in Village Applications</i> Carl Weinberg (Carl Weinberg Associates), <i>Renewable Technologies in Grid Connected Applications</i>	
<i>Panel 2: New Initiatives and Financing Mechanisms for Renewable Electricity</i>	12
Achilles Adamantiades (World Bank), <i>World Bank Solar Initiative (SI)</i> Charles Feinstein (World Bank), <i>Financing Renewable Energy Projects through the Global Environment Facility</i> Keith Kozloff (World Resources Institute), <i>Rethinking Development Assistance for Renewable Electricity</i> K.R. Locklin (Appropriate Technologies International), <i>Commentary</i> Gayle Jackson (Gayle P.W. Jackson, Inc.), <i>The Venture Capital Industry as a Source of Financing for Renewable Energy Technology</i> Anil Cabraal (World Bank), <i>Asian Alternative Energy Unit (ASTAE) Program</i> Gunter Schramm (IFC), <i>International Finance Corporation Financing of Renewable Energy Projects</i> Judy Siegel (U.S. Export Council for Renewable Energy), <i>Commentary</i> Richard Hosier (UNDP), <i>Renewable Energy Project Support at The United Nations Development Programme</i> Anthony Bromley (UNIDO), <i>UNIDO's Program for Promoting Solar Energy Applications</i> Boris Berkovski (UNESCO), <i>World Solar Summit Process</i> Mike Nicklas (International Solar Energy Society), <i>Commentary</i>	
<i>Panel 3: Regional Financing and Country Experiences</i>	23
Ernesto Terrado (World Bank), <i>World Bank Projects in Renewable Energy</i> Russell deLucia (deLucia and Associates), <i>Renewable Energy Project Implementation in Asia</i> Luis Prado (International Fund for Renewable Energy and Energy Efficiency), <i>Renewable Energy Project Implementation in Latin America and the Caribbean</i> David Bloomgarden (U.S. Department of Commerce), <i>Africa Development Bank's Energy Lending</i>	

Steve Imrie (*European Union*), *Renewable Energy Project Implementation in Eastern Europe and the Former Soviet States*
V. Bakthavatsalam (*Indian Renewable Energy Development Agency*), *Renewable Energy Project Implementation in India*

Conclusions 30

APPENDICES

Appendix A: Workshop Participants A-1

Appendix B: Speaker Materials B-1

Acknowledgments

The IEA Working Party on Renewable Energy would like to thank its joint host for the workshop, The World Bank, for providing the location for the workshop, for assistance in planning the workshop, and for providing several key speakers. In particular, the valuable contributions of Vernetta Hitch, Rachel English, and Achilles Adamantiades are gratefully acknowledged.

The Working Party would also like to thank Carolyn Beeler of the Oak Ridge Institute for Science and Education for applying her considerable organizational skills in making the workshop run smoothly and for generating this useful record of the meeting to provide to workshop participants and other interested parties.

In addition, Ron White of the National Renewable Energy Laboratory provided critical assistance in the design of the workshop and in the editing of these proceedings.

Finally, thanks are extended to the workshop participants who shared freely with their information and made the event a success. The clear and encouraging message delivered by the participants to conduct follow-on workshops has been clearly heard and will be acted on.

PROCEEDINGS

Summary (As prepared by The World Bank)

Introduction The Working Party on Renewable Energy (REWP) of the International Energy Agency (IEA) organized a two-day seminar on the role of financing organizations in the development and deployment of renewable energy (RE). The World Bank (WB) and the US Department of Energy (USDOE) hosted the workshop. Delegates were mainly senior government representatives from the 23 IEA member countries, whose responsibilities are related to all or most of the renewable sources of energy. In addition, representatives of the European Union, United Nations, trade organizations, utilities and industries and the WB attended the meeting. The workshop was recognized as an important first step in a dialog required between the parties involved in the development of RE technology, project preparation and the financing of RE. It was also recognized that much more is required - particularly in terms of increased collaboration and coordination, and innovative financing - for RE to enter the market at an accelerated pace, and that other parties (for example from the private sector and recipient countries) need to have increased involvement in future initiatives.

Collaboration

Numerous Activities Delegates heard about many RE activities which are underway, and the roles of many players in the field. Table 1 summarizes the different programs and activities presented by the delegates at the workshop (this table is in no means a complete listing of even the activities underway by the organizations present at the workshop). The large number and variety of efforts in RE have both advantages and disadvantages:

<i>Disadvantages and Advantages</i>	●	efforts may be duplicated	<i>but</i>	●	we can learn from each other
	●	schemes may fail through lack of finance	<i>but</i>	●	pooled together, finance may be sufficient
	●	the number of technical assistance and finance options can be confusing to recipient countries	<i>but</i>	●	competition between financiers may sometimes be healthy

Organization and Speaker	Programs Highlighted at Workshop	
IEA John Tilley	Technology Collaboration Program	Collaboration on technology development, demonstration and information dissemination between countries through IEA Implementing Agreements covers RE as well as fossil fuels and energy end-use technologies.
	Climate Technology Initiative	A linked set of technology projects which contribute to the development and deployment of energy and environmental technologies which can help to respond to global climate change concerns in industrialized and industrializing countries. As well as R&D, activities include transfer of voluntary programs, innovative financing mechanisms, networking of RE centers, and development of technology aspects of national climate response plans.
IEA Eric Lysen	IEA Photovoltaic Program	To enhance the international collaboration efforts on technology development and demonstration through which photovoltaic energy becomes a significant energy option in the near future, both for OECD countries and DCs.
UNDP Richard Hosier	Initiative for Sustainable Energy	Coordinates government agencies, private sector and bi- and multi-laterals. Focuses on increasing the level of energy services delivered, in DCs, through energy efficiency, RE and technical innovation. Country driven. Not a source of capital.
UN Walter Shearer	Centers of Excellence	A concept was developed to establish 8 regional centers of excellence, starting at a national level in China and India.
UNIDO Anthony Bromley	International Center for Application of Solar Energy (CASE)	Works with international and local industries and institutions. Promotes and assists in the development of sustainable solar energy technologies in DCs.
UNESCO Boris Berkovski	World Summit Process	1996-2005 Governments, NGOs and others relevant actors are establishing a global information network system, promoting training and research, and demonstrating the benefits of RE. A World Solar Summit is being organized for late 1996.
Indian Renewable Energy Development Agency (IREDA) V. Bakthavatsalam Gayle Jackson Inc (Venture Capital) Gayle Jackson		Successful experience in India, aided by WB and bilaterals to stimulate, promote, support and accelerate an efficient, environmentally sustainable infrastructure for effective exploitation of new and renewable sources.
	Environment Technical Investment Fund	Set up by the Edison Electric Institute to invest in commercialization of emerging energy efficiency and renewable technologies.
	Energy Transition Fund	To be set up by the McArthur Foundation.

Key to Progress

The key message of the workshop was that collaboration - through open dialog; through dissemination of present and future activities, and of lessons learned; and through further *more focused* workshops - should make the various RE initiatives more productive and speed up the development and deployment of RE. It was suggested that 'focused' workshops should be held at 9- to 12-month intervals.

Organization and Speaker	Programs Highlighted at Workshop	
European Community Steve Imrie	THERMIE (1990-94) JOULE-THERMIE (1995-98)	<p>Program includes the promotion of RE technology. Focuses on demonstration, promotion and dissemination of benefits. Finances EC Energy Centers; investment appraisal guides; advice on 3rd party financing, case studies; a source of finance guide; and "investment fora".</p> <p>Also mentioned 6 other programs or sources of finance: Phare (TA for central and eastern European countries), Tacis (TA for former Soviet Union countries), EIB/EBRD (low cost loans), Sprint (3rd party financing and risk guarantees); and Eurotech/Seed (development, venture capital and start-up capital)</p> <p>The African Development Bank has no RE projects at present but is re-capitalizing their Fund and defining regional energy strategies.</p>
U.S. Department of Commerce David Bloomgarden National Renewable Energy Laboratory Jermoe Weingart	Village Power Initiative	Covers technology development; pilot projects in 10 countries; economic and financial analysis.
GEF Charles Feinstein	Project Development Facility	Provides incremental cost financing to obtain global benefits. Leverages other finance. 3 windows: Window A provides up to \$25,000 for concept development. This can be requested by anybody, with WB approval. Window B provides up to \$350,000 for pre-investment and feasibility studies. This must be requested by a government and have approval from the GEF Secretariat. Window C provides up to one million dollars for detailed project design. This has the same requirements as Window B.
IFC Gunter Schramm	Project Investment Renewable Energy and Energy Efficiency Fund	Buys down uneconomic elements on environmental grounds. The IFC is scoping a fund of about US\$100m specifically for renewables and energy efficiency. A portion would be available for project preparation. Would also be a window to GEF funds.
WB Anil Cabraal/ Ernesto Terrado/ Achilles Adamantiades	Asia Alternative Energy Unit (ASTAE), The Solar Initiative, other WB projects and ESMAP	ASTAE, a donor/WB pilot, supports RE and Energy efficiency (DSM) development in WB/GEF power sector assistance to Asia. Its current portfolio includes over \$600m in WB/GEF funding for 11 DSM/RE ongoing or proposed projects/ components. The Solar Initiative is a Bank-wide proposal intended to assist in the identification of project possibilities, prepare and finance commercial and near-commercial RE technologies and facilitate international research, development and demonstration.

With sufficient collaboration, each organization should find its niche, based on its comparative advantage, so that each organization may have fewer, but better focused activities. The objective should thus be flexible, coordinated programs, able to respond to different needs, but with common overall objectives and common *country*-level strategies. The financing organizations have a role to play in activities which promote policy reform, facilitate private sector investment in RE, facilitate R&D, and fill financial gaps.

Financing The financial aspects of project planning and implementation were discussed by a number of delegates. Particular concerns were raised about:

- the need for grant financing at the identification and, possibly, pre-feasibility stage (i.e., before traditional sources of funds available); and
- the need for recipient countries to understand better the “financing matrix”, i.e. the blending of funds from various sources for the various project components. In addition, the following points were raised:

Flexibility The challenges faced in the deployment of RE are different in each country due to different levels of resources, different needs, and also different levels of acceptance of RE technologies. Multilateral organizations and other financing institutions must be flexible to meet these different challenges and strategies thus need to be designed at the country level.

Different Technologies RE technologies have different problems for mobilizing finance. Grid-connected wind is commercial and the easiest to finance, though R&D continues. Photovoltaics can be commercial in off-grid applications. For off-grid applications, R&D investment should be directed towards the technology with the steepest learning curve.

Amount of Funding Much discussion focused on whether there was sufficient funding for the identification and preparation of RE projects. Participants accepted that a useful actions would be for members of the Working Party to communicate to their respective government authorities the need to dedicate more funds toward RE development in developing countries and to make these funds more effective through linking them with activities of international funding agencies.

World Bank and GEF

Financing The WB's procedures were criticized by some as too cumbersome and time consuming. Similarly, it was noted that GEF funds require additional clearance steps that are interjected into the existing WB project cycle and that, for funds greater than \$25,000 (Windows B and C), government approval is also required.

Local Financing A lack of local financial infrastructure was recognized as presenting a barrier to the deployment of RE. Some delegates raised the importance of building the capacity of local financiers as an important role for international financial organizations and governments – as is already happening, for example, in India.

Venture Capital Venture capital, provided by firms that invest in young and rapidly growing companies, is already being used to finance promising RE technologies in OECD countries. Venture capital is attracted by the potential for high returns in the order of 22-25%(to reward for higher risks). Specialized RE funds with RE experts have been set up in the USA, for example, to internalize these benefits.

Other Requirements

Facilitators The role of the facilitators in target countries to prepare RE proposals was discussed as a means to overcome the fact that, in many countries, there is little local expertise with either RE or project finance and thus there is a lack of awareness of opportunities, technologies and financial sources. Many of the companies involved in the local markets are small, and not accustomed to putting together major programs, or applying for funds. In addition, management of RE projects could be improved through such facilitators.

Centers of Excellence It was recognized that, to encourage the penetration of RE in developing countries, there is a need to strengthen the international collaboration and coordination of RD&D with a view to transferring technology to DCs, enhancing local "ownership" of RE technologies and adapting to local conditions, and removing local barriers. The establishment of an international network of RD&D centers (often called Centers of Excellence), including a number of such centers in developing countries was discussed. This would require enhancement of existing centers and the possible creation of new centers and more effective exchange of information and staff. Various delegates mentioned they had products which could be used as resources for such centers.

Introduction

International Energy Agency

The International Energy Agency (IEA) is an autonomous body that was established in November 1974 within the framework of the Organization for Economic Cooperation and Development (OECD) to implement an international energy program.

It carries out a comprehensive program of energy cooperation among 23* of the OECD's 25 member countries. The basic aims of the IEA include the following:

- i) Cooperation among IEA participating countries to reduce excessive dependence on oil through energy conservation, development of alternative energy sources, and energy research and development
- ii) An information system on the international oil market as well as consultation with oil companies
- iii) Cooperation with oil-producing and other oil-consuming countries with a view to developing a stable international energy trade as well as the rational management and use of world energy resources in the interest of all countries
- iv) A plan to prepare participating countries against the risk of a major disruption of oil supplies and to share available oil in the event of an emergency

** IEA participating countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway (by special agreement), Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States. The Commission of the European Communities takes part in the work of the IEA.*

IEA Working Party on Renewable Energy

The Working Party on Renewable Energy (REWP) consists of government senior representatives from IEA member governments and the European Commission whose responsibilities are related to all or most of the renewable sources of energy.

The REWP provides advice to the IEA Committee on Energy Research and Technology (CERT) and other IEA bodies on the promotion of collaborative R&D and demonstration, removal of institutional barriers to market deployment, and identification of environmental impacts by the following means:

- (1) Identifying of those renewable energy technologies which are expected to respond most effectively in the short and longer terms to energy security concerns and environmental and economic goals of member countries.
- (2) Arranging studies and technology information exchange on topics of common interest, conferences, workshops, and other activities.
- (3) Exchanging information on the status and development of renewable energy technologies and national renewable energy programs.
- (4) Initiating, evaluating, and reviewing on a periodic basis, Implementing Agreements and other international collaborative activities. Currently, there are seven IEA Implementing Agreements on renewable energy, including programs related to bioenergy, geothermal (planned), hydrogen, hydropower, photovoltaic power systems, solar heating and cooling, solar thermal power and chemical systems, and wind turbines; in addition, the IEA Implementing Agreement CADDET Renewable Energy aims to broaden and improve exchange of information on demonstrated renewable energy technologies.
- (5) Coordinating with other sectoral bodies of the IEA that conduct related studies, information exchanges, and meetings relevant to renewable energy technologies.
- (6) Reviewing, evaluating, and participating in related activities conducted by other IEA bodies.
- (7) Serving as liaison with selected nonmember countries, and other institutions and entities whose functions address the area of renewable energy technology with a view to seeking possible areas of collaboration and avoiding duplication.

Workshop Presentations

A welcome to the workshop was provided by the following:

- Richard Stern, World Bank
- Godfrey Bevan, International Energy Association, Renewable Energy Working Party
- Allan R. Hoffman, U.S. Department of Energy

Panel 1: Status of Technologies and Markets

Moderator: Karl G. Jechoutek, World Bank

The context for an examination of various means of financing renewables includes technological readiness, modularity in application, and costs on the supply side and market size (including ability to pay), distribution networks, and service capabilities on the demand side. Additionally, due to the contrast between conventional energy and most renewable energy in terms of environmental impacts, some understanding of both global and local environmental benefits is useful. The opening session provided this context for household, village-level, and grid-connected applications.

Renewable Technologies in Household Applications

Doug Barnes, World Bank

The energy problem in rural areas is that the technologies supplied do not meet household needs, but are most often designed to meet government program guidelines instead. When this mismatch occurs, progress is delayed. Two billion people are currently without electricity services; many, if not most, of these households are not aware of the range of services that is available. Suppliers do not focus on these consumers since the available incentives come from government projects.

There are some myths regarding rural household energy that need to be eliminated:

- The market is two billion people without electricity.
Such a number may be reasonably accurate, but real market estimates must include an analysis of ability to pay.
- People in rural areas do not have the means to pay for energy services.
Some can pay, and some cannot.

- People in rural areas are happy with existing energy services.
Many people would welcome modernization and energy service alternatives.
- Household renewable energy systems are less expensive than conventional.
Yes, but they're not cheap.

Solutions to rural household energy problems will include the following:

For Retailers: Focus attention on household consumers, not government-subsidized programs. Perform real market studies to better define target groups, and develop retailing strategies. Carefully define the blockages between supply and demand. Provide more and better interactions between system designers and consumers, thereby making the technologies more appropriate to household needs. Ensure product quality through establishing standards and monitoring consumer satisfaction. Provide more retailer-based consumer credit, and better after-sales service and support.

For Government: Get out of the business of purchasing and distributing household systems. Support the whole system, but use a more market-oriented approach. It is important to provide technical assistance that includes training and market development. Work to make the playing field level for trade by neutralizing tariffs and taxes. Ensure quality control by establishing testing labs, etc. Do not establish schemes to support uniform pricing of electricity or other household energy sources, because this prevents the development of markets for new technologies and keeps useful technologies out of the rural areas. Encourage diversity of suppliers and technologies so that a competitive market can emerge and determine price. Address the issue of credit availability, for both production and distribution network investments and consumer loans.

Conclusion: People in rural and periurban areas have a substantial need for improved energy services. Both the private sector and the government need to develop systems that service these needs. The focus must now be on consumers in the market, rather than on government programs.

Renewable Technologies in Village Applications
Jerome Weingart, J. Weingart Associates

"Village power" is defined as a reliable supply of high-quality electricity services that can support social and economic development at costs commensurate with the community's willingness and ability to pay, in a manner that is widely replicable, transferable, and sustainable.

Current activities for the National Renewable Energy Laboratory's (NREL's) Village Power Initiative include technology development; pilot projects; communicating through workshops, the Internet, and a project data base; and software models for economic and financial analysis, and optimization of cost and performance.

Challenges for village power include the following:

- Two billion people currently lack reliable access.
- Power is central to social and economic development.
- Significant additions to CO₂ emissions are possible--concern for social and economic development and the global environment.
- Effective low-carbon paths need to be found for development--renewable energy is central to this technology.

The key operational challenge is making "small is beautiful" big enough to count.

Village power technology is the capacity to provide a service in a specifiable, sustainable, and replicable manner. There are technologies to provide the full delivery system for village power. To meet that challenge, the technology has to be proven, local, and competitive. There is a need for policies and financing that support these emerging commercial markets.

Needs for village power include economically productive uses, community needs and services, and household electrical energy needs. Equipment available on a commercial basis includes independent units in wind and photovoltaics, and wind-photovoltaic-diesel hybrids. This equipment can be used to provide 24-hour power. Home (photovoltaic) lighting systems provide service of high value, but the cost is high. The reliability of small units is compromised by battery failure and cloud cover. Hybrid power systems are emerging, which optimize renewable energy use and provide 24-hour power and the least-cost alternative. There are currently 23 hybrid systems worldwide.

The new model for off-grid power supply is a hybrid system; it appears workable without subsidies. There are currently no models for large-scale, commercial market-driven applications for renewable energy for renewable power. Market aggregation, community participation, and cost recovery to owners and operators are needed, as well as local operations and management facilities.

Renewable Technologies in Grid-Connected Applications

Carl Weinberg, Carl Weinberg Associates

There is a fundamental shift occurring from constructed energy, in which gains arise from economies of facility scale, to manufactured energy, in which gains arise from economies of product manufacture. In the historical pattern for grid-connected generators, efficiencies rise as capacity increases and, therefore, the unit cost of electricity drops. The typical "S" curve in boiler-type power plants begins to disappear. The manufacturing learning curve, not the scale of the project, that drives the cost.

One implication of this shift is that existing standard project financing approaches can often be inappropriate for renewable technologies, because costs and the forces that determine them are different than those of conventional power systems. For most renewables, the capital costs are high in proportion to operating costs. Capital is a major component.

This means that there is as much cost reduction potential in innovative financing as there is in innovative technology. There can be a 25% reduction in costs through creative financing.

As noted above, the standard large power plant cost curve decreases with the consumption of electricity. With small, decentralized technologies, however, if the costs of transmission and distribution are greater, it is possible to move off grid to minimize the costs. Where the unit costs of renewable technology do not change with size, the technology's value increases as it moves toward the ultimate consumer. However, most utilities do not know the costs of transmission and distribution or the shapes of the load curves at lower levels in the distribution system, e.g., substation levels. They know only the characteristics at the central station. In short, there is an incorrect assumption that the costs of serving each customer on the system are identical.

Value can be derived from investing in feeder-support systems. Depending on how the systems are financed, even though the price may be higher than that of the central unit, the economic value of power near the consumer is also higher. Near-term bulk power (e. g., wind energy) is currently the most economic grid-connected renewable option in the United States because the private sector can bring it on line faster than utilities can.

To improve the market share for renewables, reduce the costs and work on quantifying the value to the system from well-planned projects. To close the gap, the market will eventually have to be stimulated. There is a need to have finances that match the characteristics of renewables. Financing should be considered for small businesses that support renewables locally. Analyses should be framed in terms of costs at the customer level, rather than busbar costs. Finance energy portfolios, not energy projects.

Conclusion: There is a need to increase choices at all levels and to find financing alternatives.

Questions and Comments

Q. Berkovski: Why is there a limited market for solar cookers?

A. Barnes: The technology works well and they are cheap and affordable, but they require most of the day for a meal to cook and supervision is needed. The constraints are not with the technology, but with the process of preparing food. If solar cookers were used in a compound that is secure, solar cookers could be used.

Q. Benemman: Have solar thermal power plants been investigated, and if so, what were the results?

A. Weinberg: Solar thermal electric power plants have potential, but the technology is not at the same point in its development as other technologies. Their potential costs could be competitive, but R&D and demonstrations are needed.

Comment. Sherrer: The context of village and household technologies is that of development. UN work found that such technologies are not for the poorest of the poor. Education and economically productive income-generating activities are needed to decrease poverty. Effectiveness is achieved by

focusing energy for productive activities. Support at the household level can be achieved if the income of the household is increased. They can then improve their quality of life and their ability to purchase energy.

Comment. Godfrey: The workshop focus seems to be on electricity, but keep in mind heating/cooling, transport, and farming--producing productive enterprises. The customer needs have to be defined, energy efficiency should be designed in, and then electricity supply can be considered. If supply is considered first, it is backward.

Comment. Weingart: I concur; end use is an essential consideration.

Comment. Weinberg: The least-cost, highest-value solution includes the efficient use of energy. Efficiency needs to be woven into whatever solution is devised.

Comment. Jechoutek: There is a need to get away from the old central planning mind-set.

Panel 2: New Initiatives and Financing Mechanisms for Renewable Electricity

Moderator: Karl G. Jechoutek, World Bank

In response to the technical advances, cost reductions, and--quite importantly--recognition of both global and local environmental benefits associated with renewables, some potentially important new financing initiatives have emerged. Presentations in this panel focused attention on the plans and progress of these global initiatives.

World Bank Solar Initiative (SI) **Achilles Adamantiades, World Bank**

Note: The Solar Initiative has two foci: (a) the development of a pipeline of projects that can be financed by the World Bank and others, and (b) improving the quantity and scope of research and development on renewable energy. The presentation outlined below deals with R&D; project financing is addressed later by E. Terrado — The Editors

The larger increments in growth in electric power will be outside the OECD countries, with the highest amount of growth in developing countries. Because of this growth, and because the needed capacity is so large, energy and the environment must be seen as one entity. Development of advanced technologies from generation to end use has occurred, but must be strengthened. Both the private and public sectors have important roles in the needed research and development.

Public sector activities need to focus on externalities, accounting for the higher risk of long-term R&D, and making clear the risks of doing nothing. In addition, there are a number of problems in

R&D that must be of concern to policy makers—in particular, both the overall size of expenditures and the range of items being pursued. Given that the market growth will be in developing countries, we must take stock of the current research portfolio and ensure that it is relevant to the needs of developing countries.

Improved coordination of R&D through a network of Regional Centers of Excellence has been discussed. If new efforts are to be made, there is a need to focus on technology adaptation, deployment, and evaluation. Such centers will require infrastructure development and can benefit from alliances with other researchers. Thus, there is a need to better define the roles for the Centers of Excellence. In addition to technical problems, there are economic, financial, and institutional issues that must be addressed. More progress can be made by fixing financial problems than by fixing the technologies. Therefore, innovative finance mechanisms need to be examined, and measures need to be taken to strengthen institutional structures.

Some practical issues that need to be addressed include integrating existing centers with the proposed new institutions, monitoring work in R&D centers, quality control, transferring experience from developing centers, training personnel, and staff exchanges.

In summary, the highest potential for growth and environmental problems is in developing countries. There is a need to transfer technology to the developing countries and to change the focus to local "ownership." Broader consensus is necessary to determine what R&D is needed. The proposed Centers of Excellence could address these problems; one component they need is an international panel to guide the effort.

Financing Renewable Energy Projects Through the Global Environment Facility **Charles Feinstein, World Bank**

The Global Environment Facility (GEF) is a partnership of UNDP, UNEP, and the World Bank. GEF's role is to finance large-scale, capital-intensive projects. GEF is a financing mechanism that provides incremental cost financing to obtain global benefits. Requests for funding must come from a government or to the private sector with government approval.

Support for renewable energy has been strong. Emphasis has been placed on technology and market development and institutional reform. Examples of such efforts can be found in the Philippines and India. For GEF II, resources have increased and activities are more country-driven and more strategic. It demonstrates that we could all work together to make projects happen.

Resource allocation takes into account the learning curve (mentioned above, Weinberg), with priorities being in developing countries. Technology transfer will be included—for example, there is a biomass gasification project in Brazil and a combined gas turbine and solar thermal-electric project that is being developed. An innovative effort under consideration is a photovoltaic "green carrot" type solicitation.

Such an effort was used by the United States to encourage appliance manufacturers to introduce an efficient refrigerator into the market. The need being addressed is finding a way to drive down the cost of photovoltaics, perhaps with a large purchase from a single supplier.

GEF funding is integrated with the World Bank cycle. Screening for eligibility is done by GEF with project preparation advance windows to facilitate the process. The project, though, must pass an interagency review and be authorized by the GEF council.

The following windows of support have been established:

- Window A--less than \$25,000 to anyone to stimulate the development of concepts.
- Window B--preinvestment and feasibility studies of less than \$350,000. This window requires a government request and is approved by the GEF Secretariat.
- Window C--supports detailed design development work of less than \$1 million and requires a government request and GEF Secretariat approval.

Questions and Discussion

The UN is developing a program for a network of Centers of Excellence linked for joint benefits and division of labor. Each center will have an emphasis and serve the renewable requirements of a region--eight centers and a subnetwork in each region to connect the other centers. The Consultative Group on International Agricultural Research (CGIAR) model may not be appropriate.

Q. Devin: Is there any connection with the core financing of project implementation in relation to the GEF windows?

A. Feinstein: Yes. At Window A, it is not a concern. At Window B, there are some indications that the Bank will support a loan for nonincremental cost financing. At Window C, it is a definite condition and, as noted, at this stage a presentation to the management committee is needed.

Comment. Hoffman: There is a need to consider how to coordinate the various efforts in the best possible way to effectively use our resources.

Q. Berkovski: Explain the role of government and the role of the market. What would be the limitations to use government to promote renewable energy?

A. Barnes: There are different approaches to market dissemination: central planning approach, market orientation, and technology approach, and they are not mutually exclusive. The current trend is away from the central planning approach and toward market orientation. This varies, however, depending on the country and technologies, but the approach is that aid should go to market development, technical assistance, and training. The types of programs used depend on the needs of the country and its people.

Q. Bevan: Are the mechanics in place to spend the money from GEF wisely? Do we need to enhance the mechanisms to allow the spending of the money?

A. Feinstein: Countries have evaluated the GEF structure and determined whether they wanted to replenish it. Clients have three years before they need to table their national communication, i.e., their plan for dealing with climate change. There are large forces in motion, but it will take time for it to converge. Things need to gear up.

Q. Bevan: The problem is that there are not enough people to produce large-scale proposals.

A. Feinstein: Agree. The aim of the windows is to facilitate project development.

Panel 2: New Initiatives and Financing Mechanisms for Renewable Electricity (cont.)

Moderator: Allan R. Hoffman, U.S. Department of Energy

In this segment of the workshop, specific people made presentations, and others were designated to provide commentary on the work presented. Commentary is appropriately designated.

— The Editors

Rethinking Development Assistance for Renewable Electricity

Keith Kozloff, World Resources Institute

There are two categories of barriers in achieving market penetration:

- Renewables cost too much (supply).
- Users do not fully and fairly assess their value (demand).

Progress to overcome these barriers can be made through international cooperation.

Renewable technologies are declining cost technologies. The costs can be reduced through economies of production, but does the private sector have incentives to bring about cost reductions? There is an increased dependence in the United States on overseas markets to keep companies going. Domestically, the private sector is interested in low capital-intensive technologies and centralized power. In this market, the points of leverage are fewer.

There are opportunities for international programs to make a difference. Most early renewables projects were grants or loans. Neither the projects nor the broader initiatives have the mandates, resources, and incentives to look at all barriers that inhibit moving the technology from one stage to the next. Numerous agencies have responsibility for implementation, and cooperation is necessary.

Funding has been inconsistent of funding over time. Most of the support has gone to small hydro- and geothermal. Markets for grid and off-grid applications remain too fragmented to induce the private sector to invest to bring down costs.

Thus, the benefits from cooperation include an opportunity to link technology push and market pull, to pool resources to achieve stable program funding, to achieve better economies of scale, and to reduce inconsistencies among programs.

Specific opportunities for cooperation include the following:

- Strengthening bilateral development assistance guidelines to minimize the use of aid
- Expanding national programs to allow participants from other countries
- Coordinating RD&D among existing centers
- Creating a multilateral mechanism for international commercialization

Recommendations:

1. Explore institutional mechanisms for international cooperation
2. Develop priority opportunities for targeted technologies
3. Identify ways to overcome institutional and financial barriers

Commentary

K. R. Locklin, Appropriate Technologies International

Increased cooperation and enhanced coordination among the various programs are the key. Development finance institutions are charged with having the long view, but focus on narrowly defined least cost. Therefore, they miss the point. This practice is changing, though.

The OECD-style development is not the best model for the world. There is a need to go beyond cooperation and coordination and reform the finance institution policies. In India, policy reform has taken hold and changed the markets.

There is a shortfall in total funding to sustain current per-capita levels of energy consumption that require outside capital inputs. The rush to privatization tends to reduce utility interest in programs and make them sensitive to higher capital costs. It is difficult for analysts to evaluate risks associated with renewables. There is a need to "mainstream" the review of renewable project investments and to train private investors how to evaluate risk.

A new, nonprofit energy investment service firm has been organized called E&Co. The mission of the firm is to promote developing country enterprises that create economically self-sustaining enterprises, use environmentally superior technologies, and produce a more equal distribution of energy--especially to the poor. There is a need to mobilize more conventional private and public sector financial resources to invest in renewable energy, energy efficiency, and cleaner technologies in the uncertain market conditions of developing countries.

The Venture Capital Industry as a Source of Financing for Renewable Energy Technology
Gayle Jackson, Gayle P.W. Jackson, Inc.

Professional venture capital is provided by firms of full-time professionals who invest alongside management in young, rapidly growing companies that have the potential to develop into significant competitors in regional, national, and global markets. Both major corporations and private foundations use the venture capital industry in interesting ways.

Venture investing can facilitate access to capital for small companies, facilitate business ties, and provide an attractive financial return. Venture firms have a five- to ten-year orientation and are looking for higher returns (in the 22%-25% range) and are willing to accept higher risks.

The impetus to use renewable energy technologies comes from competition, deregulation, privatization, demand growth, and environmental concerns.

Corporations are increasingly using venture firms to help them identify emerging business opportunities and to evaluate the firms and technologies with less risk than with 100% equity. (This is sometimes called corporate venturing.) Corporate use of venture funding has challenges, however. For example, there are potential conflicts between venture capitalist and corporate objectives. The venture firms seek to maximize return on investment, while the corporate investor may rank strategic objectives above return on investment. Venture investments require a long-term horizon (five to ten years), and corporations must commit personnel and not simply funds to get full value from their investments.

An interesting use of corporate venturing by the Edison Electric Institute is the EnviroTech Investment Fund, which focuses on electric, renewable, and energy-efficient technologies. It seeks to invest in technologies that reduce greenhouse gases. It selects one of every 150 investments screened. One potential source of a project pipeline could be the "rejected" investments from funds such as this.

Other funds are active in this area. The Energy Transition Fund invests in energy efficiency and renewable energy projects. The MacArthur Foundation contributes to sustainable energy economy. The return potential was sufficient to draw from its asset base. It is attempting to convince other foundations to allocate funds for this purpose.

Corporations are effectively using the venture industry, and this is a growing trend. Venture capital firms are willing to focus a dedicated fund on investing in emerging technologies, evaluate a range of technologies in early stages, pick companies that have the potential to develop into significant competitors, and accelerate commercialization and deployment of the technologies.

Not all firms will do this, but there are a number that will. They may play a small but useful role in the overall effort.

Asia Alternative Energy Unit Program
Anil Cabraal, World Bank

The Asia Alternative Energy Unit (ASTAE) looks at ways of bundling projects to reduce transaction costs. The focus has been on opportunities in Malaysia, Indonesia, Thailand, and the Philippines. ASTAE was established as a pilot program as a result of the FINESSE program. Mobilizing resources and funds to do project preparation is becoming increasingly difficult.

The main objectives are to prepare alternative energy projects, assist in forming policies, and provide technical assistance and training. Other objectives include strengthening the institutional capacity and working with World Bank staff to design, finance, execute, and manage alternative energy projects. A report entitled "Opportunities for Renewable Energy in Asia: The Asia Alternative Energy Unit Experience" will be published and released in July 1995.

The ASTAE model is useful in determining how to integrate options into delivery services. Without GEF funds, many of these projects would not have occurred. Financial pressures have increased; therefore, there is a need to limit the number and scope of projects. It is crucial for institutions to be open to initiatives and to have the necessary resources to prepare projects quickly.

Key elements from the ASTAE model include strong bank management support for unit work, donor encouragement and financial assistance, and operational focus on project development and implementation.

International Finance Corporation Financing of Renewable Energy Projects
Gunter Schramm, International Finance Corporation

The International Finance Corporation (IFC) is the private sector component of the World Bank, with a current financing volume of 25% of the World Bank's volume. The IFC concentrates on countries and clientele of the World Bank, but it does not lend to public enterprise and is prohibited from accepting government guarantees. The maximum participation is 25% of the project cost. The size of a standard investment is from \$1 million to \$100 million. The IFC offers financing of products, resource mobilization, and advisory services.

The IFC plays a role in renewable energy, since a large number of activities are private, not public, and the private sector plays a significant role. The IFC is looking for renewable project investments. There are currently no project packages being considered, but hopefully by the end of the year wind power plants and others will be considered.

Renewable projects are smaller, and preparation time is higher; therefore, they are harder to sell and put on a sound financial basis. The IFC has a department that works with GEF to buy down preparatory costs and attract some GEF financing.

The pervasive lack of capital is a problem. The IFC has decided to investigate the possibility of putting together a Renewable and Energy Efficiency Investment Fund. Preparation is currently under way, and by the end of the year, the fund should exist (\$100 million-\$200 million). The fund will handle smaller projects than those the IFC normally deals with and will attempt to match its own funding with "soft" funding from other sources to buy down preparatory costs. The concept is to mobilize private sector funds for renewable projects, and the core of the project to be financed must be self-supporting and economically and financially sound.

Capital formation is difficult for renewable energy projects since they are smaller and require more time. Opportunities for the IFC in off-grid photovoltaic electrification include expanding manufacturing and assembly, photovoltaic equipment leasing, and distributor/dealer inventory financing.

Commentary

Judy Siegel, U.S. Export Council for Renewable Energy

Barriers to participation in renewables include the overall lack of awareness of technology, financing perceptions, policy (quotas, tariffs), and the lack of in-country institutions.

There is a recognition that renewable technologies are maturing--they have proven cost- competitive and more efficient. There is a stronger baseline of projects, and funds are increasing for renewables. There is a need, however, to find good, affordable mechanisms for providing credit in rural areas.

ASTAE

ASTAE is a successful, effective program. There is a need to increase the awareness of renewables within the World Bank. Focus is currently on the public sector, but emphasis is increasingly on public-private partnerships. *Weaknesses:* The long project development cycle hurts, since the bank is looking for shorter time frames. Focus has been in the Asian energy sector. There is a lack of bank policies. The success of ASTAE has not been replicated in other World Bank regional organizations. *Recommendations:* (1) Continue to make support for technologies known at the highest levels in the bank, and (2) mobilize other financing to support ASTAE.

IFC

The IFC's focus is on the private sector. It helps to reduce the risk to private investors, leverages funding from others, and is establishing the Renewable Energy and Efficiency Fund. *Weaknesses:* Typically, the average threshold of \$20 million is out of reach of many renewable energy projects, and there has been a lack of funds to develop projects. *Recommendations:* Continue to support IFC work and encourage the development and use of the renewables fund.

Venture Capital

The venture capital area is a new source of funds with focus on high-tech industries such as renewables. There is a longer-term participation for partnerships, and partners are willing to take on higher risks. *Weaknesses:* Partners seek higher returns (20% or more), and the focus has historically been domestic. *Recommendations:* (1) Recognize the need to better understand the venture capital

industry, perhaps through some educational exchanges, and (2) evaluate venture capital funds based on the company's needs, goals, and objectives.

Renewable Energy Project Support at the United Nations Development Programme
Richard Hosier, UNDP

The UNDP has been the primary source of funding for technical cooperation within the UN agencies. The UNDP exists to do the following:

- Strengthen international cooperation
- Help the UN become a unified force for sustainable human development
- Focus resources for maximum contribution

Priority areas include eliminating poverty, regenerating the environment, creating jobs, and improving the conditions under which women live and work.

The sustainable energy focus is on increasing the level of energy services delivered, not on energy supplied, consumed, or sold. The UNDP energy initiative will focus on energy efficiency (including planning for facilities not yet built, which will determine future requirements), renewable energy programs, and modifying the traditional model of technology transfer to ensure that new, more appropriate technologies are made more readily available.

The new Sustainable Energy Programme will work with developing countries to strengthen indigenous capacities in energy efficiency and renewable energy. It will help to create a supportive regulatory environment, encourage innovative demonstration projects to promote new technologies, formulate energy action programs, and work with other government and private sector agencies to encourage a broader range of financial alternatives.

The UNDP has adopted a focus on sustainable energy which includes analyzing energy needs and uses in terms of the level of energy services and which will translate into the use of renewables and enhanced energy efficiency. Attention will be given to coordinating initiatives, enabling countries to follow through on initiatives, building consensus around future plans, and supporting projects designed to increase the impact of initiatives. The UNDP's sixth programming cycle will be under way starting in 1996, and programs will be steered, as much as possible, into support for projects consistent with the sustainable energy approach. The UNDP is an invaluable collaborator in the sustainable energy arena.

UNIDO's Program for Promoting Solar Energy Applications
Anthony Bromley, UNIDO

UNIDO's primary concern is industrial development, but one aspect of the focus is on energy. It is considered a technical assistance delivery agency. The promotion of renewable technology is being accomplished by looking at R&D institutions that have been engaged in solar energy research since

the mid-1980s. There is a need to develop a mechanism for enlarging international cooperation and enhancing the effectiveness of solar energy research in developing countries and bringing researchers and donors together. Areas in which this improved coordination could have an impact include large-scale manufacturing and central production, and the creation of the International Centre for Application of Solar Energy (CASE) in Australia.

CASE is intended to be a single center in a developing country. It was established in February 1994 in Australia through a cooperative agreement with UNESCO.

UNIDO's Program for Promoting Solar Energy Applications (cont.)
Gordon Thompson, CASE

CASE is a joint initiative that has been operational for six months. Its charter is to promote renewable energy in developing countries. Analysis is done using the life cycle approach, which facilitates project formulation and the search for sustainable solutions. Objectives include promoting collaboration, assisting in the development and application of appropriate technologies, promoting the adoption of solar energy technologies, commercialization, technology transfer, and training. CASE works with partners in joint venture arrangements in establishing and creating sustainable solutions/projects.

World Solar Summit Process
Boris Berkovski, UNESCO

The World Solar Summit Process (WSSP) will address the following: favorable governmental policy toward renewable energy, governmental guarantees for the project, knowledge of the requirements of typical customers in the world, and knowledge of reliable and easily maintained technologies. This knowledge needs to be provided to the heads of governments.

UNESCO has an unfailing support for renewable energies. Renewable energies need to be promoted, and UNESCO is a vehicle to do this. There has been much support for the process from many countries. WSSP calls for different initiatives worldwide. The September 1996 World Summit in Zimbabwe will discuss strategic projects (six selected thus far) to be accomplished collaboratively by participating countries to design, manufacture, and commercialize solar energy technologies. Also there will be discussion of the World Plan of Action for high-priority renewable energy projects for the next ten years (1996-2005). Funding of these strategic projects and the World Plan of Action will be necessary.

A global education and training program is necessary. It is suggested that one strategic project be done in this area, as it is a prerequisite for success for any program. For that to be achieved, collaboration is necessary. One idea is to introduce the concept of using renewable energy in schools so that from the very beginning there will be an understanding of our ability to create a sustainable energy supply in the world.

Commentary

Mike Nicklas, International Solar Energy Society

The International Solar Energy Society (ISES) is trying to assemble worldwide initiatives and fill the gaps it sees in various programs. ISES will release materials during the Zimbabwe Congress.

Problem areas with respect to initiatives that have been discussed during this workshop include the following:

- The big picture is missing.
- We may be overselling solar industry.
- Expectations of what can be provided are high.

There is a need to look at root causes in developing countries, and the lack of jobs is the biggest problem. An attempt needs to be made to create an energy needs-based systems approach to the technologies.

World Wide Web connections are essential to communicate with the rest of the world.

There is plenty of project financing money available, but guarantees need to be made to make the loans safer. Do not worry about project funding, but build a mechanism to create credibility to groups. Finance and buy down the risk area. In high-inflation areas, go after bonds that are backed, as are other securities. There may be a need to come up with a "preliminary" form for "idea people" to submit project ideas that are designed to fill priority needs. For example, develop a basic form with the information required from the agencies that are interested, combine the input, and put it on the World Wide Web.

Much needs to be done in training and applied research. Most of the money is going to basic research, and there is a real need to encourage research into applied areas. Developing countries are being taken advantage of. New initiatives are needed to address business-related opportunities. There is a need for education and business practices training as they relate to renewables.

It is essential to have a coordinating body to link all agencies to avoid duplication. Work to combine initiatives and priorities, and develop common elements to push forward collectively. The World Solar Summit Process cannot happen unless everyone supports it. The only way to make changes to the process is to get involved with it.

Questions and Discussion

Comment. Berkovski: Top politicians will attend the Asian Solar Summit in January 1996, and countries will present projects. All are encouraged to contribute to the success of the summit. We must unite our forces to get renewables off the ground.

Q. Bevan: Mobilizing efforts is required in the field, with one example being ASTAE. A large effort is necessary to get projects going. Difficulties of competition seem to be unavoidable. How do we get a large number in the field in a short term?

A. Kozloff: There is no opposition to competition as long as it is fair. A thriving, competitive market is the ultimate goal.

A. Hoffman: One mechanism for minimizing some types of unfair competition is the GATT.

Q. Godfrey: There is a need to be more innovative in encouraging private financing. There are numerous programs that are not coordinated. Who is the agency's customer? What is going to be commercialized and where, and how do you maintain a competitive position?

A. Adamantiades: The World Bank and GEF insist on competitive procedures to ensure competitive procurement. There is a need to aggregate projects to justify the expenditure of resources. The client has to be properly identified, and it may be a financial intermediary.

A. Mak: Clients vary and will change continuously. The UN's clients are numerous; the UN changes as the environment changes. There is an interagency network to coordinate efforts, and each agency has its own role.

A. Hosier: The customer for the UNDP is government, in both transitional economies as well as developing economies. As long as government has the best interests of its people in mind, there are no discrepancies. Work has begun to coordinate with the World Bank and nongovernment organizations.

A. Devin: The Renewable Energies and Energy Development Group has published a document including recommendations in which countries commit to developing policy and begin to apply it.

Comment. Hoffman: Technologies need to get in the field. One innovative technique is the Golden Carrot Program to bring to market a more efficient refrigerator. A single company won \$30 million.

Panel 3: Regional Financing and Country Experiences

Moderator: Achilles Adamantiades, World Bank

This session focused on the approaches to renewable energy systems financing in various regions, including discussions of major financing mechanisms, technologies and activities being supported, processes being used, and the successes and shortcomings of these approaches. In particular, significant problems and potential solutions were presented.

World Bank Projects in Renewable Energy

Ernesto Terrado, World Bank

One ongoing renewable energy project at the World Bank is in India. Additional projects are in advanced stages in Asia and are being developed in Brazil (Biomass Gasification Project). Prior to 1990, the bank had one project in Brazil.

Investment criteria of the bank for renewable loans include the following:

- Whether specific criteria are met for the loan
- Whether the technology is mature
- Small-scale project management constraints
- Lack of enabling environment
- Lack of absorptive capacity

In the last three years, changes have occurred that have made more projects possible--in particular, the creation of the GEF and the birth of the Solar Initiative. There is now an opportunity to combine regular investment funds with grant money and bring near-commercial technologies into investment status.

IENPD is the lead department for the Solar Initiative, which is a bankwide initiative since work takes place with all bank departments. There is a need to network with external institutions to build knowledge and address the lack of project preparation resources. The Solar Initiative's objectives are the identification and preparation of project possibilities and conduct of assessment work and technical assistance as needed, since all countries are not yet ready for a project.

A private U.S. company started work in Mexico to look at large solar thermal power plants. Even if technology is more expensive, there are environmental reasons why it can be brought into the market. Because such projects have environmental benefits, there is the possibility of a GEF buydown of the capital cost of a plant. The bank is interfacing with both the government and the people doing the project preparation work.

Other examples of current work include Peru, where there is work in support of putting photovoltaics into a rural electrification project. In South Africa, a project for application of photovoltaics to rural electrification is being developed. In Brazil, there is work to put renewables into existing energy efficiency project lending. In Argentina, there is also the possibility of using renewables in a rural electrification project. Assessments are being conducted in China, Tunisia, Morocco, and Russia.

A prefeasibility study on the Mexico project was financed by Rockefeller and Bechtel. The role of the Solar Initiative is to ensure that the government, utility, and people doing the work are interfacing. There are numerous possibilities for this project, which is based on technology in commercial use in California. Initial results of the project indicate costs in the range of \$.069 kWh at 90% capacity. A pure combined cycle gas turbine is still cheaper, but with a \$50 million GEF grant, ISCCS could be cheaper. One critical step in the project is that the GEF contribution must be justified.

The project in Argentina is relatively new. It is rural electrification of dispersed communities using grid and off-grid systems being done by a private concession system. This is a subsidized project. The government wants the concession payment to be yearly, but the front-end subsidy is more acceptable than the yearly payment to some.

Conclusions: Constraints to lending still remain--dealing with small projects, affordability issues, subsidy issues, and the lack of bank resources for project identification and preparation. The bank needs to continue work on policy and reforms, make bank task managers more aware of renewable energy projects, and coordinate with other agencies.

Renewable Energy Project Implementation in Asia

Russell deLucia, deLucia and Associates

There are a lot of situation-specific, commercially viable renewable energy projects happening, but many more are not happening due to constraints. To overcome barriers, there are institutions that have pertinent roles and responsibilities to address, and there are synergies within the financial sector that can promote renewable energy market development. International development financing institutions (DFIs) have special roles and responsibilities.

The capital intensiveness of projects brings additional risks and requires greater information transfer between the sponsor and lenders. Commercial projects tend to share a set of characteristics. The focus is on smaller-scale projects. For example, in the United States, the state with the largest portion of renewable energy in its overall state energy balance is Maine, due to its biomass resource endowment and aggressive regulatory procedures. Internationally, there is an enabling environment in India that has changed in the last two years. In addition, states are beginning to enact regulatory changes that alter the commercial risk of investments.

International DFIs are not doing their job in sourcing and packing of resources, in part due to constraints. There is a need for existing players to be more aggressive. There is an issue of the learning curve and the capacity to deal with risks and the transfer of know-how.

There is an enormous range of capacity to deliver the supply of necessary debt and equity needed for projects. It varies from country to country, depending on regulations and institutions. Not all institutions have the same constraints as the World Bank does.

Governments have to redress policy biases. There is a need for more capital participation, and multilaterals and bilaterals need to be innovative and rely more heavily on underutilized modalities and instruments, such as cofinancing and guarantees. Look at the experience base of institutions: they can do more to solve problems and open up markets. Costs for innovative initiatives will be higher, but they are compatible with the focus. Entities should become more proactive with initiatives.

Renewable Energy Project Implementation in Latin America and the Caribbean

Luis Prado, International Fund for Renewable Energy and Energy Efficiency

Local governments and the private sector are willing to implement renewable energy projects. Do international financial organizations have a role to play? Renewables are spreading; do we want to participate or not?

It is easier to work on lending to the power sector for reform by providing leverage to the private sector rather than negotiating with federal agencies. The difficulty is that there is a trend toward negotiating with governments whose officials are resisting change.

It is more effective to work on renewables by expanding the scope of the proposal rather than focusing on renewables. All need to work together for the common good. This can be done by supporting private sector initiatives to local financial intermediaries and making capital accessible to private partners according to criteria designed for demonstration projects. Such steps can also expand the number of actors in the electric power sector to promote competition.

State governments and utilities are willing to go toward privatization. The difficulty is in designing a regulatory system for the electric power sector. They are open to the idea of using local financial intermediaries to lend to the private sector, thus expanding the scope to independent power production, cogeneration, and energy efficiency. However, it is difficult to move ahead in free-standing loans for solar energy or renewables.

Local firms have a significant portfolio of projects ready to go—energy efficiency projects with paybacks of one to two years. In many cases, they are looking for joint ventures.

Diesel-powered systems are unreliable and, thus, create a big market opportunity in Brazil. Maintenance is impossible. Current subsidies are being evaluated, and local utilities are considering the possibility of giving subconcession areas for independent power producers.

Renewables are being used in urban areas, and there is much potential there. Technical support has been given, and new buildings are being advertised as having solar heating systems. Where electric water heaters are used, the peak time can be alleviated by using solar heaters for water.

Africa Development Bank's Energy Lending
David Bloomgarden, U.S. Department of Commerce

There is currently no renewable energy portfolio in the African Development Bank, but the potential for developing one exists. Within the African Development Bank there is a resistance in borrowing countries and in bank staff because of lack of awareness of renewable technologies. This bank is the largest single source of finance on the African continent.

Lending commitments have been decreasing. It is anticipated that this declining trend will level off or will start to go up as new priorities are established.

This potential is due to a new bank energy policy established to overcome identified obstacles. It is the basis for doing valuable renewable work. It supports planning institutions in the energy sector, cost recovery through long-run marginal cost-based planning, and energy projects where the cost can be recovered. The policy supports training, for both bank personnel and country experts and managers. It also encourages evaluating environmental impacts, renewable energy awareness, global

energy (solar and wind), and information dissemination. Most energy lending is associated with agriculture projects in North Africa. This is in response to the largest interests in the bank; great potential exists in other areas.

Most of the energy lending portfolio is in electricity. Electricity is 12.2% of all projects financed by the bank. The African Energy Program is designed to carry out analysis of energy situations to define regional strategies. The final phase of this study is taking place. It has identified conservation and renewables and will be developing projects in these areas that will be funded when the African Development Fund is replenished.

Bank policy does not yet match performance, but the potential is there. GEF and the World Bank are clearing the way by setting precedents.

International Energy Agency Activities

John Tilley, International Energy Agency

The International Energy Agency (IEA) is a well-established mechanism for dialogue between OECD countries on energy policy and energy technology issues. The Technology Collaboration Program has over 40 projects under way including renewables. There are Technology Information Centers established that include information on renewable technologies. There are collaborative projects run by experts in OECD and non-OECD countries. The criterion for participation in these programs is that one must have something to contribute to a common pool. Participation is open to the private sector as well as academia, international organizations, etc. These projects could be a useful vehicle to link with Centers of Excellence.

The Committee on Energy Research and Technology focuses on technology and R&D policy. There are four technology committees reporting to this committee--the Renewable Energy Working Party is one of them. Work that is currently under way includes policy issues for a renewable energies report, lessons learned from case studies in the renewable technology area, environmental impacts of renewable energies, and implications of large-scale deployment of renewable energy technologies. This is done through pooling the experience of OECD countries. Opportunities for technology collaborations are being sought.

The Climate Technology Initiative is an OECD member country initiative intended to be the aggregation of practical projects in the technology area where activities meet the objectives of the Climate Convention. It is a forum for countries to work together on projects and is open to participation from all countries. It currently covers eight areas identified by OECD countries to set up practical projects, and countries are identifying additional areas.

International Energy Agency Activities (cont.)

Eric Lysen

One of the collaborative projects of the Climate Technology Initiative is Photovoltaic Solar. The PVPS mission is to enhance collaboration efforts through which photovoltaic solar energy becomes

an option for OECD and developing countries. Targets of the program include recommendations for improvement of PVPS, methods for evaluating and maximizing benefits, guidelines for interconnection to the grid, and assessing how others can make use of the network to offer services.

Assistance for developing countries includes support of donor and financing organizations to improve understanding of photovoltaic power, entering into dialogue, helping to organize seminars, accessing data centers, working on case studies with lessons learned, assisting in developing guidelines, and providing advice to international organizations.

Assistance is free, but it isn't cheap. The modalities of how to cooperate are being worked out.

Renewable Energy Project Implementation in Eastern Europe and the Former Soviet States **Steve Imrie, European Union**

The European Commission is the legislative arm of the European government. DG XVII represents energy programs. One of its programs, THERMIE, was complete as of 1994. Its new program, JOULE-THERMIE, will run from 1995 to 1998 to promote energy technology.

THERMIE was operational from 1990-94, with the focus on the demonstration of energy technologies and the promotion and dissemination of technologies. The trend is to move into marketing and technology dissemination. There are activities in all member states and developing countries. There are 14 European Energy Centers throughout 12 countries.

Activities in the financial field include producing investment appraisal guides (procedures for preparing a business plan), third-party financing, guides to sources of finance, case studies and success stories for financing, investment forums (facilitation between the investment community and project promoters to put together a deal), bankers' round tables (discussions with key groups on how to finance renewable energy projects), and general awareness raising (workshops, seminars). Work is being done on developing an action plan to ask each group what the barriers are to renewable projects and how to solve them.

In third world countries, barriers to finance include the lack of awareness of opportunities, limited sources of finance, lack of skills and training, no local financial infrastructure, and the impression that energy prices are low so there is no need for renewable energy.

Recent activities in third world countries include training workshops in accounting techniques, computer-based information packages, investment guides, studies and market plans, and assistance with approaching funding organizations.

THERMIE works in conjunction with other organizations (e.g., the World Bank, the United Nations, PHARE). The European Community is involved in six programs in energy and renewable energy financing in central and eastern Europe:

- PHARE--provides technical assistance for economic restructuring, financing studies, and technology transfer, and has a revolving fund for projects
- TACIS--a former Soviet Union technical assistance program
- EIB/EBRD--a low-cost loans program
- SYNERGY--a program for third world countries on institution building and energy policy advice
- SPRINT--an investment forum on third-party financing
- EUROTECH/SEED--provides development capital

JOULE-THERMIE focuses on research and development (JOULE) and demonstration and promotion (THERMIE). Priority lines for action are being devised, and past activities are being evaluated. The program will continue network building, develop closer links with European banks, and explore novel financing techniques.

Conclusions for third world countries include evaluating past activities, continuing the role of European Community Energy Centers, and further addressing the role of finance.

Renewable Energy Project Implementation in India

V. Bakthavatsalam, Indian Renewable Energy Development Agency

Dr. Bakthavatsalam presented a video entitled "Energy Forever," an informative corporate film about the Indian Renewable Energy Development Agency (IREDA) diverse activities. — The Editors

Much experience has been gained in India. The most important factor in any developmental program is the policy framework; the rest then becomes easy. In India there is a separate ministry, the Ministry of Nonconventional Energy Resources/Institution for Promotion, Finance, and Development, as part of IREDA, that is singularly dedicated to renewable energy development.

The development program is profitable. The recovery rate has been 95% for seven years of operation. Recommendations include having a consultation forum process, simplifying the mechanism of procedures, and auditing and sharing experiences periodically.

Scandinavian Program of Assistance in the Baltic Countries

Stefan Camitz

This program aims at trying to get the experience of joint implementation and trading of emission rights. It is financed by the Swedish government and currently has 40 practical projects, one-half of

which are completed. Of these, 80% are projects dealing with the conversion of district heating boiler houses with a payback time of three to five years. These are affordable projects with a positive cash flow.

A revolving fund has been established to finance more projects. The program has a partnership attitude; it works with plant owners and is active in the projects. This reduces the risks.

Workshop Summary

Moderator: Godfrey Bevan

Conclusions of the workshop on renewable energy project implementation and financing were given, including discussion of key remaining issues and recommendations for addressing those issues by the agencies represented at the workshop.

Summary: Key Conclusions, Issues, and Recommendations

Chris Sherring, Sherring Energy Associates

More meetings and detailed workshops of this nature are necessary. The view from the field is that there is not enough money when looking at the challenge. We need to work together: collaborate, collaborate, collaborate. There is a need to be efficient with our limited resources. The various programs described need to collaborate. There is a need to be flexible--each country is different, and each situation is different. Financing institutions need to recognize these differences; no standard form can be used to meet all needs. Technologies are also different. Therefore, finances ought to be targeted toward technologies that have the steepest learning curve.

Collaboration on objectives for given countries is necessary. It is not enough to have money available; the facilitators in the countries need to put together proposals. There is a shortage of expertise in putting together proposals. One suggestion is that a single window is needed to pull together financing bodies and resources for each country. The Centers of Excellence are essential for a target country to feel comfortable with a technology. The sooner the program is under way, the better. There is a need for an independent body to evaluate technologies. IEA has this capability. There are not enough experts with experience. Organize the collaboration one country at a time. The projects are small, and the sophistication of project developers is not great. The attitudes of countries are different; there is a need to remain flexible.

Summary: Key Conclusions, Issues, and Recommendations
Matthew Mendis, Alternative Energy Development

We have come a long way in renewable energy discussions. Renewable energy has a role in meeting the energy needs of developing countries. Demand and supply are not constraints; the problem is price. "Renewable energy is free, but it ain't cheap." To make renewable energy systems more affordable, use least-cost options and level the playing field for equal access to capital. To make renewable energy more affordable, increase research and development efforts and promote technology transfer and dissemination. Catalyze declines in costs through support for large-scale applications (create a huge market to bring the costs down), develop and apply innovative financing mechanisms, and reimburse for incremental costs of environmental benefits.

Investments make it happen. To attract investments, provide sufficient returns on investments and minimize the risk; projects must have a bankable revenue stream to get the financing. Such investments work in a stable environment where private investors can be involved and there can be recognition of social and environmental benefits.

Key Issues Remaining:

Private sector - How can private sector investment in renewable energy systems be encouraged?

Transportation - How can renewable energy play a role in this field?

Global environment - Other than GEF, what sources of support can be used?

Shortage of capital - How can financial institutions tilt the balance in favor of renewable energy investments?

Scarcity of preinvestment funds - How can duplication be minimized and collaboration of agencies enhanced?

Nonfinancial barriers - What can be done to eliminate the biases in developing countries?

Recommendations:

1. Financial institutions need to take a greater leadership role in supporting financing and deployment of renewable energies.
2. Developing countries need to be empowered to lead the demand for renewable energy systems.
3. The private sector needs to be held more accountable for the social and environmental consequences of its investment actions.
4. Opportunities within the context of UNFCCC should be promoted.
5. IPPs should be held accountable for the greenhouse gases they are producing.

Questions and Discussion

Q. Hoffman: How difficult has it been to get the financial community to an investment forum?

A. Imrie: It has been difficult. They are not prepared to come unless they see a good opportunity. There is an attempt to get the investment community involved at the start of the process and to be proactive in selecting projects.

Comment. Jackson: From the venture capital perspective, if good management for projects is missing, then money will not help. The venture capitalist looks at the management team, the market potential, and then at the technology. The place to begin is with the management capacity; success lies there. Venture capitalists see the market potential for renewable technologies.

Comment. deLucia: We must distinguish between financing a venture and financing an investment project. The conventional financial community is not prepared to deliver debt that is long enough or has enough coverage. There is a need to bring additional debt to get longer positions and get additional equity. Good people with good track records can do the projects.

Comment. Bevan: A large number of bodies have decided that large sums of money are available. There is a need to work to make it more readily available. The crucial task is to spend the money.

Comment. Kozloff: There is a problem of holding the international power developers accountable for the decisions they make. There are many programs that provide assistance. How a power sector is restructured can have implications for incentives in choosing renewable versus nonrenewable technologies.

Next Steps and Concluding Remarks **Achilles Adamantiades, World Bank**

The next steps include defining the need for cooperation and defining better respective comparative advantages. Team with others; each person has a role to play. Further meetings and consultations to support and complement each other are necessary. Involve developing countries more actively in financing, project preparation, and research and development.

"Finance is never in short supply--vision is." There is a need to find a way to utilize the financing. Funds are available, but it must be determined how to use them for the right purposes. There is a need to do strategic studies for renewable energy and to harness all the resources to move forward. It is difficult to find money for project identification. Ways need to be found to utilize GEF windows.

We must commit to work together concerning Centers of Excellence, not to repeat what others have done, but to provide support to bring about what is needed. Concrete suggestions for the seeds of future Centers of Excellence are requested, as are names of individuals who could play a leading role in a guiding group for this effort.

Next Steps and Concluding Remarks

John Tilley, International Energy Agency

The IEA is willing and prepared to play a catalytic role in this process and is willing to become active as an equal partner. Better communication is needed, such as forums on a regular basis (every 9-12 months) to exchange ideas, progress, and lessons learned concerning the various activities, and a closed home page on the Internet to link groups for internal dialogue. The IEA is interested in playing a role in strengthening communication.

There is still a need to explore financing strategies. Discuss how to get over the hurdle of small project funding and limited borrowing capacity at the community level in developing countries. The IEA is interested in getting involved in this area.

Centers of Excellence will play a key role in capacity building and technology success, but there is a need to identify gaps. Implementing agreements will make a useful contribution.

Strategic projects are needed to demonstrate the capabilities of technologies, share experiences, and replicate projects. The IEA has mechanisms to help in this process.

There is a need for enhancing general awareness at the field level. All must work together to do this. The IEA currently has activities under way and is willing to collaborate.

Barriers need to be examined more closely. Barriers in field experiences match up with barriers identified in IEA's work on marketing technologies. Ensure these barriers are clearly identified, and work on solutions.

There is a need to involve developing countries more actively in projects. The IEA is interested in this area also.

Next Steps and Concluding Remarks

Allan R. Hoffman, U.S. Department of Energy

"Renewable energy is not a novelty; it is big business." It must be remembered that renewable energy is "different" and must be looked at in the context of local situations. All renewable energy is local.

We can be more creative and effective in creative financing than in technological development. Creative financing can help further the cause of renewable energy.

This meeting is a first step. Next steps include sharing workshop proceedings, learning to understand others' activities better, and learning how to use the resources available. Lending institutions are becoming aware of renewable energy, and we must take the initiative to inform and educate others. There is a need to teach young people in the world that they have more options open to them.

Concluding Remarks
Godfrey Bevan

From this point, we need to go back to our respective governments and try to extend programs into other countries. There is a need to provide authoritative information about renewable energy in a wide forum. Determine what else you can do and what you can do differently to coordinate activities better.

Appendix A

Workshop

Participants

Jasper Abramowski
International Energy Agency
2 rue Andre-Pascal
Paris, France 75775

Achilles Adamantiades
Principal Power Engineer
Industry and Energy Department
The World Bank
1818 H Street, NW
Washington, DC 20433

V. Bakthavatsalam, Managing Director
Indian Renewable Energy Dev. Agency
Core 4A, East Court
Habitat Centre Complex
1st Floor, Lodhi Road
New Delhi, India 110 003

Sam Baldwin
National Renewable Energy Laboratory
409 12th Street, SW
Suite 710
Washington, DC 20024-2125

Doug Barnes
Energy Planner
Industry and Energy Department
The World Bank
1818 H Street, NW
Washington, DC 20433

Joqehim Benemann
Flachgals Solartedhnik
Maehlen Gasse 7
50667 Koeln, Germany

Boris Berkovski
Director
Engineering and Technology Division
UNESCO
1 rue Miollis
75732 Paris Cedex 18

Eric Bevan
CONTEXTA
West Winds, Gaunts Common
BH21 4JN
Wimbome, England

Godfrey Bevan
Head of Energy Technology Branch
Department of Trade and Industry
1 Palace Street
Victoria London SW1E 5HE
United Kingdom

David Bloomgarden
International Trade Administration
Multilateral Development Bank Office
US Department of Commerce
14th and Constitution, NW
Washington, DC 20230

Eldon Boes
National Renewable Energy Laboratory
409 12th Street, SW
Suite 710
Washington, DC 20024-2125

Anthony Bromley
Technology Development Unit
UNIDO
P.O. Box 300
A-1400
Vienna, Austria

Adam Brown
IEA/REWP
Energy Technology Support Unit (ETSU)
B149, Hawell Lab
Didcot, Oxon OX11 0RA
United Kingdom

Anil Cabraal
Asia Alternative Energy Unit (ASTAE)
Asia Technical Department
The World Bank
1818 H Street, NW
Washington, DC 20433

Henri Cahen
IEA/REWP
Ministry of Economic Affairs/DGE
Bezuidenhoutseweg 6
P.O. Box 20101
2500 EC The Hague, The Netherlands

Stefan Camitz
IEA/REWP
Swedish Nat. Board for Industrial &
Technical Development
Liljeholmsvagen 32
117 87 Stockholm, Sweden

Melitta Carter
Consultant
Industry and Energy Department
The World Bank
1818 H Street, NW
Washington, DC 20433

William Chandler
Battelle-Pacific Northwest Laboratory
Advanced International Studies Unit
901 D Street, SW
Suite 900
Washington, DC 20024-2115

Russell deLucia
deLucia and Associates, Inc.
The Carriage House
5 Hastings Square
Cambridge, MA 02139

Carsten Denelles
IENDR
G5057
1818 H. Street, NW
Washington, DC 20437

Bernard Devin
ADEME
27 rue Louis Vicat
75015 Paris, France

Bosworth Dewey
OPIC
Environmental Enterprises Development
Initiative at OPIC
1100 New York Avenue
Washington, DC 20527

Allan Dolenko
Natural Resources Canada
580 Booth Street, Room 724
Ottawa, Ontario
K1A 0E4

Jane Ellis
International Energy Agency
2 rue Andre-Pascal
75775 Paris Cedex 16
Paris, France

Rachel English
Industry and Energy Department
The World Bank
1818 H Street, NW
Washington, DC 20433

Gerhard Faninger
IEA/REWP
Austrian Research Center Seibersdorf
c/o Universitat Klagenfurt
Stemckstrasse 15
9020 Klagenfurt, Austria

Charles Feinstein
Global Environment Coordination Div.
Environment Department
The World Bank
1818 H Street, NW
Washington, DC 20433

Marcello Garazzo
IEA/REWP
ENEA-CRE Casaccia
Via Anguillarese, 301
00060 S. Maria di Galeria
Rome, Italy

Bruce Godfrey
IEA/REWP
Energy Research & Development Corp.
15 Barry Drive
GPO Box 629
Canberra ACT 2601, Australia

Chandra Govindarajalu
ASTAE
The World Bank
1818 H Street, NW
Washington, DC 20433

Todd Harding
USAID
Bureau for Global Field Support
and Research
Room 508, FA-18
Washington, DC 20523-1810

Jessica Hamburger
Pacific Northwest Laboratories
901 D Street, SW
Suite 900
Washington, DC 20024-2115

Allan R. Hoffman
Office of Utility Technologies
Energy Efficiency and Renewable Energy
US Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Richard Hosier
Climate Change, Global Env. Facility
Bureau for Policy & Programme Support
UN Development Programme
1 United Nations Plaza
New York, NY 10017

Bill Howley
Winrock International
Renewable Energy and Environment
Program
1611 N. Kent St., Suite 600
Arlington, VA 22209

Steve Imrie
DGXVII, European Union
18 Avenue R Vandendriessche
Brussels, Belgium B-1150

Gayle P.W. Jackson
Gayle P.W. Jackson, Inc.
6445 Cecil Avenue
St. Louis, MO 63105

Allan Jalacic
US Department of Energy
EE-122, 5H-065 Forrestal Bldg.
1000 Independence Ave., SW
Washington, DC 20585

Karl G. Jechoutek
Division Chief
Industry and Energy Department
The World Bank
1818 H Street, NW
Washington, DC 20433

Kari Komulainen
Technology Development Centre
P.O. Box 69
FIN-00100 Helsinki
Helsinki, Finland

Keith Kozloff
Senior Associate
Climate, Energy and Pollution Program
World Resources Institute
1709 New York Avenue, NW
Washington, DC 20006

Andrew Krantz
US Department of Energy
EE-10
1000 Independence Ave., SW
Washington, DC 20585

Ken Locklin
Appropriate Technologies International
1828 L Street, NW
Suite 1000
Washington, DC 20036

Eric Lysen
NOVEM
P.O. Box 8242
Utrecht, The Netherlands 3503 RE

Matthew Mendis
President
Alternative Energy Development
P.O. Box 7698
Silver Spring, MD 20907

Klaus Mandrup
Danish Energy Agency
Landemaerket 11
1119 Copenhagen
Denmark, DK

Anke Meyer
Industry and Energy Department
The World Bank
1818 H Street, NW
Washington, DC 20433

Trond Moengen
IEA/REWP
Royal Norwegian Min. of Ind. & Energy
Ploensgate 8
P.O. Box 8148 Dep.
0033 Oslo 1, Norway

Marie Monsen
Department of Interior
OTIA-MS 4328
1849 C Street, NW
Washington, DC 20240

Ellen Morris
National Renewable Energy Laboratory
409 12th Street, SW
Suite 710
Washington, DC 20024

Isabel Moya
VANTEG
7500 Woodland Ave.
Apt. 1019, J-19
Bethesda, MD 20814

Kui-Nang Mak
Chief
Energy Planning & Management Branch
United Nations
DC-10872
New York, NY 10017

Mike Nicklas
Innovative Design, Inc.
850 West Morgan Street
Raleigh, NC 27603

Francis Nyirjesy
International Finance Corporation
1850 I Street, NW
Washington, DC 20433

Luis Prado
IFREE
777 N. Capital Street, NE
Suite 805
Washington, DC 20002

Mary Preville
IEA/REWP
Office of Energy R&D
Natural Resources Canada
580 Booth Street
Ottawa, Ontario K1A 0E4, Canada

Marshall Reed
US Department of Energy
EE-122, 5H-065 Forrestal Bldg.
1000 Independence Ave., SW
Washington, DC 20585

Jaqueline Rose
US Department of Energy
EE-542
1000 Independence Ave., SW
Washington, D.C. 20585

Arun Pi Sanghvi
IBUD
700 18th Street, NW
Room 9353
Washington, DC 20433

Gunter Schramm
International Finance Corporation
1850 I Street, NW
Washington, DC 20433

Gerhard Schriber
IEA/REWP
Head of Energy Section
Swiss Federal Office of Energy
Belpstrasse 36, Switzerland

Paul Schwengels
Environmental Protection Agency
Program Analyst
M3220, WSM
Mail Drop 2122
Washington, DC 20585

Chris Sherring
Sherring Energy Associates
1 Trumball Ct.
Princeton, NJ 08540

Walter Shearer
United Nations
DC-10872
New York, NY 10017

Judy Siegel
President
US Export Council for Renewable Energy
4th Floor
122 C Street, NW
Washington, DC 20001

Jas Singh
ASTAE (D1060)
Asia Technical Dept.
The World Bank
1818 H Street, NW
Washington, DC 20433

R. Spencer
IEA/REWP
Energy Technology Support Unit
B149, Hawell Lab
Didcot, Oxon OX11 0RA
United Kingdom

Richard Stem
Director
Industry and Energy Department
The World Bank
1818 H Street, NW
Washington, DC 20433

Debbie Stone
International Program Director
National Hydro Power Association
122 C Street, NW
Washington, DC 20001

Glenn Strahs
US Department of Energy
1000 Independence Ave., SW
Room 5H047
EE121
Washington, DC 20585

Ernesto Terrado
Principal Energy Planner
Industry and Energy Department
The World Bank
1818 H Street, NW
Washington, DC 20433

Rea Tassiou
CRES
KM Marathon Ave.
19009 Piuerni
Piuerni-Attics, Greece

Gordon Thompson
CASE
Level 3, 81 St. Georges Terrace
Perth, Western Australia
Australia 6000

John W. Tilley
International Energy Agency
2 rue Andre-Pascal
Paris, France 75775
Paris Cedex 16

Rudiger Urban
IEA/REWP
BEO, KFA Julich
Stetternicher Forst
Postfach 1913
52428 Zulich, Germany

Peter Varadi
European Commission
4620 N. Park Ave.
Suite 1606W
Chevy Chase, MD 20815

P.J.D. Versteegh
Netherlands Agency for Energy and the
Environment (NOVEM)
Swentiboldstraat 21
P.O. Box 17
6130 AA Sittard, The Netherlands

Roberto Vigotti
IEA/REWP
Research & Development Dept.
ENEL
Via G.B. Martini 3
00198 Rome, Italy

John Vos
UNDP
1 UN Plaza
New York, NY 10017

Robb Walt
Community Power Corp.

Carl Weinberg
42 Green Oaks Ct.
Walnut Creek, CA 94596

Jerome Weingart
Consultant
1600 Wilson Boulevard
Arlington, VA 22203

Ron White
National Renewable Energy Laboratory
1617 Cole Blvd.
Golden, CO 80401

Michael Wilingham
UN DDSMS Energy Branch
1 UN Plaza
Room DC1-876
New York, NY 10017

Richard Wynn
UNESCO
1 rue Miollis
75732 Paris Cedex 18

Appendix B

Presentation

Materials

Renewable Technologies in Household Applications

**Doug Barnes
World Bank**

Household Markets for Renewable Energy

Douglas Barnes and Robert van der Plas
Industry and Energy Department, World Bank

May 15, 1995

Household Markets for Renewable Energy

- Defining the Problem
- Eliminating the Myths
- Working Towards Solutions

Defining the Problem

- **Two billion people without electricity services**
- **Consumers/Households do not even know what services are available (no access to service)**
- **Suppliers often focus on government projects and not programs for consumers**
- **Result: supply does not meet household demand, and is oriented to government demand**

Eliminating the Myths

- * Myth 1: “The market is 2 billion people without energy services”--Psuedo-market studies**
- * Myth 2: “People in rural areas cannot pay for energy services”--some can and some can’t**
- * Myth 3: “People in rural areas are happy with existing energy services”--many would like alternatives!**
- * Myth 4: “Household renewable energy systems are cheaper than conventional ways and means”--Yes, but they are not cheap.**

Working Towards Solutions: Renewable Egy Suppliers/Retailers

- **Focus on household consumers and not government subsidized programs**
- **Better define target groups and retailing strategies through real market studies**
- **More interactions between system designers and consumers**
- **Organize to assure quality standards and consumer satisfaction**
- **More retailer/ consumer credit**
- **Better after sales service and support**

Working Towards Solutions: Role of Government

- ◆ **Get out of purchasing and distributing household systems through projects**
- ◆ **Technical assistance--very important, should encourage market development**
- ◆ **Liberalization of trade--make playing field level**
- ◆ **Insure quality control--establish testing labs, etc.**
- ◆ **Do not establish uniform pricing--discourages distribution**
- ◆ **Encourage diversity and competition in industry**
- ◆ **Address issue of credit availability for systems (Investments and Loans)**

Rural Energy Policy

--	--	--	--	--	--	--	--	--	--	--	--

✓ **Make more choices available**

✓ **Provide Credit Mechanisms**

Rural Energy Issues

Demand for energy services in rural areas:

	Poor	Middle	Rich
✕ Cooking/heating	gathered wood agres	gathered wood	purchased wood kerosene
✕ Water supply	human power	human/animal power	possibly a pumpset
✕ Lighting	wood, candles	candles, drycells kerosene	kerosene, dry/wet cells possible generator
✕ Information	drycells	drycells	dry/wetcells possibly generator

Cooking

Improved biomass stoves

- when people *purchase* their fuel
- or when fuel is obviously scarce
- costs typically less than \$25, payback time about one month
- installer credit seen in some countries
- ESMAP has experience with manufacturer credit

Improved kerosene, LPG stoves

- higher equipment costs, particularly LPG
- need to buy a month's supply upfront (LPG) vs daily for woodfuels/kerosene
- retailer credit seen in some countries (for LPG bottles)

Solar Cookers

- level of service lower than with conventional stoves
- one needs to adjust daily routines in order to use solar cooker

Lighting

- More than 2 billion people have no electricity.
- They are likely to use candles, kerosene wick lamp, for a few hours daily, and flashlights (1 bulb of 60W = 20 kerosene lamps).
- People use very little energy for lighting, but pay a high price indeed (@ more than \$50/kWh).
- Equipment available now is for the richest percentiles only. The poorest are left in the dark.
- Solar lanterns, the “solution” for rural poor, are in general, not a good option.

Figure 1: AFRICA LIGHTING DISTRIBUTION

- Different equipment, plus retail financing should be made available, end-users should select the appropriate solution.

Water Supply

Collecting

- usually children, women's chores, from surface water/wells
- using buckets, jerrycans
- no great potential for improvements, other than improving drinking quality

Pumping

- usually community oriented
- pumpsets are often diesel, although wind/PV maybe more economic
- individual pumps are not for many households; PV maybe a good option

For household applications energy requirements are small.

For communal applications, water service companies might be a possibility.

Information Services

- **A radio is in almost every household (drycell operated).**
- **TV's are in high demand, and in many villages there is a community tv, or run by a private operator (film house).**
- **Solar TVs are not really promoted.**
- **Solar battery chargers are not available, nor are rechargeable batteries (alkalines).**
- **More choices should be available, retailer credit will help, need to do proper market studies.**
- **ESMAP is currently working on this (Cameroon, Comoros, Kenya, Uganda)**

**Renewable Technologies
in
Village Applications**

Jerome Weingart
J. Weingart Associates

Jerome Weingart
Jerome Weingart and Associates
1600 Wilson Blvd., Suite 500
Arlington, VA 22209 (USA)
703-524-8372 (phone/fax)
703-358-9663 (voice mail)
Internet: jweingart@mcimail.com

Renewable Energy Technology for Off-Grid Community Electrification

Jerome Weingart, Consultant
Village Power Initiative
National Renewable Energy Laboratory

Village Power is ..

- Reliable supply of high-quality electricity services that can support social and economic development
- At costs comensurate with community willingness and ability to pay
- In a manner that is widely replicable, transferrable, and sustainable.

NREL Village Power Initiative

Current Activities

- **Technology Development**
 - Wind-electric ice-making systems
 - Battery charging stations
 - Hybrid power systems test and development
- **Pilot Projects (ca. 10 countries)**
- **Communications (workshops, Internet resources, village power project data base)**

NREL Village Power Initiative

Software Models

- **Economic analysis (collaboration with World Bank/ASTAE initiative)**
- **Cost and financial analysis**
- **Village power system cost and performance optimization**

Strategic Challenges for Village Power

- > 2 billion people lack reliable access to electricity
- Rural electric power is central to social and economic development
- Widespread fossil-based RE will add significantly to global CO2 emissions; global environmental concerns (GEF) mandate low-carbon development paths
- Renewable energy supplies with high-efficiency end uses are required as diesel alternatives

The operational challenge for village power

Making *small is beautiful* big enough to count!

Technology is ...

- * The full capacity to provide a service in a specifiable, sustainable, and replicable manner
- * It is *not* hardware

The technology for sustainable off-grid village power supply

- Field-proven commercial equipment
- Local competitive commercial infrastructure for supply, installation, operation, and service
- *In-country policies that support commercial markets and environmental sustainability*
- Financing mechanisms for developers, suppliers, intermediaries, and end users

Economic Productivity

- Ice making, refrigeration, and food processing
- Microenterprise: boat building, wood working, machine shops, stores, handicrafts
- Small-scale irrigation, cash crop gardens
- Small-scale construction, civil works, village infrastructure

Community Needs/Services

- Potable water supply (pumping, storage, distribution, disinfection)
- Health clinics
- Schools
- Churches, mosques, and community centers
- Entertainment (cassettes, TV)
- Public lighting
- Telecommunications

Household Electric Energy Needs

- Lighting (including security)
- Entertainment, information, and education (cassette players, TV)
- Water pumping (sometimes)

Renewable Energy Equipment for Village Power

- * Independent small wind-electric, solar-electric, and biomass power units
- * Wind, PV, and wind/PV diesel hybrids
- * Micro-hydro
- * Micro-geothermal

Configurations for Renewable Energy and Village Power

- Isolated PV home lighting systems
- Mix of isolated PV and wind units with a microenterprise and community services “park”, with hybrid power (24 hours)
- Community-wide microgrid; 24-hour AC power

Solar Home Lighting Systems

- Increasingly available in developing world
- Provide highly valued residential and community services (lighting and entertainment)
- 50Wp unit with battery, controller, and lights is US\$400 - 800; ca. 0.15 kWh/day (\$3.00/kWh)

Limitations of Small PV Units

- Reliability compromised (battery failures, cloudy weather)
- Low useful daily energy (0.15 kWh/day for 50W system)
- Very expensive electricity (\$1-3/kWh)
- Not suitable for productive loads and economic development

Hybrid Power System

Attributes of renewable energy-based hybrid power systems

- * Permit economic optimization of renewable energy component
- * Provide high-quality 24-hour AC power
- * Provide daytime power without degrading diesel performance
- * Can be the least-cost preferred alternative for off-grid village power (life-cycle basis)
- * Maximize diesel fuel and operational efficiency, and diesel genset life

IPC Hybrid Systems in Indonesia

Community	Population	Power System	Hybrid Unit
Tanglad and Julingan, Nusa Penida	2,000 (400 homes)	200 kWh/day	PV/wind/diesel
Bonto, Sumbawa	1,000 (200 homes)	100 kWh/day	PV/diesel

The Kerosene Equivalent

Basic Household Lighting

With Kerosene

2-3 Lanterns
80 Lumens
1 1/2-3/4 Liter/day
7-10 Cents/Day

With Electricity

3 Lights + Outlet
1600 Lumens
150 Whrs/day*
7-10 Cents/Day

20 X More Light for Same Cost

* Same Level as Solar Home System

Typical Household Use of Electricity

Lighting, Entertainment, Information, Education & Security

4 Lights + Outlet
TV (B&W)
Radio/Cassette
2300 Lumens
500 Whrs/day*
\$.25 /day or \$7.50/Month

5 Hrs = 100 Whrs/Day

4 Hrs = 40 WHrs/Day

12 Hrs = 60 WHrs/Day

4 Hrs = 100 WHrs/Day

2 Hrs = 30 WHrs/Day

6 Hrs = 170 WHrs/Day

Total: 500 WHrs/Day

Typical Payment for One kWhr of Energy Service (Medium Income Household in Pangkajene Islands, South Sulawesi)

No Electricity

- Kerosene for lighting
- Candles
- Batteries (Dry and Wet)
- 200 Watt-Hours/Day (equivalent)

Kerosene: .15 \$/Day = .75 Liter = 4 Lamps @ 1000 Lmhrr*

Other: .15 \$/Day (Battery for TV and radio)**

.30 \$/Day for 200 Whrs or \$1.50/kWhr

* Equal to 120 Whrs of electricity

** Equal to 80 Whrs of electricity

Energy Cost

(US Dollars)

Daily Monthly

Kerosene : .15 4.50

Other: .15 4.50

.30 9.00

Price Per kWhr: \$1.50

(Kerosene has 30% subsidy)

Solar Home System

- 12VDC Electricity 2-3 Lights
- Radio and Small B&W TV
- 2-4 Hours/Night
- 135 Watt-Hours/Day
- Cost per Connection: \$600

Energy Cost

Daily Monthly

Electricity: .33 10.00

Other: 0 0

.33 10.00

Price Per kWhr: \$2.50

SHS Produces 135 Watt-hours of Electricity Service Per Day and Costs \$10.00 Per Month
@135 Whrs/Day for 30 Days = 4 kWhrs/Month @ \$10.00/Month = \$2.50/kWhr

Present utility practises for RE

- Electricity priced far below cost; subsidies are typically 70 - 90%
- Small fraction of the community is served
- Diesels operate at low capacity and with poor efficiency
- Not sustainable, works only for the relatively rich

Logic Behind a New Model for Off-grid Rural Electricity Supply

- Measure payments in unelectrified communities (candles, kerosene, dry cells, auto batteries, and charging services) \$5-\$15/household-month
- Assume people will pay same or more for superior energy services (*not kWh*)
- Establish flexible prepayment mechanism for electricity purchase as commodity
- Recover (most to all) costs of service through revenues from prepayment mechanism

Market Aggregation as a Requirement for Sustainability

- Attracts private investment in electricity delivery on large scale
- Stimulates competition
- Justifies investment in local equipment production capability (importing oil is cheaper than importing renewable energy equipment)

Requirements for Sustainable use of Village Power Systems

- * Community participation
 - needs identification
 - financial (partial/full equity, full O&M costs)
 - social organization
- * Full cost recovery to owners/operators
 - Mix of community and external revenues (eg. government infrastructure investments)
 - Willingness and ability to pay

Requirements for Sustainable Use of Village Power Systems

- Local operation and maintenance facilities
- Local capacity for equipment manufacture, supply, installation, maintenance, and repair
- Assured fuel security
- Supply cost $\Leftrightarrow$ user's willingness and ability to pay

A New Commercial Model for Off-Grid Rural Electrification

- > Sell and price electricity as kerosene is sold (prepayment meters and "power cards")
- > Eliminate connection charges
- > Provide all households with hookups; option to buy as little or much as desired
- > System operator (utility, private company) gets full revenue, up front
- > Daytime power for productive uses

Typical PLN Community

(Eastern Islands)

20-30% Connections

New Model Community

100% Connections

Capital Costs:	\$163,000*
Number of Connections:	249
Cost per Connection:	\$654
Life Cycle Cost (20 yrs):	\$290,000
Life Cycle Revenue:	\$300,000
Loss Over Project Life:	0
Subsidy Required :	0*

* Fully commercialized, with local manufacture

Community of 249 Connections

New Model For Least-Cost & Sustainable Rural Electrification

PLN Model

- Barriers to connection (\$45)
- More connections mean more losses
- One tariff - far below market rate
- Only few (rich) get service
- Monthly bill
- Very high subsidy (80%)
- Low percentage of cost recovery
- Disincentive to increase coverage
- Few consumers, high consumption
- Diesel provides power
- Cost penalties for 24 hour power (Does not support productive use)

- ✓ High O&M Losses
- ✓ Very High Subsidy
- ✓ Few Connections

New Model

- No barriers to connection
- More connections mean less loss
- Value-based fees for service
- All households have access
- Purchase anytime, any amount
- Little or no subsidy (20-30%)
- High percentage of cost recovery
- Incentive to increase connections
- Many consumers, low consumption
- Renewable energy provides power
- No extra costs for 24 hour power (Supports productive use)

- ✓ No O&M losses
- ✓ Little or No Subsidy
- ✓ Many Connections

Innovative Financing Options for Private Sector Village Power

- * **Create micro-utility markets to attract foreign investment**
 - Private sector concessions for off-grid rural power delivery (eg. Argentina, 1995)
 - Private power contracts (eg. to government electric utilities) for off-grid power
 - Build/own/operate/transfer contracts with public sector entities
 - Networks of rural electric cooperatives

Challenges to the Development Community

- Provide cost- and risk-sharing with the private sector and government for path-finding projects for large-scale use of renewable energy-based village power
- Provide financing and policy guidance to support new private sector initiatives, especially *private power for off-grid RE*
- Support electrification and economic development goals rather than hardware

**Renewable Technologies
in
Grid Connected Applications**

Carl Weinberg
Carl Weinberg Associates

World Bank/ IEA Workshop

Renewable Technologies in Grid Connected Applications

Carl J. Weinberg

Washington D.C., May 15, 1995

Weinberg Associates
42 Green Oaks Court
Walnut Creek, CA 94596
Tel 510-932-2275

Emerging Utility Technologies

New emerging technologies represent tools for fundamental changes in the utility business.

**Economies of facility scale
Constructed Energy**

**Economies of product production
Manufactured Energy**

WEINBERG ASSOCIATES

Change in Attributes

- **Investment - Smaller \$: More Often**
- **Construction Time - Short
(less than 1 to 2 years)**
- **Innovation - Continuous**
- **Increased Flexibility and Options**

RENEWABLES CHARACTERISTICS

**COSTS HIGH CAPITAL
 LOW OPERATING
 "BUY THE FUEL UPFRONT"
 "BUY JOBS NOT FUEL"**

**COSTS OF CAPITAL
 MAJOR COMPONENT**

Cost of Service Equation for Tomorrow's Utility

Providing competitive service in the future will mean minimizing the cost of service, not just the busbar energy costs.

$$\text{\$} = (f + G, S, T, D)$$

RENEWABLES CHARACTERISTICS

Modularity Allows

Movement toward the customer

Value Increases with

Situations for Consideration of Distributed Systems

$\$G + \$T + \$D \ll \DU Centralized planning based on central generation (large load centers). Cost of central generation plus the cost of T&D is much less than the cost of distributed resources.

$\$G + \$T + \$D > \DU Distributed planning based on distributed resources (islands/villages). Cost of distributed resources is less than the cost of generation, transmission, and distribution.

$\$G + \$T + \$D \approx \DU A mix of resources depending on localized costs and conditions (niches). Cost of distributed resources is approximately equal to the cost of generation, transmission, and distribution.

RENEWABLES CHARACTERISTICS

**Grid Connected Renewables
Compete with Traditional Ways of
Providing Services**

**Need to know cost of G
locational costs of T&D**

**Most Utilities do not have this
information**

The Distribution Utility of Tomorrow?

Central Generation

Distributed Generation, Storage and Efficiency

WEINBERG ASSOCIATES

The Value of the Kerman Plant to PG&E (\$1995)

Value of Kerman
PV Plant (\$/kW-yr)

Source: H. Wenger 1994

WEINBERG ASSOCIATES

The Value of the Kerman Plant to PG&E (\$1995)

Source: H. Wenger 1994

WEINBERG ASSOCIATES

RENEWABLES CHARACTERISTICS

- Devise Financial Instruments that match Renewable Characteristics
- Consider Investing in Small Business to deliver Renewables locally
- Review Alternatives not with "Busbar " Costs but " Service to Customer " Costs
- Finance Energy Portfolios not Energy Projects

**World Bank Projects
In
Renewable Energy**

**Ernesto Terrado
World Bank**

The World Bank's

Solar Initiative

- Preparation and Finance of Commercial and Near-Commercial Applications
- Facilitating an International Program for Research, Development and Demonstration

Investment Constraints

- Financial and Economic Criteria for Loans
- Technological Maturity (Track Record)
- Project Management Constraints: Usually Numerous, Small-Scale Installations
- No Enabling Environment
- Lack of Absorptive Capacity in Client Countries
- Reluctance of Governments to Borrow for Renewables; Reliance on Grant Programs

SOLAR INITIATIVE

IENPD's Project Development Activities

Strategy and Objectives

- ◆ Identify Project Possibilities/Prepare
 - ◆ Determine Need for Broader Assessment Work or TA / Implement
-
- ◆ Work with Bank central and regional Depts, IFC, GEF, ASTAE, etc
 - ◆ Network with External Renewable Energy Institutions: NREL, etc
 - ◆ Link with ESMAP program

Current Work

Project Prospects

- ◆ Mexico: *Solar Thermal Power*
- ◆ Peru: *Renewables for RE*
- ◆ South Africa: *Renewables for RE*
- ◆ Brazil: *PV/Windfarms*
- ◆ Argentina: *Renewables for RE*
- Others: Comoros, Colombia*

Assessments

- ◆ China
- ◆ Tunisia
- ◆ Morocco
- ◆ Russia

Mexico

- ◆ Prefeasibility financed by Rockefeller, Bechtel, etc
- ◆ Solar Initiative provided review/interfaces:
 - Govt/Utility
 - World Bank/GEF
 - Spencer Mgt Asso.
- ◆ 135 MW Integrated Solar Combined Cycle System (ISCCS)

Initial Results of Study:

- ◆ 6.9 US cents/kWh at 90% cap. factor, 12% solar fraction; \$1300-1800/kW
- ◆ Pure Combined Cycle GT: cheaper by 1-1.7 cents
- ◆ With \$50 million GEF grant, ISCCS cheaper than pure Combined Cycle GT

Argentina

- ◆ Rural Electrification of Dispersed Communities (1.4 million)
- ◆ Grid and Off-grid; Conventional and Renewables
- ◆ Private Concession System- Open to Local and International Firms; Project managed by Govt (SEE)
- ◆ \$147 m from Tariff Fund; \$70 m from Provincial Govts; \$97 m from National Govt
- ◆ Govt wants to borrow the \$97 m from World Bank

Issues:

- ◆ Subsidy to poor rural dwellers
- ◆ “Incentives” to Concessionaires all at front end or gradually provided over project life ?

Conclusions:

- ◆ *Constraints to Bank lending remain:*
 - Small project size
 - Affordability issues: hard to design full-cost recovery; Bank views on subsidies
 - Need to continue work on policy and institutional reforms
 - Bank TMs need more awareness
- ◆ *Lack of Bank resources for project identification/preparation*
- ◆ *Need for closer coordination with other international agencies: too many things going on...*

**Renewable Energy Project
Implementation
In
Asia**

**Russell deLucia
deLucia and Associates**

FINANCING RENEWABLE ENERGY PROJECTS: ISSUES, OPTIONS AND INNOVATIONS

Russell J. deLucia, Ph.D.

I. BACKGROUND PERSPECTIVES PERTINENT TO THE PRESENTATION

- **SIGNIFICANT DEVELOPMENT POTENTIAL [COMMERCIAL CRITERIA]**
 - ALL RESOURCES, ALL SCALES [COUNTRY EXAMPLES]
 - INCREASED ATTENTION & STUDIES BUT LIMITED DEVELOPMENT
 - WIDESPREAD EXCEPTIONS: LARGE HYDRO & TRADITIONAL FUELS
- **MULTIPLE REASONS TO REALIZE POTENTIAL VIA PRIVATE OR COLLABORATIVE [PUBLIC-PRIVATE] INVESTMENT**
 - FINANCIAL CRITERIA AT NATIONAL AND UTILITY LEVEL
 - LOCAL CAPABILITY [TECHNICAL AND FINANCIAL] WHICH CAN BE DEVELOPED [COUNTRY SPECIFIC EXAMPLES]
- **SELECTED CHARACTERISTICS OF RENEWABLE ENERGY INVESTMENTS [RELATIVE TO EQUIVALENT OUTPUT CONVENTIONAL ENERGY ONES]**
 - CAPITAL INTENSIVE, WHICH MAY BRING ADDITIONAL RISK DIMENSIONS
 - HIGH PRE-INVESTMENT COSTS
 - POSSIBLE GREATER INFORMATION ASYMMETRIES BETWEEN SPONSOR AND LENDERS
 - POTENTIALLY BETTER MATCH BETWEEN OUTPUTS AND REQUIREMENTS OF POTENTIAL USER/SPONSORS
 - SPECIAL ISSUES REGARDING SMALL/HOUSEHOLD PROJECTS

**II. A FEW COMMENTS ON MANY OF THE REGION'S ENERGY SECTORS
[DIRECT/INDIRECT INFLUENCE ON R.E. MARKET PENETRATION]**

- **PUBLIC SECTOR OWNERSHIP DOMINATED BUT CHANGING:**
 - GREATER PRIVATE PRESENCE IN FUELS, MARKETS BECOMING MORE OPEN
 - GREATER VERTICAL [G/T/D] INTEGRATION IN "NETWORK" E.G. POWER, EVOLUTION THUS FAR MOSTLY IN GENERATION AND [SELECTED] T&D THROUGH WHEELING, TRADING/MARKETING [EMERGING]
 - "RULES OF THE GAME" IN EVOLUTION: LIKELY DIRECTIONS - MORE COMPETITIVE, HARMONIZATION OF TERMS AND INCENTIVES FOR LOCAL AND NON-LOCAL PLAYERS
- **SELECTED FEDERALIST STRUCTURE [E.G. CHINA & INDIA]**
 - IMPLICATIONS: BOTH OWNERSHIP AND REGULATION
- **POLICY & REGULATORY SHORTCOMINGS/BIASES**
 - DISTORTIONS/SUBSIDIES IN ENERGY AND RELATED TECHNOLOGY PRICING: ESPECIALLY IN POWER
 - TAXES AND DUTIES ON EQUIPMENT
 - IMPLICATIONS FOR REFORM & SPECIAL PROGRAMS/INCENTIVES
- **POLICY INITIATIVES & RELATED INCENTIVES & PROGRAMS FOR NEW AND RENEWABLE ENERGY [OR LACK THEREOF]**
 - SPECIAL PROGRAMS ARE EXCEPTION RATHER THAN RULE
 - THE VERY SPECIAL CASE OF INDIA: FEDERAL [DEPRECIATION, SPECIAL PROGRAMS, IREDA]
 - INDIAN STATE R.E. POWER REGULATIONS: TABLE 1

Table 1 - Indicative Status of Declared State Level Private Renewable Power Regulations

State	Resources Covered	SEB Purchases Rs./kwh	Banking months/% change	Wheeling % of Energy	3rd Party Selling
Andhra Pradesh	S.Hydro ⁴	2.25	allowed	10%	allowed
	Wind	2.25	8m (Aug-Mar)	2%	allowed
Gujarat	Wind	1.75	6 month	2%	not allowed
Karnataka	S.Hydro ⁴	n.s.	t.b.n.	2-10% ²	allowed
	Wind	1.25	-	2%	allowed
	Co-generation	1.75	6%	6%	allowed
Kerala	S.Hydro	t.b.n.	t.b.n.	12%	-
	Wind	std	6 mo.; 2%	2%	-
Madhya Pradesh	S.Hydro	2.25	-	2%	allowed
	Wind	2.25	n.y.f.	2%	allowed
	Co-generation	2.25	-	2%	allowed
Maharashtra	Co-generation	2.25 (>4MW)	-	-	-
		2.20 (<4MW)	-	-	-
Orissa (hydro)	S.Hydro	t.b.n.	t.b.n.	2-8% ³	allowed
Punjab	S.Hydro	2.25	not allowed	2%	allowed
	Co-generation	1.5	-	2%	allowed
Tamil Nadu	S.Hydro ⁴	t.b.n.	< 6 mo	15%	n.y.f.
	Wind	2.00	3 mo	2%	not allowed
	Co-generation	2.00	2%	15%	allowed
Uttar Pradesh	S.Hydro ⁴	1.75	<1 year, % t.b.n	2% ¹	allowed
	Wind	1.75	1 year	2% ¹	allowed
	Co-generation	*	1 year	12.5%	allowed (<5km)
Acronyms: t.b.n = to be negotiated mutually n.s. = not specified n.y.f = not yet formulated std = standard private power rate Notes: 1. 2.5% when 3rd party sales * = minimum of 2.25 or 16% ROE 2. depends on size: < 1MW 2%; 2-3MW 5%; >3MW 10% 3. depends on size: <3MW 2%; 3-15MW 8% 4. this state also has a royalty on water use, either fixed or t.b.n.					

Table Source: IFREE-dLA-IDS

3

III. COMMERCIAL AND DEVELOPMENTAL OBJECTIVES TO BE KEPT IN MIND

- **ADDITIONALITY IN INVESTMENT**
 - MORE RENEWABLE ENERGY DEVELOPMENT
 - MORE LOCAL AND INTERNATIONAL FINANCING
 - MORE PLAYERS/PARTICIPANTS, LOCAL AND INTERNATIONAL, IN ALL CATEGORIES OF ROLES
- **FINANCING SUPPLY AND INTERMEDIATION [FIGURE 1]**
 - MANY CATEGORIES: POTENTIAL DEBT, EQUITY AND QUASI-EQUITY
 - IN PRINCIPLE: MANY SOURCES - INDIVIDUALS, OTHER PLAYERS [TABLE 2] & SPECTRUM OF FIs
 - IN PRACTICE: FEWER SOURCES, FEWER FIs [MORE BELOW]
 - THE SPECIAL PROBLEM OF THE ABSENCE [RELATIVE] OF RURAL SOURCES AND FIs
 - THE SPECIAL ROLE OF DFIs: INTERNATIONAL, NATIONAL, STATE/LOCAL
- **ADDITIONAL PLAYERS AND ADDITIONAL ROLES FOR EXISTING PLAYERS [TABLE 2]**
 - LESSONS FROM MARKET PENETRATION ELSEWHERE: MORE PLAYERS AND DEVELOPMENT OF PLAYER'S ROLES
 - DIRECT AND INDIRECT ROLES: SOME OF WHICH FACILITATE FINANCING SUPPLY
- **ACHIEVING THE OBJECTIVES**
 - NEED TO MANAGE THE TECHNICAL AND COMMERCIAL RISKS
 - NEED TO TRANSFER THE EXPERIENCE FROM THE U.S. AND OTHER OECD COUNTRIES [MORE BELOW IN IV. & V.]

Figure 1
Schematic Flow of Financing and
Intermediation

Table 2: Participant/Players and Investment Roles

Principle/Direct Roles

- A. **Providers of Debt and/or Equity Financing**
 - Developer/Sponsor, Bank and non-Bank FIs, Passive Investors . . .
- B. **User/Buyer of Output**
 - Industrial/Commercial Entity, Utility . . .
- C. **Provider of Other Commitments to Support the Investment**
 - Government or other Guarantees . . .
- D. **Providers of Inputs During Construction**
 - Engineering Contractors/Erectors, Equipment Suppliers . . .
- E. **Provider of Key Inputs During Operation**
 - Fuel Supplier, O & M Contractor, Utility as Wheeling Provider . . .

Supporting Roles - Insurance Providers, Trustee for Reserve or other Accounts, Legal, others . . .

27

IV. OWNERSHIP & FINANCING PARADIGMS: CONVENTIONAL & INNOVATIVE

- **OWNERSHIP STRUCTURES: TWO MODELS OF DIRECT OWNERSHIP [FIGURE 2]**
 - U.S. "UNDIVIDED INTEREST" APPROACH
 - PROJECT ENTITY APPROACH
 - ORGANIZATIONAL/OWNERSHIP ISSUES: ALLOCATION OF RISKS, ALLOCATION OF BENEFITS, VARIOUS CONSIDERATIONS INCLUDING FUNCTIONAL RESPONSIBILITIES
 - OFTEN CO-DETERMINE WITH FINANCING STRUCTURE AND RISK MANAGEMENT
- **THREE BROAD CATEGORIES OF RISK AND EXAMPLES [TABLE 3]**
 - COMMERCIAL
 - POLITICAL/SOVEREIGN/COUNTRY
 - FORCE MAJEURE AND OTHER
- **COMMERCIAL RISKS, TRANSACTION COSTS, AND OWNERSHIP AND/OR FINANCING STRUCTURES: A HIERARCHY OF INVESTMENT TYPES [CATEGORIES FROM BOX 1]**
- **FINANCING STRUCTURES AND IMPLICATIONS**
 - CURRENT COMMERCIAL PRACTICE
 - NON- OR LIMITED RECOURSE PROJECT FINANCING
 - HYBRID STRUCTURES TO ACHIEVE ADDITIONALITY
 - INNOVATIVE/SPECIAL CATEGORY 1 - PERFORMANCE CONTRACT TYPE [BOO, BOOT ETC.]
 - INNOVATIVE/SPECIAL CATEGORY 2 - RURAL ENERGY SCHEMES

Figure 2: Alternative Ownership Structures
Direct Ownership
 (Indirect via Subsidiary Also Possible)

U.S. "Undivided Interest" Approach

Project Entity Approach

Legend: - - - - - Ownership or leasehold interest in physical asset
 — Ownership in equity

Source: Adapted from Kidder, Peabody & Co., 1979.

[Handwritten mark]

Table 3: Risk Categories and Examples [Selective]

- A. Commercial Risk**
 - A1. Development Phase**
 - Design Adequacy
 - Completion Delay
 - Cost Overrun
 -
 -
 - A2. Operations Phase**
 - Fuel Price and Supply Reliability
 - Equipment Performance and Reliability
 - Resource [Wind, Hydro, ..] Risk and Associated Output Shortfalls
 - Output Purchase - Demand and Price
 -
 -
- B. Political/Sovereign/Country Risk**
 - Availability of Foreign Exchange
 - Change in Enabling Regulations
 -
 -
- C. Force Majeure & Other Non-Political**
 - Earthquake
 -
 -

**Box 1 (excerpt): A Hierarchy of Investment Types with
Differing Transaction Cost, Financial Structuring
and Commercial Risk Implications**

- Type I:** The potential supplier and the potential user are the same entity in physical terms. This for example could be the case for industrial facilities that produce methane as an effluent treatment byproduct and then use some of this methane for power generation and some for process heat, all of it being is consumed "within the boundaries" of the industrial facility.
- Type II:** The potential supplier and the potential user (or users) are different entities (although perhaps members of the same group) but are contiguous in location or have some other special circumstances (such as ownership of a right-of-way) that allows the physical transport of electricity or heat between the supplier and user. For example, this might be the situation for a sugar mill (the potential supplier) and an adjacent industrial user.
- Type III:** The potential supplier and the user are not contiguous nor do they have other special circumstances allowing ease of transit so that to effect the sale they require either:
- a. the permission and or participation of third parties to allow construction of the transport conduit (e.g., power transmission line and/or pipeline for steam/hot water or for the methane); or
 - b. participation of the local utility to "wheel" the electricity from supplier to user.
- Type IV:** The potential buyer is the local utility.

Financing & Rural Energy Schemes

[Box 3 excerpts]

- Renewable E. often "least cost" on life cycle
 - both HH (PV) systems, &
 - "small" grids based on wind, hydro, ... hybrids
 - economic l.c. even with "system costs" more so with development multiplier & env. b.
 - & in l.c. depends
- Constraints: Why Not Happening
 - = high 1st costs / & in. capability of HH & communities
 - lack of supply entities / change agents
 - lack of financial intermediation
 - implicit (e.g. fuelwood), explicit (etc) subsidy of competing
- Nonetheless Models of Success (commercial & tech)
 - HH many, multiple models, & in key to reaching any but "wealthiest"; only recent attempts at "leasing"
 - "small grid", need integral of tech, inst & fin. innovation (e.g. Nepal micro hydro)
- A Few Integrating Comments
 - not clear whether in general can happen w/o development assistance at least at start/in part
 - Roles for Gov DFIs to do more, do better, do different

V. SELECTED CHARACTERISTICS [COMPARATIVE AND RELATIVE] OF THE REGION'S FINANCIAL SYSTEMS & RELATED MATTERS [EMPHASIZING THE ADDITIONALITY OBJECTIVES, DRAWING FROM SELECTED COUNTRY EXPERIENCE]

- **OVERALL CHARACTERISTICS**
 - **OFTEN [ESPECIALLY IN NON-OECD] DOMINATED BY PUBLIC SECTOR ENTITIES IN MANY SEGMENTS BUT PRIVATE PLAYERS IN ASCENDANCE**
 - **ENORMOUS RANGE: FROM VERY WELL DEVELOPED TO LIMITED**
 - **EVEN WHERE SOME MODESTLY WELL DEVELOPED SEGMENTS &/OR INSTITUTIONS [BANK & NON-BANK] SOMETIMES SOME SEGMENTS ARE NOT PRESENT [LEASING CO., PRIVATE INSURANCE/PENSION FUNDS, MERCHANT BANKS] AND/OR HAVE FEW PLAYERS**
 - **STILL VERY REGULATED/CONTROLLED (NOT JUST PRUDENTIAL REGULATION), BUT WHILE NOT FULLY CLOSED STILL FAR FROM OPEN TO NEW \$ OR PLAYER ENTRY [LOCAL OR FOREIGN]; TREND TOWARD GREATER OPENING**
 - **IMPLICATIONS OF DIFFERENTIAL ACCESS TO SERVICES AND ABSENT OR THIN MARKET OF SPECIALIZED SERVICE**
- **PROJECT AND RENEWABLE ENERGY PROJECT FINANCE EXPERIENCE**
 - **SOME CONSIDERABLE EXPERIENCE FROM [NON-HOUSING] TERM PROJECT FINANCING BY LOCAL FIs**
 - **IMPORTANT INTERNATIONAL DFI SPONSORED TWO-STEP LENDING EXPERIENCE**
 - **PRESENCE OF SOME [COUNTRY/SECTOR SPECIFIC] PRIVATE ORIENTED INTERNATIONAL DFI EQUITY AND DEBT PROJECT/TERM FINANCE**
 - **WITH FEW EXCEPTIONS [E.G. INDIA] LIMITED EXPERIENCE OF FI PLAYERS WITH RENEWABLES**
 - **PROJECT/LIMITED-RECOURSE FINANCE STRUCTURES AS PRACTICED BY OECD FIs HAVE YET TO DIFFUSE**
 - **OUTSIDE OF INDIA NOT AWARE ANY LOCAL EQUITY [BOURSE] MARKETS FOR FINANCING**
 - **U.S. AND OTHER INTERNATIONAL IPP PLAYERS BEGUN TO USE U.S. AND INTERNATIONAL CAPITAL MARKETS INCLUDING SOME INNOVATIVE STRUCTURES AND APPROACHES, THUS FAR FOCUS OF THESE PLAYERS IS LARGER AND CONVENTIONAL ENERGY PROJECTS**
 - **NEW SPECIALIZED FUNDS NOTED, BUT THEY TOO FOCUSING ON LARGER AND CONVENTIONAL ENERGY PROJECTS**

V. CONTINUATION OF SELECTED CHARACTERISTICS [COMPARATIVE AND RELATIVE] OF THE REGION'S FINANCIAL SYSTEMS

- **RURAL/SMALL-SCALE PROJECT FINANCE AND FINANCIAL INSTITUTIONS EXPERIENCE**
 - **IMPORTANCE OF ISSUE BEING RECOGNIZED, SOME INITIATIVES BUT STILL FEW**
 - **MUCH GREATER CHALLENGE [RELATIVE] WITH RESPECT TO "BUILDING ON EXISTING INSTITUTIONS" FOR FINANCIAL INTERMEDIATION**
 - **IMPLICATIONS OF SIZE OF FINANCING [FOR HOUSEHOLD PROJECTS]**
- **RESULTANT CURRENT SITUATION**
 - **LIMITED FINANCIAL OPTIONS EVEN FOR EXPERIENCED PLAYERS**
 - **UNTAPPED LOCAL CAPITAL SUPPLY**
 - **HIGH TRANSACTION & RELATED COSTS**
 - **UNDEVELOPED MARKET PENETRATION FOR PROJECTS & TECHNOLOGIES WITH GOOD TECHNICAL & FINANCIAL VIABILITY (NARROWLY DEFINED WITHOUT CONSTRAINTS AND TRANSACTION COSTS)**

VI. FINANCING OPTIONS - SOME INTEGRATING COMMENTS: ORGANIZATION, SOURCES AND RELATED

- **OWNERSHIP AND OTHER "DEAL" CHARACTERISTICS AFFECTING FINANCING POSSIBILITIES [SEE ALSO IV.]**
 - **RESOURCE OWNER FACES DIFFERENT AND SOMETIMES GREATER RISKS**
 - **PROJECT OWNERSHIP: PUBLIC, PRIVATE, MIXED**
 - **LOCAL VERSUS OFFSHORE**
 - **STATE/REGIONAL LOCATION**
 - **WHO IN THE DEAL: EQUIPMENT SUPPLIER, ENERGY SELLER, ENERGY BUYER(S), OTHERS**
 - **HOW THE DEAL IS STRUCTURED**
- **WHAT MENU OF OPTIONS: THE SPECTRUM FROM: "PURE VANILLA", TO "VANILLA/CHOCOLATE/STRAWBERRY" TO "57 FLAVORS"**
 - **THE MORE GENERAL CASE OF LIMITED OPTIONS**
 - **TRANSACTION AND RELATED COSTS OF ONE-OF-KIND MAY BE PROHIBITIVE**
- **INDIA AS A REGIONAL EXAMPLE WITH MORE EXTENSIVE AND GROWING MENU OF OPTIONS AND EMERGING INNOVATIONS**
 - **ESCOs AND OTHER PERFORMANCE CONTRACT STRUCTURES**
 - **USE OF LEASING**
 - **EMERGENCE OF JOINT SECTOR STRUCTURES**
 - **GROWING USE OF CAPITAL MARKET**

VI. CONTINUATION OF FINANCING OPTIONS - SOME INTEGRATING COMMENTS

- LOOKING AT INDIA AS EXAMPLE OF A MORE EXTENSIVE MENU, SOME OBSERVATIONS ARE:
 - SELECTED SUPPORT FOR PRE-INVESTMENT: SPECIAL SOURCES GRANTS/SUBSIDIES [NATIONAL AND STATE, SOME CHANNELLING OF INTERNATIONAL FUNDS]
 - TERM PROJECT DEBT FINANCING WIDELY AVAILABLE [SOME CHANNELLING OF INTERNATIONAL FUNDS] WITH SOURCES SUCH AS:
 - FEDERAL LOAN PROGRAMS
 - STATE ENTITY [MECHANISM FOR IREDA, AND/OR STATE]
 - NATIONAL DFIs [TERM/PROJECT]
 - STATE DFIs [ALSO EQUITY]
 - COMMERCIAL BANKS [SHORT TERM]
 - LOCAL SUPPLIER'S [EQUIPMENT] CREDITS [EMERGING]
 - INTERNATIONAL SUPPLIER'S CREDITS [BUT OFTEN NOT PERTINENT]
 - LOCAL LEASE FINANCE [SOME CHANNELLING OF INTERNATIONAL FUNDS]
 - INFRASTRUCTURE SPECIALIZED GROUPS [EMERGING]
 - OTHER MARKET SOURCES [EMERGENT DEBT INSTRUMENTS]
 - LOCAL EQUITY SOURCES [REFERENCE TO V.]
 - SPONSORS: ENERGY SELLER, ENERGY BUYER(S), OTHERS
 - PRIVATE PLACEMENT
 - PUBLIC [IPO] MARKETS
 - FOCUSING ON DIRECT EXTERNAL SOURCES [INDIRECT IMPLICIT IN ABOVE], DEBT AND/OR EQUITY
 - INTERNATIONAL AGENCIES [E.G. ADB, IBRD, IFC]
 - SPECIALIZED INVESTMENT FUNDS [EMERGING]
 - "RIO DRIVEN" [EMERGING GEF/BILATERAL, JOINT IMPLEMENTATION]
 - EXPORT CREDITS

VII. ACHIEVING THE ADDITIONALITIES: SUGGESTIONS FOR GOVERNMENTS, INTERNATIONAL DFIs AND DEVELOPMENT AGENCIES

- **TO FOSTER SUCH COMMERCIALLY VIABLE INVESTMENTS & GREATER LOCAL PRIVATE PARTICIPATION: DO MORE, DO IT MORE INNOVATIVELY**
 - **FOCUS ON SYNERGIES WITH CAPITAL MARKET DEVELOPMENT**
- **GOVERNMENTS MUST REDRESS THE POLICY BIASES**
 - **PRICING, SUBSIDIES AND DUTIES/TAXES**
 - **APPROPRIATE PRIVATE POWER REGULATIONS & INCENTIVES**
 - **REMOVE/RELAX BARRIERS & REGULATORY COSTS**
- **GOVERNMENTS, BILATERALS AND MULTILATERALS SHOULD SUPPORT TA & INSTITUTIONAL BUILDING:**
 - **FINANCIAL ENGINEERING AND RISK MANAGEMENT**
 - **BUILDING THE CAPACITY OF LOCAL FINANCIAL INTERMEDIARIES**
 - **BUYING DOWN INITIAL TRANSACTION COSTS**
- **FOR INCREASES IN CAPITAL PARTICIPATION, BILATERAL AND MULTILATERAL ENTITIES DOING MORE:**
 - **CONTINUE AND INCREASE LINE-OF-CREDIT INITIATIVES**
 - **IMPLEMENT VIA COLLABORATION WITH LOCAL FIs**
- **BILATERALS AND MULTILATERALS DOING BETTER AND INNOVATING, A MULTI-DIMENSIONAL PERSPECTIVE:**
 - **INITIATIVES MUST TARGET INCREASES IN NEEDED FINANCING SUPPORT - DEBT, EQUITY AND QUASI-EQUITY & IMPROVE TERMS AND CONDITIONS**
 - **INITIATIVES MUST UTILIZE ENTITY'S COMPLETE MENU OF FINANCING INSTRUMENTS AND MODALITIES**
 - **INITIATIVES SHOULD BUILD ON ENTITY EXPERIENCE ESPECIALLY NON-ENERGY OPERATIONS & OPERATIONS UTILIZING LOCAL INTERMEDIARIES**
 - **PARTICULAR ATTENTION TO INITIATIVES WHICH COMBINE INSTRUMENTS & MODALITIES TO ACHIEVE THE ADDITIONALITIES**
- **BILATERALS AND MULTILATERALS DOING BETTER AND INNOVATING FOCUSING ON DEBT [& PERHAPS AS COMPLEMENT TO DOING MORE (ABOVE)]:**
 - **GREATER USE OF UNDER-UTILIZED MODALITIES & INSTRUMENTS (E.G. COFINANCING & GUARANTEES)**
 - **TO ACHIEVE THE ADDITIONALITIES IN LONGER TERM DEBT - "TAKE-OUT" REFINANCING WINDOWS**

- BILATERALS AND MULTILATERALS DOING BETTER AND INNOVATING, FOCUSING ON EQUITY AND QUASI-EQUITY [& PERHAPS AS COMPLEMENT TO DOING MORE, AND INNOVATING ON DEBT]:
 - SYNERGIES WITH LOCAL AND INTERNATIONAL CAPITAL MARKET INNOVATION, SUCH AS:
 - CREATION & IMPLEMENTATION OF SPECIALIZED INVESTMENT FUNDS
 - CREATION & IMPLEMENTATION OF PRIVATE PLACEMENT MARKET FOR EQUITY [OR QUASI-EQUITY]
 - DEVELOPMENT/ASSISTANCE OF LEASING INSTRUMENTS AND MECHANISMS FOR EQUIPMENT COMPONENTS [INCLUDING SMALL SCALE PROJECT EQUIPMENT]
 - DEVELOPMENT/ASSISTANCE TARGETING BOTH PLAYERS AND MARKETS FOR DEBT OR EQUITY INSTRUMENTS IN PROJECTS/INVESTMENTS AND/OR FIRMS [WHOSE ASSETS ARE LARGELY IN SUCH INVESTMENTS]
- BILATERALS AND MULTILATERALS DOING BETTER AND INNOVATING, A FEW CLOSING SUGGESTIONS WARRANTING MENTION:
 - CREATION OR STRENGTHENING OF PERFORMANCE CONTRACT ESCOs [TO OVERCOME SPECIFIC RISK & FINANCING CONSTRAINTS]
 - INITIATIVES TO FOSTER RURAL MICRO UTILITIES, ESCOs OR OTHER ENTITIES UTILIZING RENEWABLE ENERGY TO DELIVER RURAL ENERGY SERVICES
- SOME CLOSING PERSPECTIVES FOR THE BILATERAL AND MULTILATERAL ENTITIES
 - YES, TRANSACTION AND OTHER COSTS FOR SUCH INNOVATIVE INITIATIVES WILL BE HIGHER, BUT
 - SUCH INITIATIVES ARE COMPATIBLE WITH ENTITIES' INCREASINGLY PRIVATE-SECTOR FOCUS
 - SUCH INITIATIVES STRONGLY COMPATIBLE WITH OTHER ENVIRONMENTAL AND DEVELOPMENT OBJECTIVES
 - ENTITIES HAVE PERTINENT EXPERIENCE AND EXPERTISE [MUCH IN NON-ENERGY OPERATIONS]
 - HENCE THE ENTITIES SHOULD BE PROACTIVE WITH SUCH INITIATIVES: THE PEOPLE, THE ECONOMIES AND ENVIRONMENT OF ASIA AND BEYOND WILL BENEFIT

Africa Development Bank's Energy Lending

**David Bloomgarden
U.S. Department of Commerce**

AFDB Bank Group

(in millions dollars)

ENERGY POLICY

- **INSTITUTIONAL SUPPORT FOR PLANNING INSTITUTIONS IN THE ENERGY SECTOR**
- **SUPPORTS FINANCIAL AND COST RECOVERY BY APPLYING LONG RUN MARGINAL COST PLANNING**
- **SUPPORTS TRAINING FOR ENERGY PLANNERS BOTH IN BORROWING COUNTRIES AND IN THE BANK**
- **SUPPORTS ENVIRONMENTAL IMPACT ASSESSMENTS**
- **TAKE INTO ACCOUNT THE ROLE OF WOMEN IN ENERGY USE**
- **SUPPORT FOR RENEWABLE ENERGY AWARENESS AND DEVELOPMENT**

AFDB Bank Group Approvals by Sector

1993

AfDB Energy Lending by Region

AFDB Energy Loans by Sub-Sector

**Renewable Energy Project
Implementation
In
Eastern Europe
And
The Former Soviet States**

**Steve Irmie
European Union**

**The Role of Financing Organisations in the
Development and Deployment of Renewable Energy
15-16 May 1995, Washington D.C.**

**Renewable Energy Project
Implementation in Eastern
Europe and the Former
Soviet States**

**Mr Steve Imrie
OPET-CS, DG XVII (Energy)
European Commission, Belgium**

INTRODUCTION

THERMIE

- ▲ ***EC's Programme for the promotion of energy technology***
- ▲ ***5 years (1990 to 1994)***
- ▲ ***700 million ECU support***
- ▲ ***4 sectors - renewables, energy efficiency, solid fuels, hydrocarbons***
- ▲ ***Demonstration, Promotion & Dissemination***
- ▲ ***Activities in the Members States & Third Countries - OPET Network, EC Energy Centres***

THERMIE & FINANCE

- ▲ Investment Appraisal Guides**
- ▲ Third Party Financing**
- ▲ Sources of Finance**
- ▲ Case Studies**
- ▲ Investment Fora**
- ▲ Bankers Round Table**
- ▲ Awareness Raising**

***Conference with Financiers to
address the barriers to the funding
of renewables projects***

September 1995

As part of the development of an Action Plan for RES

FINANCE & 3rd COUNTRIES

BARRIERS

- ▲ Awareness
- ▲ Sources of Finance
- ▲ Skills & Training
- ▲ Local Financial Infrastructure

RECENT ACTIVITIES

- ▲ Training in accounting techniques
- ▲ Investment Guides
- ▲ Computer based information
- ▲ Studies
- ▲ Assistance with funds
- ▲ TPF

THERMIE & OTHER PROGRAMMES

FINANCE & OTHER EC PROGRAMMES

▲ **PHARE**

▲ **TACIS**

▲ **EIB/EBRD**

▲ **SYNERGY**

▲ **SPRINT**

▲ **EUROTECH / SEED**

THE FUTURE

JOULE-THERMIE

Nearly 1 billion ECU support over the period 1995 to 1998, under EC's 4th Framework Programme. Focusing on research and development (JOULE), and on demonstration and promotion (THERMIE) of energy technologies

FINANCE

Evaluate past activities, continue with network building, TPF, develop closer links with EIB/EBRD, look at more novel financing techniques, seed capital, barriers (Action Plan)

THIRD COUNTRIES

Evaluate past activities, continue with role of EC Energy Centres, further address role of finance

**Renewable Energy Project
Implementation
In
India**

**V. Bakthavatsalam
Indian Renewable Energy Development Agency**

IEA:REWP Workshop on
Role of Financing Organisations in the Development and
Deployment of Renewable Energy Technologies

15th May 1995,
World Bank Headquarters, Washington DC

**RENEWABLE ENERGY FINANCING
- AN IREDA MODEL**

BY
Dr. V.BAKTHAVATSALAM
Managing Director

**INDIAN RENEWABLE ENERGY DEVELOPMENT AGENCY
LIMITED**

IREDA

RENEWABLE ENERGY FINANCING: AN IREDA MODEL**DR. V. BAKTHAVATSALAM**

Managing Director,

Indian Renewable Energy Development Agency Ltd

New Delhi, India

1.0 The renewable sources of energy

The renewable sources of energy namely Wind, Small Hydros, Biomass and Solar radiation are plentiful, widely distributed and environmentally attractive. Renewable energy technologies add no heat to the global environment and make no net contribution to the atmospheric carbon dioxide. The special characteristics of Renewable Energy which makes it attractive are:

- ⌘ Decentralised production and use involving large number of producers and consumers.
- ⌘ Usually higher initial cost compared to conventional systems but zero or low cost fuels.
- ⌘ Low gestation periods, providing quicker benefits.

The potential of various NRSE technologies in India are:

Renewable Energy Potential in India

Energy Source	Estimated Potential
Hydro Power	84,000 MW
Small Hydro	10,000 MW
Ocean Thermal Power	50,000 MW
Sea Wave Power	20,000 MW
Tidal Power	10,000 MW
Wind Energy	20,000 MW
Solar Energy	5×10^{15} kwh / year
Bio energy	17,000 MW
Co generation	8,000 MW
Draught Animal Power	30,000 MW

IREDA

RENEWABLE ENERGY FINANCING: AN IREDA MODEL

2.0 The Barriers and options for development of renewables

Energy market distortions pose well-recognised barriers to renewable power development. Production and consumption subsidies lower the price of competing fossil fuels relative to renewable energy systems connected to a grid. Subsidised energy prices also bias decisions away from decentralised applications of renewable energy that compete against fossil fuels and grid extensions. They also encourage wasteful consumption and discourage demand for efficient electric appliances.

In most of the developing countries and also in the south asian region the scientific, engineering, financing and marketing capabilities are weak. Most of Our countries also have inadequate institutional mechanisms to effectively commercialise these renewable energy technologies. Trade policies can also hamper the flow of technology. Commitment to service is also equally important issue.

3.0 An Institutional Option :Rural Energy Enterprises(REE)

For achieving accelerated commercialisation and the wide spread use of Renewable energy systems, an innovative institutional model is proposed. A national level institution will be the apex body which will have franchises at the state level. The franchisees could have the legal constitution of Private Limited Company, Public Limited Company, Proprietorship concern or Partnership concern. The franchisees will have an option to hold an equity in the apex company and the apex company will have an option to do the same with the franchisees. The State level franchisees will again sub-franchise to Rural Energy Enterprises(REE) at the village level or at the district level. The legal constitution and the organic linkages are the same as the ones between the apex institution and the state level franchisees. The REEs will inter-alia provide the following services.

- ◆ Financing;
- ◆ Marketing;
- ◆ Consultancy;
- ◆ Various forms of sale viz. Lease, Hire Purchase, Renting, Outright Sale etc.;
- ◆ Maintenance;
- ◆ After-sales service.

There would not be any restriction on the REEs engaging in any add-on services. The apex institution will also provide training, consultancy and management input to the franchisees. The apex institution will also provide the training, consultancy and management input to the franchisees. The apex institution will also do the overall promotion through the print and electronic media. The apex institution would assure quality and will also regulate the mechanism. The REE model is compared with the existing alternatives in the table. This model will have the following advantages:

IREDA

RENEWABLE ENERGY FINANCING: AN IREDA MODEL

- ♦ More commercial and profit oriented and there is a direct incentive for performance.
- ♦ Purely private enterprise oriented.
- ♦ The apex institution and the franchisee have mutual interests in each other progress due to the two-way equity participation.
- ♦ Sustainable and replicable model suited for massive programmes.
- ♦ A very large rural coverage and reach.
- ♦ Oriented towards large scale rural employment.
- ♦ Organised service networking.

CRITERIA	NGOs	CO- OPERATIVES	TRUSTS/ SOCIETIES	GOVT. UNDERTA KING	REEs
Technical Feasibility	Yes	Yes	Yes	Yes	Yes
Commercial Viability	No	Yes	No	Yes	Yes
Replicability	No	No	No	Yes	Yes
Sustainability	No	Yes	No	Yes	Yes
Effective Management	Yes	No	Yes	Yes	Yes
Commitment	Yes	No	Yes	No	Yes
Profitability	No	No	No	No	Yes
Score	3	3	3	5	7

It may be also noted that no such institutional model is a universal solution for accelerated commercialisation of renewable energy technologies and it has to need based. Therefore a multi-model approach based on the socio-politico-economic-cultural situation in the country where the programme is being implemented is necessary.

4.0 The IREDA Model

4.1 The inception

Taking into account the limitations of the conventional banking approach and to accelerate the momentum of development and large scale utilization of renewable energy sources and primarily for promoting, developing and financing NRSE technologies, The

IREDA

RENEWABLE ENERGY FINANCING: AN IREDA MODEL

Indian Renewable Energy Development Agency Limited was incorporated on 11 the March 1987, as the financial and promotional arm of the Ministry of Non-Conventional Energy Sources, Govt. of India.

4.2 IREDA's Mission

IREDA's mission is to stimulate, promote, support and accelerate an efficient, environmentally sustainable infrastructure for effective exploitation of New & Renewable Sources of Energy(NRSE) for productive purpose.

It operates a Revolving Fund to develop and promote viable NRSE technologies in the country.

4.3 Objectives

IREDA's active objectives are to :

- ☼ Extend Financial support to manufacturers and users
- ☼ Promote renewable energy
- ☼ Act as a financial intermediary
- ☼ Assist in rapid commercialization

4.4 Corporate Values

In order to deliver better service to the promoters in renewable energy, IREDA has defined it's corporate values:

We value:

- Customer friendliness
- Team work
- Productivity
- Total Quality
- Partnership for Sustainable Development

4.5 Highlights of performance

- ⌘ Sanctioned 463 projects, amount Rs. 5128.3. million.
- ⌘ Total disbursements amount to Rs. 2339.2 million.
- ⌘ Sustained recovery rate of over 95 per cent since inception.
- ⌘ Profit before tax in 94-95 Rs. 90.26 million.

IREDA

RENEWABLE ENERGY FINANCING: AN IREDA MODEL

- ⌘ Percentage of growth from 1987 to 1995; 615% rise in no. of projects sanctioned spectacular 4363% in loan amount, tremendous increase of 83 times in loan disbursements and 53 times in Profit before Tax.
- ⌘ Equity base of Rs. 1000 million.
- ⌘ Bonds issue of Rs. 500 million in 1995 fully subscribed.
- ⌘ Divident paying.
- ⌘ Performance rated "Very Good" by Department of Public Enterprises, Government of India.
- ⌘ The CRISIL credit assessment has indicated IREDA's capacity to make timely payments of interest and principal on its debts as "STRONG".

4.6 Global Partnership

IREDA's track-record of achievements has attracted World-wide attention. Renowned multilateral and bilateral agencies have come forward to join in the global movement for sustainable development

- ❖ World Bank has mobilised a line of credit to the tune of US \$ 195 million for the "INDIA : RENEWABLE RESOURCES DEVELOPMENT PROJECT".
- ❖ The project envisages installation of a capacity of 187.5 MW in three renewable energy sectors:
 - ◊ Small Hydro,
 - ◊ Windfarms and
 - ◊ Solar Photovoltaics.
- ❖ The Participants in financing are International Development Agency(IDA) ,Global Environment Facility (GEF) ,Danish International Development Agency (DANIDA) and Swiss Development Co-operation (SDC).

IREDA

RENEWABLE ENERGY FINANCING: AN IREDA MODEL**Financing Plan of the India: Renewable Resources Development Project**

All figures in US\$ Millions

Capacity Break-up of the India: Renewable Resources Development Project

All figures in MW

- ❖ Asian Development Bank (ADB) has provided assistance amounting to US \$ 3,54,000 as technical assistance for a RENEWABLE ENERGY DEVELOPMENT PROJECT study to establish a line of credit.
- ❖ The Renewable Energy Development Project Study which has hence been submitted is expected to result in a line of credit of US \$ 150 Million in the following sectors of renewable Energy:
 - ◊ Wind Energy
 - ◊ Co-Generation
 - ◊ Biomethanation
 - ◊ Solar Thermal Energy
- ❖ The Government of Netherlands has sanctioned a grant-in-aid of 40 million Guilders for promoting NRSE technologies in India.

IREDA

RENEWABLE ENERGY FINANCING: AN IREDA MODEL

4.7 IREDA's Power Field

Increasingly, NRSE technologies are gaining ground in the country. To ensure a sharper focus on more relevant technologies. IREDA has defined its thrust areas, it has also adopted technologies that fit into India's natural resources and complementary to its geo-climatic configurations for self reliance.

4.8 Thrust areas

- ❖ Wind Energy
- ❖ Solar energy
 - ◊ Solar Thermal
 - ◊ Solar Photovoltaic
- ❖ Small Hydro Power
- ❖ Co-generation
- ❖ Bio Energy

4.9 Highlights of lending terms

To promote NRSE sector in an accelerated manner, IREDA offers soft financial assistance to promoters.

IREDA's financing norms

Quantum of Assistance	Maximum 80% of the project cost
Rate of Interest	2.5%- 15.5 %
Moratorium	Maximum 3 years
Repayment Period	Maximum 10 years

4.11 Towards Sustainable Development

- Encouraging more and more women participation.
- Entrepreneurship Development Programmes.
- Encouraging women co-operatives.
- In a world, Grievously waking upto the threatening realities of global warming, ozone depletion and green-house effect ,IREDA takes critical care to ensure environment-friendliness and better eco-balance.
- Encouraging rural Development, Self employment, Self Reliance and Poverty Alleviation through decentralized NRSE systems.

IREDA

RENEWABLE ENERGY FINANCING: AN IREDA MODEL

- IREDA's projects have also displaced conventional sources of energy to the tune of:

Coal	429; 711 Metric tonnes
Furnace Oil	27;717 Kilolitre
Diesel	449.5 Kilolitre
Electricity	157.5 Million KWHrs
Fuel Wood	53;000 Metric tonnes

4.12 Market Orientation

The role of new entrepreneurs in development of NRSE technologies can not be over-emphasized. Consequently, IREDA right from the inception has been market oriented in its attempt.

- Identification of potential entrepreneurs and familiarising them with various facets of project identifications, formulations, implementation, financial management etc, have been a continuous exercise at IREDA.
- IREDA regularly conducts business meets, seminars and workshops.
- Human Resources Development programme receives added impetus at IREDA.
- Monitoring cells and fool-proof monitoring mechanisms have yielded quality outputs and strict control over financial management and loan recovery.
- Need-based promotional incentives and communication inputs are being given through varied media mix for educating target audience and create market simulation for the projects.
- Technical Back-up Cells are set up to extend technical/financial services.
- IREDA's institutional structure has been strengthened to equip it to handle emerging responsibilities.
- A Research Cell has been set-up.
- Development and consultancy Cell has been established to offer assistance to entrepreneurs nationally and internationally.
- Joint ventures are promoted in the thrust areas of power generation to help small scale developers.

4.13 The future

Beyond it's immediate set of objectives, IREDA is also laying down it's future plan perspectives. IREDA is extending support to renewable energy options like Denro Thermal Power, Energy from Urban Wastes etc. Areas like Energy efficiency & conservation, Consultancy & Exports, Training & Development are also being seen as promising in IREDA's scheme of operations.

IREDA

RENEWABLE ENERGY FINANCING: AN IREDA MODEL

More and more possibilities are being explored in environmental friendly new and renewable energy fields, to make NRSE technologies a people's movement and to provide **ENERGY FOR EVER**

IREDA

HIGHLIGHTS OF PERFORMANCE

Figures in Rs. Millions

Sl No.	Parameters	1993-94	1994-95	Cumulative from 1987-88 till end of 1994-95	% increase over 1987-88	% increase over 1993-94
1	Projects sanctioned (Nos)	94	136	463	615	44
2	Financial Assistance sanctioned	1623.9	2529.1	5128.3	4363	56
3	Disbursements	559.1	1302.9	2339.2	8300	133
4	Total income	83.7	150.5	413.1	7374	80
5	Profit before tax	45.8	90.2	250.3	5311	97
6	Earnings per Share(Rs)	1287.5	156.45	788.5	633	21

Financial Performance

1993-94 Vs 1994-95

*Figures in Rs.
Millions*

1993-94

1994-95

All Figures are provisional

SANCTIONS

FIGURES IN RS MILLIONS

YEARS

Sanctions

Figures are provisional

DISBURSEMENTS

FIGURES IN RS MILLIONS

Disbursements

The figures are provisional

Cumulative No. of sanctions

Sectoral Break-up

■ Numbers

**Summaries:
Key Conclusions,
Issues, and
Recommendations**

**Matthew Mendis
Alternative Energy Development**

1995 IEA Workshop on the The Role of Financing Organizations in the Development and Deployment of Renewable Energy

A Summary of the Key Conclusions, Issues and Recommendations

by

Matthew S. Mendis

President

Alternative Energy Development, Inc.

Silver Spring, MD.

16 May 1995

CONCLUSIONS

- Q. Does renewable energy (RE) have a role to play in meeting the growing energy demands of the developing countries?**
- A. The answer given by most of the presenters at this workshop is a resounding yes!!!**
- **DEMAND is not the constraint.**
- Q. Are the supply of proven renewable energy resources and technologies readily available?**
- A. Again there appears to be little argument about the abundance of renewable energy resources and the technological readiness of many RE systems.**
- **SUPPLY is not the constraint.**
- Q. Then what is the big problem?**
- A. "In many cases renewable energy is free but it ain't cheap" - E. Terrado**
- **PRICE is the key factor.**

CONCLUSIONS (continued)

- **AFFORDABILITY**

Q. If renewable energy is not free, can the relatively lower income consumers of the developing countries afford this form of energy as opposed to more conventional forms?

A. Whenever it is the least-cost option.

Q. How do we make RE systems affordable?

**A-1 Level the playing field - unanimous agreement:
(a necessary but not sufficient condition)**

CONCLUSIONS (continued)

- **STRATEGIES**

A-2 Increase R&D efforts especially in the developing countries - the Solar Initiative / UN Centers of Excellence - the "Technology Pullers" .

A-3 Promote technology transfer and dissemination - the "CIGRETT Promoters".

A-4 Catalyze declines in RE system costs through the support for large-scale applications - the "Market Pushers".

A-5 Develop and apply "innovative financing mechanisms" - the "FINESSEers".

A-6 Reimburse for the "incremental costs" of the global environmental benefits - the "GEFers".

CONCLUSIONS (continued)

- **INVESTMENTS - MAKING IT ALL HAPPEN**

Q. How do we target/attract investments for affordable RE systems/services?

A. If we had the definitive answer to this question ... we would not be sitting in this workshop. However, one of the most important criteria identified is to provide a sufficiently attractive return on investment (RoI) for the investors. Other criteria identified included:

Minimizing risk;

Having a bankable revenue stream;

Working in a stable social, political and economic environment;

Attracting/involving private sector investors;

Accounting for social and environmental benefits.

REMAINING KEY ISSUES

Private Sector

- **The energy sector is becoming increasingly privatized.**
- **The private sector wants to maximize profits while minimizing risks.**

ISSUE: How do the financing agencies encourage the private sector to invest in RE systems that in many cases are only marginally profitable when compared to other investment options?

Transportation Needs

- **Energy for transportation is one of the fastest growing segments of energy demand in many developing countries.**
- **Transportation services and mobility are key elements for social and economic growth.**

ISSUE: How can renewable energy systems be applied to meet the growing transportation energy demands of developing countries?

REMAINING KEY ISSUES

Global Environment

- **The UNFCCC has set limits and targets for reduction of GHG emissions.**
- **RE systems avoid or help reduce GHG emissions.**

ISSUE: Besides the GEF, how can RE systems be supported / compensated for their global environmental benefits and thereby help meet the targets of the UNFCCC?

Shortage of Capital

- **The competition for investment capital is intense not only within the energy sector but across sectors.**
- **The need for investment capital in the energy sector far outweighs the supply of investment capital for the sector.**

ISSUE: How can the financial institutions represented at this workshop tilt the balance in favor of investments for RE systems?

REMAINING KEY ISSUES

Scarcity of Pre-Investment Funds

- **RE investments tend to require more work for identification, preparation and appraisal.**
- **There is a growing scarcity of funds available from the development assistance agencies for support of project preparation / development work.**

ISSUE: What can be done to minimize the duplication and enhance the collaboration of the development assistance agencies working in the field of project preparation / development of RE systems.

Non-Financial Barriers

- **Institutional and policy biases against RE systems are entrenched in many developing countries.**
- **Infrastructure and technological biases also exist in many developing countries.**

ISSUE: What can be done to encourage and help the elimination of these biases in developing countries?

KEY RECOMMENDATIONS

- **Institutions like the World Bank and the IFC need to take a greater leadership role in supporting the financing and deployment of RE - e.g., the World Bank Group consistently makes more than US\$1.5 billion a year in net profits. Why does it continue to have to beg the donors for a few million dollars of support to maintain its cutting edge programs like ESMAP and ASTAE?**
- **The developing countries need to be empowered / enabled to lead the demand for RE systems that are favorable for their economies rather than to blindly accept the status quo.**
- **The private sector needs to be held more accountable for the social and environmental consequences of its investment actions.**
- **The opportunities for RE within the context of the UNFCCC initiative "Joint-Implementation" should be more aggressively promoted.**
- **The globalizing IPPs (e.g., ENRON, Hopewell, etc.) should be encouraged to consider RE systems within their portfolio of projects.**

World Bank Solar Initiative (SI)

**Achilles Adamantiades
World Bank**

WORLD BANK
ENERGY AND ENVIRONMENT

***RESEARCH, DEVELOPMENT,
AND DEMONSTRATION
(RD&D)***

Presented by:
Achilles Adamantiades, Ph.D..

BACKGROUND :

ENERGY DEMAND

■ Major Driving Force: Energy Demand Growth in Developing Countries

Examples:

- OECD Countries, Installed Capacity > 2 TW
- Developing Countries, Installed Capacity < 0.6 TW (with population 6 X OECD's population)
- Expected Growth in DCs in the next 4 decades about 5 TW

Background:

ENVIRONMENT

Major Advances in Developing Countries:

ADVANCE:

MAGNITUDE:

Electric Plant Efficiency
Boost (1900-1993)

from 3% to 50%

Unit Cost Reduction

factor of 30

Particulate Matter Reduction

99.9%

Sulfur Dioxide (new IC)
Reduction

95%

WHY RD&D EXPANSION

■ *Possibilities for Innovation as high as before*

Recent Examples:

- "Clean coal
- "Gas turbine combined cycle
- "Solar energy technologies
- "Fuel cells
- "Energy storage (e.g., batteries)
- "Efficient end use
- "Improved use of traditional fuels (fuel wood)

WHY RD&D EXPANSION

■ *Environmental Concerns*

- Indoor Pollution
- Local Pollution
- Global Pollution

ROLES IN RD&D

■ *Private industry RD&D*

- "Oil and gas
- "Coal
- "Electricity

■ *Public RD&D*

- "externalities
- "Risks in long-term RD&D
- "Risks in "do nothing" option

ASSESSING RD&D

Joint NRC - WB Symposium

- Address current inadequacies in energy RD & D
- Address gaps in environmental RD&D (e.g. oceans and climate)
- Take stock of current state
- Shift emphasis to needs of developing countries and related issues of local and global environment

ASSESSING RD&D (continued)

Joint NRC - WB Symposium

- Sharpen respective roles of public and private sector
- Take into account needs of emerging markets
- Underpin and document the case for a new initiative, including...
- Development of Regional Centers of Excellence

RENEWABLES USE IN DEVELOPING COUNTRIES

■ Key Needs:

- Technology adaptation for local situations
- Deployment and evaluation
- In-country infrastructure development
- Alliances to facilitate all of these

Energy & Environment

REGIONAL CENTERS OF EXCELLENCE (I)

■ *Define a focused role for the Centers - technical problems*

- Characterization and performance of biofuels
- Suitability of solar technologies under local conditions
- Maintenance requirements under local conditions
- Performance and optimization of design and operation of energy storage devices

Energy & Environment

REGIONAL CENTERS OF EXCELLENCE (I) *Continued...*

- Potential of local manufacturing
- Analysis and testing of cooling methods under local conditions
- Development of simpler, more efficient and more durable measuring devices (e.g., anemometers)
- Local suitability of pollution control technologies and devices
- Low-cost methods for pollution control
- Local networks for environmental monitoring

Energy & Environment

REGIONAL CENTERS OF EXCELLENCE (I) *Continued...*

- Information networking
- Studies in microclimate and local ecosystems
- Evaluation and preparation of demonstration projects
- Analysis of regional interconnections and energy networks
- Study of quality of power problems (especially acute in DCs) and remedies

ENERGY AND ENVIRONMENT REGIONAL CENTERS OF EXCELLENCE (II)

■ *Focus role for the Centers' - economic/financial/institutional issues*

- Economic performance under local capital/labor/materials/etc. conditions
- Financial intermediation under regional environment
- Financial viability of local institutions and ways of improving it
- Means of establishing local ownership

ENERGY AND ENVIRONMENT REGIONAL CENTERS OF EXCELLENCE (II) *Continued...*

- *Focus role for the Centers' -
economic/financial/institutional issues*
 - Options for village and rural electrification
 - Household energy surveys
 - Analysis of institutional weaknesses and methods of improvement
 - Assessment of national and regional renewable energy potential and drafting of Action Plans
 - Study of legal and institutional impediments and incentives for private sector participation

MAJOR ISSUES REGARDING CENTERS OF EXCELLENCE

- Number and location
- Costs, financing, long-term sustainability
- Relation, networking, and interactions with existing RD&D centers
- Monitoring and quality control
- Balance between basic and applied research
- relationship with academic research

MAJOR ISSUES REGARDING CENTERS OF EXCELLENCE

continued...

- Parallels and differences with CGIAR - lessons learned
- Transfer of experience from RD&D centers in developed countries
- Appropriate involvement of private sector
- Global networking on energy and environment project data and studies

MAJOR ISSUES REGARDING CENTERS OF EXCELLENCE

continued...

- Role in training of personnel
- Staffing - Secondment (detailing) of staff
from developed countries - staff exchanges

CONCLUSIONS

- Largest potential and prospects of energy growth in developing countries
- Environmental problems also most acute in developing countries
- Change of focus needed toward DCs to develop local "ownership"
- Up to now, RD&D centered in developed countries
- Broad consensus exists that a better focused RD&D is needed

CONCLUSIONS *continued...*

- Energy and the Environment need to be considered as a nexus
- Regional centers of Excellence could be an appropriate, needed, and potentially successful way of addressing effectively the problem
- An international panel of distinguished persons in Energy and Environment would be needed to guide the effort

Financing Renewable Energy Projects Through The Global Environment Facility

**Charles Feinstein
World Bank**

GEF and GLOBAL WARMING: Renewable Energy Prospects

Kim Westerskov / Oxford Scientific Films

**GLOBAL
ENVIRONMENT
FACILITY**

PARTNERS IN GLOBAL SOLUTIONS

Partners in GEF Implementation

- ***UNDP:*** technical assistance
- ***UNEP:*** scientific and technical advice
- ***World Bank:*** investment operations;
funds administration

**GLOBAL
ENVIRONMENT
FACILITY**

PARTNERS IN GLOBAL SOLUTIONS

Financing Modalities

- Provides *incremental cost* financing (i.e., portion not justified in the domestic context) to obtain *global benefits*
- In response to *government requests* or may grant direct to *private sector* with government approval

GEF Support for Renewable Energy

Biomass

Wind

Direct Solar

Geothermal

Urban Waste

Hydro

- *Technology development*
- *Market development*
- *Institutional reform*

Philippines Geothermal Project

India Alternate Energy Project

GEF II Characteristics

- **More \$\$\$ (\$800 million ➡ \$2 billion)**
 - 40%-50% to Global Warming
- **More Strategic**
 - FCCC-linked
 - National Plans and Strategies
- **More Country-Driven**
 - National priorities for ESD

**GLOBAL
ENVIRONMENT
FACILITY**

PARTNERS IN GLOBAL SOLUTIONS

Dimensions of the Problem

**GLOBAL
ENVIRONMENT
FACILITY**

PARTNERS IN GLOBAL SOLUTIONS

Resource Allocation Strategy

“Buying Time”

- ◆ < \$25/tonne Carbon
- ◆ Technologies:
 - Fuel switching
 - Methane leakage/flaring
 - Adv. generation cycles (IGCC, PFBC, AGT)
 - Demand-side efficiency
 - Carbon sequestration & biomass production

“Technological Lifeboat”

- ◆ Low or no carbon & high present cost, but steep learning curves
- ◆ Technologies:
 - PV
 - Solar thermal-electric
 - Wind
 - Biomass gasification/GT
 - Fuel cells

Learning Curve Effects

**GLOBAL
ENVIRONMENT
FACILITY**

PARTNERS IN GLOBAL SOLUTIONS

Developing Country Priorities

AGENDA

1. Poverty alleviation
2. Economic growth
3. Technology transfer
-
-
- xx. GHG abatement

**GLOBAL
ENVIRONMENT
FACILITY**

PARTNERS IN GLOBAL SOLUTIONS

Technology Transfer

- *Brazil biomass gasification/gas turbine*
- *Solar thermal-electric program*
- *PV "Green Carrot" global competitive solicitation*

Brazil Biomass Gasification/G.T.

Solar Thermal-Electric Projects

PV Module Cost

Leveraging GEF Resources

**\$1.5
billion**

**\$300
million**

**GLOBAL
ENVIRONMENT
FACILITY**

PARTNERS IN GLOBAL SOLUTIONS

GEF Project Development Facility

Window A

- < \$25,000
- For concept development
- Any requestor
- WB approval

Window B

- < \$350,000
- For pre-inv. and feasibility studies
- Govt request
- GEFSec approval

Window C

- < \$1,000,000
- For detailed project design
- Govt request
- GEFSec approval

Rethinking Development Assistance For Renewable Electricity

**Keith Kozloff
World Resources Institute**

International Cooperation in Commercializing Renewable Energy Technologies

**Keith Kozloff
World Resources Institute**

**IEA Workshop on Renewable Energy
May 15-16, 1995
Washington, DC**

Illustrative Cost/kWh Reductions from Ten Year Stream of Installations

Technology	Cumulative Installed Capacity	Cost Reduction
Solar Thermal	1100 Mw	55%
PV	180 Mw	60%
Biomass	525 Mw	37%
Wind	1000 Mw	40%

ANNUAL RENEWABLE ELECTRIC CAPACITY ADDITIONS (Excluding Hydro)

INTERNATIONAL MECHANISMS FOR PROMOTING COMMERCIALIZATION OF RENEWABLE ENERGY

	R&D	Demon- stration Projects	Market Diffusion	Policy Reform
Grants				
Loans				
Equity Capital				
Project Development				
Training				
Organizational Development				
Information Services				

Table 1. Activities of the United Nations system in the implementation of the Nairobi Programme of Action

Nature of activities and entities of the United Nations involved Priorities of the Nairobi Programme of Action	Supporting measures		Technology/resource transfer	
	Information exchange, studies, publications, reports to intergovernmental meetings	Meetings, symposiums, experts groups, seminars, workshops	Technical cooperation projects/activities	Financial assistance/grants
Energy assessment planning	DIESA, DTCO, ECA, ECE, ECLAC, ESCAP, ESCWA, FAO, IBRD, UNESCO, UNEP, UNIDO, UNITAR, UNU, WMO	DIESA, DTCO, ECA, ECE, ESCAP, ESCWA, FAO, INSTRAW, UNDP, UNESCO, UNIDO, UNITAR, UNU, WMO	DTCO, ECE, ESCAP, ESCWA, FAO, ILO, UNIDO, UNDP	UNDP, IBRD, IDA
Research, development and demonstration	DTCO, ECA, ECE, ECLAC, ESCAP, ESCWA, FAO, UNIDO, UNU	DTCO, ECA, ECE, ESCAP, ESCWA, FAO, UNIDO, UNU	DTCO, ECE, ESCAP, ESCWA, FAO, UNICEF, WHO	UNDP
Transfer, adaptation and application of mature technologies	DTCO, ECA, ECE, ECLAC, ESCWA, FAO, UNIDO, UNU, UNICEF, WHO	DTCO, ECE, ECA, ECLAC, ESCAP, ESCWA, FAO, UNIDO, UNU, UNICEF, WHO	DTCO, ECE, ESCAP, ESCWA, FAO, UNIDO, UNU, UNICEF, WHO	UNDP, IBRD, IDA
Information flows	DIESA, DTCO, ECE, ESCAP, FAO, UNESCO, UNU	DTCO, ECE, ESCAP, FAO, UNESCO, UNU	DTCO, ECE, ESCAP, FAO, UNESCO	UNDP
Education and training	DIESA, DTCO, ECA, ECE, ESCAP, ESCWA, FAO, UNESCO, UNIDO, UNU	DTCO, ECE, ESCAP, ESCWA, FAO, UNESCO, UNIDO, UNU	DTCO, ECE, ESCAP, FAO, UNESCO	UNDP
Rural energy development	DTCO, ECA, ESCAP, ESCWA, FAO, UNU	DTCO, ECA, ESCAP, FAO	DTCO, ESCAP, FAO	UNDP, IFAD

Source: Reports from the entities of the United Nations system.

Note: For a list of abbreviations, see annex.

Percent of Total Energy ODA Devoted to Renewables

GENERATING TECHNOLOGIES' MARKET SHARE (MW) OF INDIAN PRIVATE POWER PROPOSALS, 1993

Potential Benefits from Greater Coordination

- Technology-push strategically linked to market-pull activities
- Program funding stability and predictability improved by pooling resources
- Economies of scale and comparative advantage more effectively exploited
- Inconsistencies reduced among multiple programs operating in same country

Examples of Possible Opportunities

- **Strengthen bilateral development assistance guidelines for minimizing use of aid to gain competitive advantage**
- **Expand national programs to allow participants from other countries**
- **Coordinate RD&D among existing national and international centers**
- **Create multilateral mechanism for undertaking international commercialization activities**

Recommendations for Next Steps

- Explore alternative institutional mechanisms and homes
- Develop priority opportunities for targeted technologies
- Identify ways to overcome institutional and financial barriers

**The Venture Capital Industry
As Source of Financing
For
Renewable Energy Technology**

Gayle Jackson
Gayle P.W. Jackson, Inc.

World Bank Workshop
May 15 - 16, 1995

Use of the Venture Capital Industry To Develop Commercially Promising Renewable Energy Technologies

Gayle Jackson
Gayle P.W. Jackson, Inc.

Outline

- **The Venture Capital Industry -- Overview**
- **Focusing Corporate Venturing on Emerging Energy Technologies**
- **Use by Foundations of Venture Capital Investing in Renewable Energy**
- **Summary and Conclusions**

The Venture Capital Industry

- **Definition:** Professional venture capital is capital provided by firms of full-time professionals who invest alongside management in young, rapidly growing companies that have the potential to develop into significant competitors in regional, national and global markets.
- **Size of industry:** US \$ 35 + billion
- **Sources of \$:** Pension funds, Foundations, Wealthy Individuals, Endowment funds, Professional venture capitalists, ***CORPORATIONS***

What Venture Capitalists Do

- **Finance new and rapidly growing companies**
- **Purchase equity securities**
- **Assist in developing an innovative (often high technology-based) business idea**
- **Take higher risks with the expectation of higher rewards**
- **Have a long-term orientation (5 - 10 years)**

Some Results of the Venture Capital Industry

- Computer companies: Digital Equipment Corporation, Apple Computer, Compaq, Sun Microsystems
- Semiconductor industry: Intel and Cypress
- Software industry: Microsoft, Lotus, Aspen, Systemsoft
- Biotechnology: Genentech, Cetus, Genzyme
- Other: Federal Express

The Venture Capital Industry and CORPORATIONS

- Of \$35 billion under professional venture capital management, \$4 - 5 billion (and growing) comes from **CORPORATIONS**
- Over 100 multi-national corporations use professional venture capital investing as a corporate development tool -- known as *corporate venturing* or *corporate venture investing*
- Corporations specify focus of investments

EXTERNALLY MANAGED CAPTIVE CORPORATE VENTURE CAPITAL PROGRAMS

ESTABLISHED	CORPORATE-MANAGER	INITIAL CAPITAL COMMITTED (\$MM)
1976	INCO - TA ASSOCIATES (1)	20
1981	FERRANTI - AMERICAN CAPITAL (SBIC)	5
1983	THORN EMI - (SMALL WEST COAST)	8
	LOUISIANA PACIFIC - FIRST SERVICE	10
1984	BMW - CHURCHILL (2)	15
	ASEA - HARVEST	6
	MONSANTO - ADVENT LTD.	16
	MONSANTO - ALAFI	25
1985	RJR NABISCO - ADVENT	15
	DUPONT - BBHO	10
	MITSUMI - VISTA/ORIEN	20
1986	ETHYL - GRYPHON	15
	ALCOA - ADVENT	96
	BROWN BOVERI - ADVENT	
	HOFFMANN-LA ROCHE - ADVENT	
	BROKEN HILL PROPRIETARY - ADVENT	
	AGFA - ADVENT BELGIUM	4
1987	WESTERN MINING - ADVENT	15
1988	PHILIPS - VISTA	5
	PFIZER - H & Q (LIFE SCIENCES)	30
	LEND LEASE - ADVENT	15
	MONSANTO - ADVENT	30
1989	NIPPON STEEL - ADVENT	18
	D & B - BAIN	35
	H. B. FULLER - SAI	15
1990	BRITISH GAS - ELECTRA	22
	APPLE COMPUTER - ADVENT	15
	G. D. SEARLE - G & G DIAGNOSTICS	15
	NTT - ADVENT	10
	CIBA GEIGY - ACCEL	10
1991	DE BEERS - ATHENA	~ 10
	SANDOZ - AVALON	10
	EASTMAN KODAK - HORSLEY KEOGH	~ 25
1992	NESTLE OY - ADVENT	15
1993	ROYAL PTT NEDERLAND-ADVENT	15
TOTAL CURRENTLY ACTIVE (3)	28 PROGRAMS	~ 465

(1) COMPLETED IN 1983 (2) TERMINATED IN 1986 (3) REFLECTS TERMINATIONS AND ROLL-OVERS FROM INITIAL FUNDS
SOURCE: ADVENT INTERNATIONAL

What the Venture Capital Industry Can Do for CORPORATIONS

- Facilitate access to small, emerging companies where technological innovations with commercial application are most likely to be found
- Help evaluate emerging business opportunities using tested venture capital criteria -- *management, market, technology*
- Limit corporate exposure

- Facilitate joint business ties between the corporation and early-stage company (supplier/purchaser, joint venture, licensing arrangement, etc.)
- Help identify companies with important new products, technologies and concepts (early "window" on emerging businesses) and *eliminate* companies with poor prospects
- Get to know the strengths and weaknesses of future acquisition candidates without 100% equity ownership
- Potential for attractive financial return on investment (ROI) in addition to strategic benefits

ENERGY TRANSITION FUND

ADVENT'S TRACK RECORD IN ENERGY

		<u>INVESTED CAPITAL</u>	<u>CURRENT VALUE¹</u>	<u>PROJECTED RETURN²</u>
ENERGY	12	\$20.7M	\$38.2M	\$61.8M
ENVIRONMENTAL & RELATED	<u>21</u>	<u>\$42.3M</u>	<u>\$81.8M</u>	<u>\$124.7M</u>
TOTAL	33	\$63.0M	\$120.0M	\$186.5M

PROJECTED NET INVESTOR IRR 22-25%

¹ Based upon 12/94 valuations; Includes public companies at market value

² Based upon Advent's best estimate of ultimate liquidation value

Factors Prompting Corporate Initiatives to Seek and Use Emerging Energy Technologies

- **Increased global competition**
- **De-regulation**
- **Privatization**
- **Energy (especially electricity) demand growth in industrializing countries**
- **Concerns about environmental impacts**

CAVEATS:

- Potential conflicts between venture capitalist (VC) and corporate objectives -- VC wants to maximize \$ and ROI; CORPORATE investor may rank strategic objectives higher than \$ROI. Should address in investment charter.
- Long-term commitment (need 5 - 10 year time horizon)
- CORPORATION must commit human resources to get full value of association with venture capitalist and to monitor the deal flow
- Limits on amount of money that can be used effectively

Using the Venture Capital Industry to Respond to Global Climate Change Concerns

Examples:

The EnviroTech Investment Fund

Energy Transition Fund

The EnviroTech Investment Fund

- An initiative of Edison Electric Institute
- A venture capital fund to invest in companies focusing on commercialization of emerging electric and renewable technologies that are more energy efficient than those currently in the marketplace -- will search worldwide
- *Principal aim:* Seek technologies that reduce greenhouse gases as compared with prevailing technologies or processes
- Open to electric utilities, not only in the U.S. but also in Europe, the Pacific Rim and elsewhere

EnviroTech Investment Fund Objectives

- 1. Achieve attractive rate of return for investors
(> 20% Internal Rate of Return is target)**
- 2. Demonstrate the electric utility industry is taking concrete steps to reduce greenhouse gases**
- 3. Achieve strategic and commercial objectives for participants: (a) Early window on new technologies that will impact the delivery and use of energy AND (b) the opportunity to be a part of the new commercial venture**
- 4. Support the industry's commitment to develop new electric and renewable technologies that benefit the economy, the environment and society**

EnviroTech Fund: The Investment Charter

Fund managers are charged with finding companies and technologies in these areas:

- **Alternative and renewable energy technologies (wind, biomass, solar, thermal and photovoltaics)**
- **Energy efficiency, including HVAC equipment, motors, and lighting;**
- **Alternative Energy for transportation including batteries, fuel cells and other related technologies;**
- **Environmental Waste treatment including wastewater treatment, hazardous waste treatment;**

- **Medical Waste destruction, including plasma processing, pyrolysis and microwave processing;**
- **Electric Power Generation, storage, transmission and distribution technologies.**

Technologies Currently Being Evaluated for the EnviroTech Fund -- Some Examples

- **High-energy, rechargeable lead-acid batteries for electric vehicles and other applications**
- **Geothermal heat pumps**
- **Co-generation development**
- **Non-CFC based solvents**
- **Waste treatment and analysis**
- **NOx reduction equipment**

EEL's Selection of Venture Capital Fund Manager

- **Extensive diligence investigation of candidate firms**
- **Selected one of the world's largest international venture capital firms, with offices in Boston, San Francisco, London, Germany, Italy and Hong Kong**
- **Strong focus on energy, environmental and industrial sectors**
- **Extensive deal flow and access to U.S. and international investment opportunities**
- **Strong, well documented track record**

- The selected venture firm screens more than 10,000 investment opportunities per year worldwide (a portion of which are energy/environmental technologies)
- Typically screen 150 investments for every one investment made

— REPRESENTATIVE ADVENT ENERGY INVESTMENTS —

Unique Mobility:	High performance electric motors for EV market
Superconductivity:	Superconducting energy storage systems
Ballard:	Polymer membrane fuel cells for heavy EV and remote power applications
Enviroplan:	Continuous emission monitors for industrial/utility stack gas
EBT:	Electronic ballasts for fluorescent lighting
ReTec:	Environmental engineering and remediation contracting services
WTE:	Waste processing, recycling and energy recovery facilities

Representative Energy Investments (cont)

Xenergy: Demand side management

Neonix: Lighting

SystemSoft: Power Management

Astropower: Photovoltaics

Bolder: Batteries

Sorapec: Batteries/materials

**World
Geoscience:** Resource discovery

Renewable Energy Technology "Dealflow" -- Recent Examples

Photovoltaics -- Systems integrator proposing to integrate vertically several photovoltaic companies offering village systems, navigations systems, etc. in same geographic area

Wind power -- some activity in higher efficiency wind turbines

Geothermal -- Some deals involving refinancing of fairly large IPP's based on renegotiated power purchase contracts; some "crazy things" in ocean thermal

Solar thermal -- Some new materials companies (coatings) that would increase yield of existing solar thermal technologies

Enabling technologies -- inverters, power conditioning technology that provides balance for photovoltaic-based system; batteries (Ballard) with efficiencies that improve economics of fuel cell technologies

The Energy Transition Fund -- A "Foundation" Initiative

Background

- MacArthur Foundation is major U.S. charitable foundation with \$3 billion in assets
- In 1990, MacArthur Foundation joined with two other major foundations (Rockefeller and Pew) to start an Energy Foundation that would invest in energy efficiency and renewable energy projects. Annual budget = \$10 + million). Money came from annual charitable giving budget, NOT from foundation's asset base.

- **In 1994, MacArthur decided to try to stimulate other foundations to allocate funds from their asset base to invest in a fund that would focus on renewable energy technologies and it would be lead investor with a \$10 million commitment**

Energy Transition Fund

- MacArthur Foundation initiative -- \$10 million lead investor commitment
- Objectives: (1) Attractive ROI and (2) Meaningful impact on transition to a sustainable energy economy
- Technology areas:
 - Energy Conservation
 - Energy Distribution/Controls
 - Alternative/Renewable
 - Automated Monitoring
 - Recycling/Waste Management
 - Technologies that enable conservation
 - Energy Storage
 - Transportation
 - Industrial Process
 - Software

Summary and Conclusions

- **Some *corporations* are using the venture capital industry to do focused investing in renewable and energy efficient technologies**
- **These corporate initiatives are prompted by factors that are likely to continue to be relevant -- increased global competition; de-regulation; privatization; energy (especially electricity) demand growth in industrializing countries; and concerns about environmental impacts of energy use patterns**

- Some *charitable foundations* whose charters support investment in energy efficiency and renewable energy technologies are using venture investing as a way to accelerate commercialization and deployment of these technologies

- Selected venture capital firms are willing and have the expertise to:

- a) Focus a "dedicated" fund on investing in emerging energy technologies;

- b) Evaluate a wide range of energy technologies in early-stage companies worldwide;

c) Pick the companies that have potential to develop into significant competitors in regional, national and global markets; and

d) Accelerate the commercialization and global deployment of the technologies

- **Using professional venture capitalists, focused venture investing can contribute to sustainable energy economies while making money for investors**

Asian Alternative Energy Unit (ASTE) Program

**Anil Cabraal
World Bank**

Opportunities for Renewable Energy in Asia: The Asia Alternative Energy Unit Experience

Anil Cabraal
Asia Alternative Energy Unit
The World Bank

Overview

- Energy Background in Asia
- Role for World Bank
- From FINESSE to ASTAE
- Asia Alternative Energy Unit (ASTAE)
- ASTAE Objectives
- ASTAE Strategies
- ASTAE Accomplishments
- Summary

From FINESSE to ASTAE

- FINESSE Program initiated 1988 - World Bank, U.S. Department of Energy, Netherlands DGIS, UNDP
- Workshop in 1991 - Identified alternative energy opportunities in Malaysia, Indonesia, Thailand and the Philippines
- Set the stage for Bank, its borrowers and donors to mainstream alternative energy investments in Bank-assisted projects
- ASTAE established in January 1992

Asia Alternative Energy Unit (ASTAE)

- Pilot Program - Asia Technical Department
- Funded principally by the FINESSE donors
- Supported also by other donors on project/task-specific basis
- Small core staff of renewable energy and DSM specialists with support from consultants

ASTAE Objectives

- Mainstream alternative energy projects in Bank lending
- Strengthen institutional capacities to identify, assess and implement projects
- Foster public-private sector partnerships

ASTAE Strategy

- Identify, prepare and supervise alternative energy projects
- Alternative energy planning
- Institutional strengthening
- Policy and regulatory guidance
- Best practices dissemination

Accomplishments

- World Bank/GEF portfolio in Asia: Over \$ 540 million in loans, credits and grants (FY 93-98) in 12 operations
- Significant growth in support for alternative energy in Asia
 - FY 1994 - 0.1% of power sector lending
 - FY 1997 - Exceed 14% of power sector lending
- Supporting studies and Sector Work
 - China: Renewable energy strategy development
 - Best Practices for PV Household Electrification
 - Integration of renewables into least cost electrification
 - Drafting PV specifications

Examples of ASTAE Assisted Projects

Project	Fiscal year	Alt. Energy Loan/Credit/ Grant Amount \$ millions
India: Renewable Resources Development	FY 93	141
Thailand: MEA Distribution Systems & Energy Efficiency	FY 93	9.5
Indonesia: Second Rural Electrification	FY 95	18
India: ORISSA Power Sector Restructuring	FY 96	80
India: Rajasthan Solar Thermal Project	FY 96	57
Pakistan: Energy Efficiency	FY 97	~50
Indonesia: Renewable Energy Development	FY 97	~200
Sri Lanka: Energy Services Delivery	FY 97	~24

Summary

- **ASTAE - Ingredients for Success**
 - Strong Bank management support
 - Donor encouragement and financial support
 - Operations focus on project development and implementation
- **Clients and Bank staff beginning to identify & include projects in national plans and project proposals**
- **Higher levels of resources needed for alternative energy projects due to:**
 - Smaller scale of projects
 - Innovative implementation mechanisms
 - Limited local institutional capacities
- **Impact of current budgetary pressures and restructuring**

**1995 IEA Workshop on the
Role of Financing Organizations in
The Development and Deployment of Renewable Energy Technologies
Washington, D.C. USA
May 15-16, 1995**

**OPPORTUNITIES FOR RENEWABLE ENERGY IN ASIA:
THE ASIA ALTERNATIVE ENERGY UNIT EXPERIENCE**

**Anil Cabraal, Renewable Energy Specialist
Asia Alternative Energy Unit (ASTAE)
Asia Technical Department
The World Bank**

OPPORTUNITIES FOR RENEWABLE ENERGY IN ASIA: THE ASIA ALTERNATIVE ENERGY UNIT EXPERIENCE

Anil Cabraal, Renewable Energy Specialist
Asia Alternative Energy Unit (ASTAE)

Introduction

Alternative energy represents an economically and technically viable source of helping to meet some of the continued load growth in the developing world. As environmental pressures increase, such technology offers a responsible alternative to traditional power sources, such as fossil fuels. Renewable energy and energy efficiency can help meet energy service needs in an ever widening array of applications for sustainable human and economic development. To mainstream these innovative options, cost-effective technologies must be continued to be developed. Furthermore, an effort must be made to strengthen institutional capacities and foster public-private partnerships to enable the developing countries to use these technologies.

Background in Asia

The Asia Region faces a myriad of challenges in its current development process. Asia contains the world's fastest growing economies, its most densely populated areas and the majority of its poor people. Asia's population, estimated at 3.4 billion is almost five times that of the population of all of the Americas. The Region as a whole is experiencing vibrant economic growth, with double digit annual growth rates in some emerging industrial economies of East Asia.

Asia's high rate of energy growth, which reaches 18% per annum in some countries, is fueled by population growth, economic development, an

energy-intensive industrial base and urbanization.

Power generating capacity alone doubled in the 1960's, again in the 70's and again in the 80's. Yet, on a per capita basis, Asia's energy use still amounts to only 1/13th of OECD's commercial energy use and 1/65th of OECD's electricity use.

The annual investments required to meet the growth in Asia's power demand for the next decade are estimated at approximately US\$600 billion or 62% of the world's projected power sector investments. The continued dramatic rise in Asia's energy consumption will require massive financial investments.

Environmental Issues

Rising commercial energy demands in Asia also threaten the environment. Power sector growth is projected to come principally from fossil fuels, primarily coal, oil, gas and from large hydropower developments. Coal and oil burning plants have significant negative environmental effects, as do large-scale hydropower projects. Asian fossil power plant emissions are expected to increase dramatically with local, regional and global consequences. In absolute terms, Asia will easily surpass all of Europe and the U.S. in sulphur dioxide emissions by the year 2000. Similarly, with respect to carbon dioxide, the principal greenhouse warming gas, Asia's emissions are projected to surpass the OECD countries by the year 2015. Conventional fossil and large-scale hydropower plants also result in significant environmental impacts to land and

water. All of these factors point to the need to address inefficiencies in Asia's power sector and to provide energy service needs while reducing the impacts on the environment.

Opportunities for Alternative Energy

These significant power sector challenges offer a unique opportunity to shift our development path toward greater sustainability and environmental and social responsibility. Renewable energy resources and energy efficiency can help address some of Asia's rapidly growing energy needs without adverse environmental impacts. In a region where less than 40 percent of households are connected to the electricity grid, small-scale renewable energy technologies can offer proven, cost-effective and environmentally benign alternatives to grid based centralized power generation for meeting the basic energy service needs. Similarly, in the rapidly growing urban and industrial centers of Asia, grid-connected renewables, energy efficiency, and demand side management (DSM) projects can be justified on economic and environmental grounds. In the near and medium term, Asia's huge power investment program must continue to rely in the main on conventional energy sources. In the longer term perspective, the share of renewable technologies and DSM within total power investments may be appreciable, as new technologies reach commercial viability.

The Role of the World Bank

Historically, the World Bank has provided investment capital for the generation, transmission and distribution of electricity as well as improvements in energy efficiency. More recently, the Bank has revised its power sector strategy and stresses the need for energy conservation and clear regulatory and

institutional frameworks for energy service delivery. The Bank also urges elimination of pricing and tariff barriers and supports commercialization of power enterprises. The Bank's new energy policy is selective. It targets power sector financial assistance only to those governments and energy suppliers who are committed to energy efficiency. The Bank seeks to strengthen specified institutional frameworks for demand-side management and market information, process and technology-intermediation functions. The Bank also supports the economic development of alternative fuels such as mini-hydro, PV, geothermal, wind energy, and biomass.

The FINESSE Program

In 1988, in association with the U.S. Department of Energy, (USDOE), the Netherlands Directorate General for Development Cooperation (DGIS), and the United Nations Development Programme, (UNDP), the World Bank initiated the FINESSE Program to identify opportunities for "Financing Energy Services for Small-Scale Energy End-Users" in Thailand, Malaysia, the Philippines and Indonesia. Much was learned from the FINESSE process. Country-specific "Energy Sector Market Studies" were conducted to identify economically and technically viable renewable energy and DSM project proposals in all four countries. Considerable enthusiasm was generated at the country level. The FINESSE program did not focus on institutional constraints within the countries nor the fit of project proposals within overall country development strategies. Participation of Bank staff working on Asia Region was limited. While FINESSE did not result immediately in lending for alternative energy by the Bank, it did set the stage for the Bank, its borrowers and the donor community to

continue and strengthen the process throughout Asia.

The Asia Alternative Energy Unit (ASTAE)

As a direct result of the FINESSE experience, the World Bank established the Asia Alternative Energy Unit (ASTAE) in January 1992. ASTAE is a pilot program, funded principally by the FINESSE partners - the World Bank, the Netherlands DGIS, the US DOE and the UNDP.

The Unit is also supported by the U.S. Agency for International Development, the German BMZ and other donors.

ASTAE was established in the Asia Technical Department to help prepare alternative energy projects, formulate alternative energy policies, provide technical assistance and training, best practices dissemination, follow-up of viable FINESSE project proposals, collaboration with donor agencies, and resource mobilization. The principal objective of the Unit is to identify, prepare, and supervise alternative energy service delivery and energy efficiency and DSM options. ASTAE works with the operational staff who manage the Bank's portfolio and pipeline of projects in Asia. Since 1992, ASTAE has supported 12 renewable energy and energy efficiency operations in India, Indonesia, Sri Lanka, Thailand, the Philippines, the People's Republic of China, Mongolia, and the Lao PDR. The Unit has also piloted innovative capacity building approaches e.g. South-South twinning arrangements, private-public sector partnerships for policy elaboration and "facilitated" workshops that enhance skills development through "learning by doing". Quantifiable results are reflected in the growing World Bank/GEF portfolio of assistance to Asia for alternative energy projects or project components, which have increased from nearly

zero to over US\$540 million in 12 Bank/GEF loans, credits, and grants. These include six operations in East Asia and the Pacific (EAP) for US\$236 million and six operations in South Asia (SAS) for US\$310 million. The Bank/GEF projects that incorporate a renewable energy component are listed in Table 1, on the next page.

Main operations within the portfolio and pipeline of World Bank and GEF-supported projects include a loan/credit for the \$141 million India Renewable Resources Development project, the \$24 million Sri Lanka Energy Services Delivery Project, the \$18 million mini-hydro and geothermal components of the Indonesia Second Rural Electrification project, an institutional strengthening component of the Lao PDR Provincial Grid Integration project and the proposed Indonesia Renewable Energy Development Project. Requests for assistance has been received for potential projects in the Philippines, Vietnam, India, Nepal, and Pakistan.

In FY94, 0.1% of the total World Bank's Asia power sector lending was allocated to renewable energy technologies. It is projected that this figure will exceed 14% by FY97, meeting ASTAE's target of at least 10% by FY96.

In addition, ASTAE is conducting supporting studies and participating in Sector Works. In all cases, the studies are either directly linked to Bank lending programs or support economic or policy studies that will ultimately influence alternative energy work. This study and sector work are summarized in Table 2, on page 5.

TABLE 1. World Bank/GEF Alternative Energy Projects (FY92-FY98)*

COUNTRY	FISCAL YEAR	ASTAE SUPPORT	STATUS	PROJECT NAME ^b	ALTERNATIVE ENERGY COMPONENT	ALTERNATIVE ENERGY LOAN/CREDIT AMOUNT (million USD)
Nepal	92		Supervision	Telecommunications V	Renewables	2.0
India	93	✓	Supervision	Renewable Resources Development ^c	Renewables	141.0
Thailand	93	✓	Supervision	MEA Distribution Systems & Energy Efficiency ^d	DSM	9.5
Lao PDR	93	✓	Supervision	Provincial Grid Integration ^e	DSM	1.5
Indonesia	94		Supervision	Sumatra & Kalimantan Power	DSM	1.8
Indonesia	95	✓	Supervision	Second Rural Electrification ^f	Renewables	18.0
India	96	✓	Negotiations	Orissa Power Sector Restructuring	DSM	80.0
India	96	✓	Preparation	Solar Thermal Power	Renewables	57.0
China	97		Preparation	Energy Conservation Project	DSM/Efficiency	50.0
Pakistan	97	✓	Preparation	Energy Efficiency	Efficiency	50.0
India	97	✓	Pre-appraisal	Uttar Pradesh Power Sector Restructuring	DSM	70.0
Indonesia	97	✓	Pre-appraisal	Renewable Energy Development ^g	Renewables	185.0
Pakistan	97		Preparation	Waste to Energy	Renewables	11.0
Sri Lanka	97	✓	Pre-appraisal	Energy Services Delivery ^h	Renewables/DSM	24.0
Vietnam	97	✓	Pre-appraisal	Dai Ninh Hydro Power	DSM	5.0
India	97	✓	Preparation	Stand-Alone DSM	DSM	100.0

* Effective dates on figures are May 10, 1995.

^b Includes lending for free standing projects and project components.

^c Private sector investments in solar PV, wind farms, and mini-hydro subprojects (GEF)

^d GEF-supported five-year DSM plan.

^e Technical assistance for DSM institutional building.

^f Small geothermal and grid-connected mini-hydro components and technical assistance for planning the integration of renewables into rural electrification.

^g Lending may reach US\$250 million. Includes support to private sector for grid-connected and off-grid solar PV, biomass, and mini-hydro, and support to PLN for mini-hydro and mini-geothermal.

^h Possible components include off-grid solar PV and micro-hydro; grid-connected mini-hydro and a pilot wind farm; and DSM.

TABLE 2. Supporting Studies and Sector Work Conducted by ASTAE

COUNTRY	FISCAL YEAR	DESCRIPTION OF ACTIVITIES
China	96	Renewable Energy Strategy Development
India/Thailand	96/97	Lessons Learned from Load Research and Management
Lao PDR	94/95	Twinning Arrangements for Institutional Strengthening, Lower Costs, Export Earnings, and Efficient Domestic Consumption
Lao PDR	95	Commercial Sector Audit Workshop for Lao PDR Power Utility Staff
Mongolia	95	Energy Sector Review -- Renewable Energy and Efficiency Opportunities in the Isolated Energy Systems
Philippines	96	Performance Testing of Compact Fluorescent Lamps (CFL) and Market Research to Assess Current and Potential Market for CFLs
Philippines	96/97	Report Summarizing DSM Collaboration Efforts
Sri Lanka	95/96	Survey of Electrified and Non-Electrified Households in Rural and Urban Areas to Determine Energy Usage
Sri Lanka	ongoing	Assistance in Formulating Standard Power Purchase Agreements (PPA) in Sri Lanka
Regional	95/96	Analysis tools for Integration of Renewables in Least Cost Electrification Planning
	95/96	Best Practices for Solar Photovoltaics in Household Electrification with Case Studies in the Philippines, Indonesia, Sri Lanka, and the Dominican Republic
	ongoing	DSM Training Workshops
	ongoing	Papers, Presentations, Conferences
	ongoing	Peer Reviews of Bank-produced studies

The ASTAE Model

The Asia Alternative Energy Unit, in partnership with our client countries and Bank, staff follows three key principles:

- (1) Mainstream alternative energy options at all levels of decision making;
- (2) Strengthen institutional capacities to identify, assess and implement proven, cost-effective alternative energy options; and
- (3) Foster public-private sector partnerships in the energy development process.

These three principles have been applied in both "top-down" and "bottom-up" approaches to the activities of the World Bank, the national governments, the private sector, NGOs and the end-users themselves.

Mainstreaming Alternative Energy

ASTAE has made progress in mainstreaming alternative energy in both the Asia region of the Bank as well as the Asian countries in which it is presently working. ASTAE has accomplished this chiefly through its assistance to Bank staff and borrowers in project preparation and supervision. It has also supported increased attention to renewable energy and energy efficiency/DSM in Bank policy work and the Bank's dialogue with borrowers. In this process, ASTAE has provided alternative energy information, analytical tools and technical assistance at all levels of the project development cycle.

In the area of information, ASTAE has:

- (a) has supported pre-feasibility studies for wind, solar photovoltaics, small-hydro and biomass cogeneration in Indonesia and Sri Lanka, as the public or private sector is unwilling to spend its resources on such studies when little is known of the commercial viability of the alternative energy projects. ASTAE also recently

participated in a reconnaissance of potential renewable energy opportunities in China and Mongolia;

- (b) conducted information and training seminars as well as Study Tours and exhibitions on renewables and energy efficiency for Bank staff and client country representatives;
- (c) conducted case studies of PV rural electrification experiences in Indonesia, the Philippines, Sri Lanka and the Dominican Republic within a "Solar PV: Best Practices for Household Electrification Study." This Study outlines the conditions and actions that are necessary for increasing the success ratio of this renewable energy option; and
- (d) compiled a database on energy efficiency and renewable energy technologies for Bank staff and client countries.

In the area of analytical tools, ASTAE has:

- (a) developed a "Least Cost Modeling Tool" used in the appraisal of the Indonesia Second Rural Electrification Project. The model allows economic analysis of conventional versus non-conventional energy options in grid-connected rural electrification planning with the objective of determining the economic least-cost option. This model will be expanded to analyze off-grid energy service options;
- (b) helped develop testing and performance standards for energy efficiency (CFL) and renewable energy technologies (PV, wind, micro-hydro); and
- (c) helped develop environmental guidelines for small-scale alternative energy projects which were used in the appraisal of the Indonesia RE II Project and assisted in formulating tender evaluation procedures in the India Renewable Resources Development Project.

In the area of technical assistance, ASTAE functions as an in-house and external resource for staff in the Asia Region and elsewhere in the Bank. It has also given short-term technical assistance to key institutions in client countries.

ASTAE consists of a small core of full-time technical experts as well as short-term consultants. The Unit is called on increasingly to assist the operating divisions of the Bank in project identification, formulation, appraisal and supervision work. In the process, ASTAE has helped to:

- Integrate least-cost alternative energy options into country energy development strategies;
- Identify and prepare feasible alternative energy projects;
- Bundle small-scale alternative energy investments into larger energy projects; and
- Design for private sector participation in the implementation of alternative energy projects.

Strengthening Institutional Capacities

ASTAE has worked to strengthen institutional capacities within the Bank and in key institutions in client countries. Within the Bank, ASTAE is an advocacy arm for alternative energy options. More important, it is a source of technical expertise for the operational divisions in the Asia Regions. In the case of strengthening the institutional capacities of the developing countries, ASTAE has:

- (a) customized technical assistance based on country specific needs. ASTAE's technical assistance builds on local capacity to support proposed alternative energy investments. The Unit has coordinated technical assistance for mini-hydro and mini-geothermal project preparation in Indonesia, development of PV bid specifications in India, Indonesia,

and Sri Lanka, and evaluation of micro-hydro plant rehabilitation in Sri Lanka. Prior to developing DSM strategies, ASTAE provided technical assistance for electricity consumption assessments to Thailand and the Lao Peoples Democratic Republic and is now engaged in similar efforts in Sri Lanka. Similarly, ASTAE has provided assistance to the Philippines for testing compact fluorescent light bulbs and to Indonesia for energy efficiency improvements in commercial building designs.

- (b) south-south twinning arrangements to transfer knowledge and practices. ASTAE actively promotes south-south cooperation for institutional strengthening, for the mutual benefits it offers the provider and receiver organizations. ASTAE has helped twinning Electricite du Laos with Malaysia's utility TENAGA and Tunisia's Agence pour la Matrise de l'Energie for organizational and management training.
- (c) use of local consultants. ASTAE makes a deliberate effort to identify and utilize qualified local consultants whenever possible to build local technical capacity to develop and sustain alternative energy projects. This has been done in the India Renewable Resources Development project, preparation for the Indonesia RED project, and in identification of the Sri Lanka Energy Services Delivery project.
- (d) targeted support for key institutions. ASTAE works to establish and strengthen key institutions for alternative energy development. In Thailand, ASTAE has helped define a new role and function for the Energy Conservation Center of Thailand (ECCT). In Indonesia, ASTAE has helped establish a PV Steering Committee to identify appropriate village cooperatives for PV energy services.

- (e) training. ASTAE organizes, supports and provides training in all aspects of renewable energy and energy efficiency project development. This includes Bank staff training and, for client Asian countries, the training of trainers as well as in-country workshops on economic and financial methods for renewable energy project appraisal, conducting of energy audits and formulation of least cost electrification and DSM strategies.

Fostering Public-Private Sector Partnerships

ASTAE initiatives to promote public-private sector partnerships include:

- (1) **Draft small power purchase agreements.**
One of the most promising areas for public-private sector partnerships is private power generation for sale to the public sector controlled grid. ASTAE is helping Bank staff and country counterparts in Sri Lanka formulate small power purchase agreements for power generation from renewable energy sources.
- (2) **Private sector participation.** ASTAE is supporting the continuing Bank dialogue in encouraging private sector and NGO participation in delivering energy services. In Sri Lanka, India, and Indonesia, ASTAE is assisting in the preparation of business plans for promotion of both grid (biomass cogeneration and wind farms) and off-grid (PV and micro-hydro) energy services.
- (3) **Establishing standards and guidelines.**
The private sector likes clear standards and guidelines to facilitate risk assessment. In the case of the Indian Renewable Resources Project, ASTAE is helping establish guidelines for bid documentation, tender evaluation and project development.
- (4) **DSM collaborative process.** Conflicting objectives among energy planners,

regulatory boards, utilities and consumers can delay or hinder DSM implementation. In this regard, the U.S. has had a positive experience with the "Collaborative DSM Process", which is based on an open and free dialogue among energy shareholders with the objective of reaching mutually acceptable agreements and compromises. Drawing on this experience, ASTAE has initiated a pilot DSM collaborative process in the Philippines, working directly with the Philippine Energy Regulatory Board, MERALCO - the municipal utility of Manila - and private sector and consumer organizations.

Summary

The ASTAE approach presents a useful model of how a multi-national development institution can help integrate alternative energy options into energy delivery services. There is recognition among Bank staff and our client countries that renewable energy is technically and economically viable and an environmentally benign source of energy. Increasingly, client countries are including alternative energy investments in their national plans, and Bank operational staff are identifying further opportunities. This suggests that the achievement of the objective of integrating alternative energy with the Bank's usual operational work is not far off.

The current climate of the World Bank is cause for concern. Due to major budgetary cuts and restructuring, the ground-breaking work of ASTAE is facing major financial pressures. Available resources are limiting the number and scope of these innovative projects. It is crucial for multilateral development institutions involved in the energy sector to be committed to such alternative energy programs to ensure their continued promotion, preparation, and implementation.

Three key elements from the ASTAE model underlie achievements reached thus far. First,

strong Bank management support for the work of the Unit has been essential for its effectiveness. Second, but equally important, has been the donors' encouragement and financial assistance. Finally, ASTAE's strength derives from its clear operational focus on project development and implementation.

As developing nations industrialize, the need for power generation is critical. These countries will demand the most attractive energy source options available, in terms of available reliable technologies, power output, and financial feasibility. This represents a key opportunity to supply alternative energy technologies either for small electricity systems, or for grid-based power generation. The importance of continued research, development, and promotion of renewable energy as a solution to capacity shortfalls and increasing environmental pressures must be stressed. Sustainability issues, such as global warming, fossil fuel dependency and depletion, massive oil spills, and increasing costs, further lead to renewable energies as the responsible option over traditional power sources.

**International Finance Corporation
Financing
For
Renewable Energy Projects**

**Gunter Schramm
(IFC)**

BACKGROUND SLIDES

**prepared for the
WORKSHOP**

**THE ROLE OF FINANCING ORGANIZATIONS IN THE
DEVELOPMENT
AND DEPLOYMENT OF RENEWABLE ENERGY**

**May 15th & 16th, 1995
Washington, DC**

IFC FINANCING OF RENEWABLE ENERGY PROJECTS

Presented by

GUNTER SCHRAMM, Ph.D., IFC Consultant

IFC's ROLE:

- RESOURCE MOBILIZATION FOR THE PRIVATE
SECTOR IN DEVELOPING COUNTRIES**

BENEFICIAL ROLE

- ✦ IFC Presence Reassures
 - ✦ Foreign Investors
 - ✦ Local Partners
 - ✦ Governments
- ✦ Honest Broker/Neutral Partner
- ✦ Measure of Political Risk Cover
- ✦ Catalyst for Other Investors and Lenders

IFC

IFC Slide Presentation

Slide No. 11

IFC's status as an independent international organization -- which understands and works comfortably with both the private sector and host country governments -- makes it an attractive partner for foreign and local investors and gives them an added measures of confidence. IFC has played the role of "honest broker" in helping companies and sponsors negotiate with host governments. In addition, the Corporation's position as a "neutral partner" reassures foreign investors and host countries. Since our role is to help their development, governments trust IFC and companies know that we understand private sector needs. Foreign investors seek IFC's participation because of the Corporation's extensive hands-on knowledge of how to do business in developing countries and excellent relationships with developing country governments. Since it acts as a catalyst and induces other financiers and investors to participate, IFC's presence is considered beneficial to a project -- from a political as well as a technical and financial standpoint. Because of IFC's extensive project financing experience, we have a large network of company contacts and a special ability to match sponsors and partners with investors.

INVESTMENT GUIDELINES

- ✦ Private Sector
- ✦ Financially, Economically and Environmentally Sound
- ✦ 25% Maximum Share of Project Cost
- ✦ Investment Size
 - ✦ \$1 Million to \$100 Million Standard Projects
 - ✦ \$100,000 to \$1 Million Small and Medium Projects

IFC

IFC Slide Presentation

Slide No. 18

In order to receive funding, projects must meet a number of IFC guidelines. Whether it is the establishment of a new enterprise or the expansion of an existing one, the project must be in the private sector, it must be technically sound, it must have a good prospect of being profitable, and must benefit the local economy. Another important criterion for IFC investments is that the project be environmentally sound. Thus, in addition to being financially, economically, and technically viable, the project in question must satisfy our stringent environmental standards and conform to host country and World Bank guidelines.

To ensure the participation of other private investors, IFC's investment is usually limited to 25 percent of the total project cost. Investments in small and medium projects range from \$100,000 to \$1 million and in standard-size projects from \$1 million to \$100 million.

SERVICES OFFERED

✦ Financial Products

✦ Loans, Equity, Quasi Equity and Risk Management Facilities

✦ Resource Mobilization

✦ Loan Participations, Capital Markets and Underwriting

✦ Advisory Services

✦ Country, Industry, Financial and Technical

IFC

IFC Slide Presentation

Slide No. 12

IFC offers three broad and complementary services. Our traditional and largest activity is project finance. Using our own funds we provide both loan and equity finance to private sector projects that meet our appraisal criteria, but which cannot get financing from other sources on reasonable terms. We also offer quasi equity and financial risk management products. It is important to point out that, although we lend on market terms, we do not compete with but -- in fact -- complement private capital.

Another major activity is that of resource mobilization. IFC raises additional funds from foreign commercial banks through its loan participation program. It helps individual corporations from emerging markets to tap the international capital markets. IFC also raises funds from institutional investors through underwriting arrangements for public offerings or the private placement of shares, debentures, and other corporate securities.

Our third and increasingly expanding activity is providing country, industry, financial and technical advisory services to member country governments and to private sector corporations.

RESOURCE MOBILIZATION: SOURCES OF PROJECT FINANCE

Total 1994 Project Cost: \$16 Billion

*Key Catalytic Role:
\$1 from IFC Attracted \$5.43 From Other Investors and Lenders*

IFC

IFC Slide Presentation

Slide No. 23

Mobilizing funds from other investors and lenders is one of our essential functions, as we actively seek partners for joint ventures and raise additional finance by encouraging other institutions to make investments in our projects.

In 1994, for every \$1 of project financing approved by IFC for its own account, other investors and lenders provided \$5.43 -- either directly through IFC's loan participations or underwriting of investment funds and securities issues, or indirectly, in the form of co-financing.

1994 FINANCING BY REGION

IFC Slide Presentation

Slide No. 17

In keeping with our global perspective and goal of achieving geographical diversity in investments, our \$4.3 billion in financing in 1994, was spread over six regions as follows: Latin America (\$1,577 million or 37%), Asia (\$1,229 million or 29%), Central Asia, the Middle East and North Africa or CAMENA (\$599 million or 14%), Europe (\$596 million or 14%), Africa (\$226 million or 5%), and Global (\$61 million or 1%).

The above figures are inclusive of syndications. Exclusive of syndications, the percentages are as follows: Latin America 19%, Asia 14%, Europe 10%, CAMENA 9%, Africa 4%, and Global 1%. (Total 57%, i.e. 43% of financing comes from syndications.)

AFRICAN MANAGEMENT SERVICES COMPANY

- ✦ Technical & Management Services to Potentially Viable Companies
- ✦ In-House & Overseas Training for African Managers
- ✦ Hands-on Managers, not Consultants
- ✦ Supported by ADB, UNDP, IFC, & the Governments of 11 Countries
- ✦ Assisted 25 Projects in 15 Countries

IFC

IFC Slide Presentation Slide No. 41

Another significant IFC activity in sub-Saharan Africa is the African Management Services Company (AMSCO), set up in 1989 and incorporated in the Netherlands. AMSCO serves as a sub-contractor to IFC to execute the Africa Training and Management Services Project, a joint initiative of IFC, UNDP and the African Development Bank.

AMSCO's main objective is to help rehabilitate ailing companies in sub-Saharan Africa and create a pool of well-qualified African managers. It thus contributes to the development of locally managed businesses that are profitable, competitive, self-sufficient, and integrated into the international business community. AMSCO also provides its client companies with experienced business executives while it trains the staff and managers of these companies to take over.

By the end of 1993, AMSCO's portfolio consisted of 25 projects located in 15 African countries. \$8.9 million in loans and \$3.1 million in training grants were made to these companies.

IFC' Role In Renewable Energy Development

GLOBAL ENVIRONMENTAL CHALLENGES

- ✦ IFC is Private Sector Window into Global Environment Facility & Montreal Protocol
- ✦ IFC Helps Private Sector Develop Projects that Promote Objectives of Climate Change & Biodiversity Conventions

IFC

IFC Slide Presentation

Slide No. 70

Concern about depletion of the earth's non-renewable resources and the limited capacity of the earth to absorb or recycle wastes has led to a growing awareness that efforts to address these issues need to be coordinated. IFC is helping to develop private sector projects that promote some of the objectives of international conventions such as the Framework Convention on Climate Change (FCCC), the Convention on Biological Diversity and the Montreal Protocol on Substances that Deplete the Ozone Layer. Such projects target energy efficiency, reducing natural gas flaring, and phasing out the use of chlorofluorocarbons, halons, and other ozone-depleting substances. IFC is also increasing communication and coordination with multilateral and bilateral development agencies, environmental businesses, and NGOs.

Two sources of multilateral grant funds for private sector projects are the Global Environment Facility and the Multilateral Fund for the Implementation of the Montreal Protocol. Projects are being evaluated in India, the Slovak Republic, Turkey, and in countries in Africa, Latin America and the Caribbean.

In support of the FCCC, IFC and the World Bank are collaborating on the development of a feasibility study and business plan to determine the role of private sector investment in the mitigation of greenhouse gases and carbon-offset activities and to assess capital requirements.

POTENTIAL IFC AND GEF ROLES IN FUTURE SOLAR ENERGY INVESTMENTS

NON-RECOURSE PROJECT FINANCE

- debt/equity investments in commercial technologies in developing countries
- GEF grants to "buy-down" capital cost difference for qualifying technologies alongside conventional IFC project financing

GENERAL MANUFACTURING/CORPORATE FINANCE

- debt/equity investments in manufacturing/assembly of commercial technologies in developing countries
- GEF grants to support investments in manufacturing/assembly investments for pre-commercial technologies

PRIVATE EQUITY/VENTURE CAPITAL FUNDS

- provide equity financing for smaller projects (5-20 MW) and promising new applications (off-grid power) involving solar and renewable energy technologies
- bilateral and GEF funds to assist with "soft costs" of project preparation, technical and institutional risks of qualifying projects or technologies
- fund management by an independent party with IFC and other key investors contributing initial capital

**THE LIMITATIONS OF CONVENTIONAL ENERGY
SUPPLY STRATEGIES**

EXAMPLE:

**THE SOUTH AFRICAN ELECTRIFICATION
PROGRAM**

STATUS OF ELECTRIFICATION IN S.A. - 1993

(000)

	METRO	TOWNS	FARMER H	TRUST AREAS	TBVC	NAT. STATES	TOTAL
TOTAL DWELLINGS	2 406	1 407	651	85	1 201	1 597	7 347
WITH ELECTRICITY	1 849	848	143	21	114	347	3 322
WITHOUT ELECTRICITY	557	559	508	64	1 087	1 250	4 025
% WITHOUT ELECTRICITY	23	40	78	76	90	78	55
POTENTIAL	435	283	270	43	347	427	1 807
"LEFT-OVER"	122	276	238	21	740	823	2 218

NOTE: * UCT DATA USED TO CALCULATE FARM ELECTRIFICATION
 SOURCES: DBSA, URBAN FOUNDATION, ESKOM, DINGLEY, TESCOT, VEKOR, DECOR, NEC, CSIR

STATUS-11
 Nov 1993

J ENGELBRECHT
 NATIONAL ELECTRIFICATION PROJECT MANAGEMENT MANAGER

**DOMESTIC CUSTOMER CONSUMPTION LEVEL: FREQUENCY DISTRIBUTION
ESKOM DISTRIBUTORS: TOTAL
(PRE-PAYMENT) 1993**

Durban option 2 April

Electrification Programme

Net Income (1993 Rands)

A CONCEPT:

RENEWABLE ENERGY AND ENERGY- EFFICIENCY FUND

CONCEPT:

Mobilize Private Sector Funds for Renewable Energy Efficiency Projects, Meeting Private Sector Quality Returns and Fulfill Public Policy Objectives

DEMAND FOR FUNDING:

There is a pervasive Lack of Funding Sources for Technically Sound, Economically Sensible and Environmentally Superior Energy Production Projects

CAPITAL FORMATION DIFFICULTIES FOR RENEWABLE ENERGY PROJECTS

Projects are Smaller in Size; they Require more Time and Support to Bring them up to Investor Quality; there is need for training, institutional change.

TECHNOLOGY CHOICE:

Wide range of Technological Alternatives. Projects sometimes Compete with Established Energy Technologies (i.e. Network Electricity), sometimes they Focus on New Market Opportunities (Remote Area Energy Supplies).

Examples:

Wind, Geothermal, Low-Head Mini-Hydro, Off-Grid Photovoltaic, Energy Efficiency Projects (DSM).

POTENTIAL ROLE FOR INVESTMENT FUND:

Be Catalyst, Provide Leadership, Combine Private Sector Funding with Public Sector Support Activities and Funding.

EXAMPLE:

**POTENTIAL IFC ROLE IN FINANCING OF OFF-
GRID PV ELECTRIFICATION**

OPPORTUNITIES:

**Expansion of PV Manufacturing and Assembly
Operations**

**PV Equipment Leasing Companies, including Local PV
Utilities.**

Distributor/Dealer Inventory Financing

**Support of Centralized, PV-Powered Battery
Recharging Stations**

**Provision of Consumer Credit Facilities for Acquiring
PV Equipment.**

NEEDED PUBLIC SECTOR/DONOR SUPPORT ACTIVITIES

**Private Sector PV Market Development Activities face
Serious Obstacles:**

- **Lack of PV Distribution Infrastructure**
- **Lack of Credit Facilities**
- **Lack of Service & Maintenance Capabilities**
- **Lack of Financing & Facilities for the Training of
Technical Personnel.**

Commentary

**Judy Siegel
U.S. Export Council
For
Renewable Energy**

Barriers to Alternative Energy Technologies

U
S
E
X
P
O
R
T
C
O
U
N
C
I
L
F
O
R
R
E
N
E
W
A
B
L
E
E
N
E
R
G
Y

Technology
Awareness

Financing/Risk
Perception

Policy

Institutional

Spectrum of RE Financing Options

General Comments on Emerging RE Financing Mechanisms

- Validate Maturation of RE Technologies
- Strong and Growing RE Project Base
- Recognize Host Country Public / Private Sector in RE Interest in Renewables
- Establish Critical Need for "Affordable" Financing Schemes
- Spectrum of Financing Options Reflects Diversity in Customer Base and Technologies

Asia Alternative Energy Unit Experience

Strengths

- Successful, Highly Leveraged Program in Mobilizing Bank RE Lending in Asia
- Enhanced Technical/Institutional Capabilities in RE by Bank Staff and Host Country Officials
- Focus on Public Sector
 - But Increased Emphasis on Sustainable Public-Private Sector Partnerships

Asia Alternative Energy Unit Experience

Weaknesses

- Lengthy Project Development Cycle
- Focus To Date Has Been on Energy Sector; Need Better Integration With Related Sectors
- Bank Cutbacks Threaten Future RE Funding
- Lack Of Bank Policies on RE
- ASTAE Model Has Not Been Effectively Replicated in Other Bank Regions

Recommendations

- Enhanced Coordination of Bilateral "Policy" Support for RE At Highest Levels in Bank
- Mobilization of Bilateral "Financing" Support for ASTAE, Related Activities in Bank, and Other MDBs

International Finance Corporation

Strengths

- Targets Private Sector
- Helps to Reduce Risk of Private Investors
- Leverages Funding From Other Sources
- Seeks Projects that Contribute to Climate Change and Biodiversity Conventions
- Proposed Renewable Energy and Efficiency Fund Would Enhance Dedicated RE Private Sector Financing

International Finance Corporation

U
S
E
X
P
O
R
T
C
O
U
N
C
I
L
F
O
R
R
E
N
E
W
A
B
L
E
E
N
E
R
G
Y

Weaknesses

- Traditional IFC Financing Threshold Has Been Too High for RE
- Lack of Available Funds for Project Preparation

Recommendations

- Provide Bilateral Support for Expanded IFC Activities in Renewables
 - Existing IFC Programs
 - Dedicated RE/EE Fund

Venture Capital

Strengths

- Finance New, Rapidly Growing Companies, Like RE Firms, Through Equity Participation
- Take on Higher Risks
- Access Non-Traditional Sources of Capital
- New Energy Funds Demonstrate Investor Interest in Climate Change and Renewables

Venture Capital

Weaknesses

- Venture Capitalists Seek High Return on Investment
- Typical Venture Capitalists Have Focused on the Domestic Marketplace

Recommendation

- Enhance Linkages Between Venture Capitalists and RE Firms to Explore Opportunities for Collaboration
- RE Companies Need to Evaluate Venture Capital Funds based on their Organizational Needs, Goals and Objectives

Conclusions

- RE Offer Enormous Benefits
- Financing Access in Increasing
- Need to Continue to Focus on Development Of Bankable, Replicable Models
- Bilateral Support is Key to Expanded MDB Activities in RE

**Renewable Energy Project Support
At
The United Nations Development
Programme**

**Richard Hosier
(UNDP)**

UNDP'S INITIATIVE FOR SUSTAINABLE ENERGY

Richard H. Hosier

**Energy and Atmosphere Programme
Sustainable Energy Department
United Nations Development Programme**

May 15, 1995

OUTLINE

I. Introduction

II. UNDP: Its Role in Technical Assistance and Capacity Building

III. Sustainable Energy: What is it?

IV. Toward a Sustainable Energy Programme

V. Conclusions

II. UNDP: Its Role in Technical Assistance and Capacity Building

Goals:

- 1) Strengthen International Cooperation for Sustainable Human Development
- 2) Help the UN become a unified and powerful force for sustainable human development; and
- 3) Focus UNDP's own resources on making the maximum contribution to key dimensions of sustainable human development

Four priority areas for UNDP's programmes are:

- 1) Poverty Elimination;
- 2) Environmental Regeneration;
- 3) Job Creation; and
- 4) Advancement of Women

III. Sustainable Energy: What is it?

Focus is on Level of Energy Services

not

the Quantity of Energy supplied, Consumed, or Sold

An increase in the level of energy services can be brought about by:

an increase in energy supply

or

an increase in the efficiency of energy use,

(or both)

Sustainability: Improving the level of energy services without
compromising the needs of present or future generations

Therefore, UNDP's Sustainable Energy Initiative Will Focus On:

Energy Efficiency:

not just the efficiency of existing facilities, but the efficiency of those facilities yet to be built

in many cases, it is the infrastructure to be built which will determine future energy requirements

Renewable Energy Work:

Solar PV

Solar Thermal

Wind Power

Biomass Power

Fuel Cell Buses

Other renewables, such as small hydro

Traditional Model of Technology Transfer Needs Modification

Many of the innovations relevant for developing countries have not been pioneered in developed countries

Ensure new, more efficient, more appropriate technology,
not old or inappropriate technology

IV. Toward a Sustainable Energy Programme

- UNDP will work with developing countries to strengthen indigenous capacity in the energy area
- UNDP will help countries to create supportive legal, legislative and regulatory environment
- UNDP will encourage countries to engage in "Leapfrogging" through supporting innovative demonstration projects and promoting new technologies consistent with sustainable energy development
- UNDP will help countries formulate national energy action programmes
- UNDP will work with governments, bilaterals, multilaterals and private sector to encourage greater financing for sustainable energy related initiatives (eg., FINESSE, and GEF)

V. Conclusions

1) UNDP has adopted a focus on sustainable energy:

The level of energy services, not the absolute quantity of energy produced or consumed

Priority will be given to strengthening human and institutional capacity in this area and creating the correct policy environment to see these initiatives implemented

Focus will be on:

Renewables and Energy Efficiency

2) Given the Strengths of UNDP, attention will be given to:

coordinating sustainable initiatives in the energy sector;

enabling countries to follow through on those initiatives;

convening those involved to build a consensus around future plans and alternatives; and

supporting projects and programmes strategically designed to increase the impact of those initiatives through leveraging additional finances and projects (eg., FINESSE, and GEF)

Working with:

Governments;

Non-governmental organizations;

Bilateral Donors;

Multilateral Development Banks and Agencies; and

Private Sector

3) UNDP'S Sixth Programming Cycle

During 5th Cycle, over US\$200 million was devoted to energy-sector projects with little or no conditionality or ability to steer

25% on Renewables;

30% on Conservation & Planning;

50% on Conventional Energy (and Nuclear Safety)

In 1996, UNDP will begin working with programme countries to redefine priority programmes for Sixth Cycle, 1997-2002

To the extent possible, these priorities will be steered into support for sustainable energy programmes

4) UNDP: An Invaluable Collaborator in the Sustainable Energy Arena

Not primary financier

Important source of grant funds in energy area

Create "enlightened demand" for renewable energy and energy efficiency around the world

Allies in working toward a sustainable energy future.

**UNIDO's Program
For
Promoting Solar Energy Applications**

**Anthony Bromley
(UNIDO)**

WHAT IS CASE?

CASE stands for

International
Centre for Application
of Solar Energy

CASE!

A joint initiative of

- **UNIDO**
- **Federal Govt. of Australia**
- **Western Australian Govt.**

APPROACH...

"LIFE CYCLE APPROACH"

Will facilitate projects from
inception through to operations
and maintenance phase

CASE OBJECTIVES

- **Advocate and promote the adoption of solar energy technologies in developing countries**
- **Promote international collaboration between research institutions, energy agencies and commercial entities in solar energy**
- **Assist in the development and application of solar energy technologies appropriate to the needs of developing countries.**

- **Promote the commercialisation of solar energy technologies, and technology transfer to developing countries.**
- **Provide training for people in every aspect of solar energy technologies from evaluation to end-user maintenance.**

How CASE Works?

*CASE works with
international & local
industries and
institutions to achieve
sustainable solutions*

CASE Services include

- Project Definition Studies
- Feasibility Studies
- Determining Method of Finance
- Project Implementation
- Project Management
- Training

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

VIENNA INTERNATIONAL CENTRE

P.O. BOX 300, A-1400 VIENNA, AUSTRIA

TELEPHONE: 211 310 TELEGRAPHIC ADDRESS: UNIDO VIENNA TELEX: 135612 uno a FAX: 232156

UNIDO'S Programme for the Promotion of New and Renewable Energy Technologies

1. *Background*

The promotional work on new energy technology has to be seen within the overall framework of UNIDO's activities on energy and industry. The organization addresses both the supply side, through the provision of energy for industry and the demand side, by improving industrial energy use efficiencies in developing countries.

Some 60 energy-related projects with a total budget of around US\$20 million are currently under implementation by UNIDO. These projects relate to policy institutional and enterprise level. By fostering the development of efficient cost effective and environmentally sound energy systems, UNIDO's activities promote industrial development and support developing countries' strategies for climate change mitigation.

Energy use in developing countries has risen by more than fourfold over the last thirty years, and is expected to continue increasing rapidly in the future. Energy services are essential for industrialization and economic growth, improving living standards.

Industry's share of energy consumption ranges from 27% in Africa to 38% in Latin America and 49% in Asia. In addition to industrial growth, there has been structural change in the manufacturing sector in developing countries, away from traditional labour-intensive light manufacturing toward more energy intensive production and processing of raw materials. Urban growth, electrification and developing basic infrastructure all raise energy intensity during industrialization.

As a result, the World Energy Conference projects that by 2020, developing countries will account for 40% of global energy consumption, up from today's level of 25%. This will require a tripling of energy supplies, presenting major financial, institutional, technological and environmental challenges to developing countries.

Many developing countries rely on imported oil of virtually all their commercial energy needs, and further increases in energy imports will impose a heavy burden on limited foreign exchange resources.

Energy production and use is already a major cause of environmental degradation and pollution in developing countries. Energy use also contributes to anthropogenic emissions of greenhouse gases and their associated climate change.

2. *New Energy Technology*

The promotional programme on new energy technology is a component of the wider activity on new technologies. It stems from recommendation of the UNIDO International Forum on Technological Advances and Development held in April 1983. This Forum noted that a large number of R+D institutions in developing countries were already engaged in solar energy research, and the view was taken that a pooling of efforts on an international scale would maximize the sorely needed benefits for developing countries. Based on the recommendation of the International Forum, the 1984 General Conference of UNIDO, adopted a resolution calling on UNIDO to promote cooperation between institutions engaged in research and development for new and renewable sources of energy. It was noted that this resolution was in line with the "Nairobi Plan of Action" of the United Nations on new and renewable sources of energy which called for international cooperation to help strengthen the developing countries' indigenous scientific and technological capabilities in the area of new and renewable energy.

In 1986, the UNIDO Consultative Group on Solar Energy Research and Application (COSERA) was established. This was seen as a mechanism for enlarging international cooperation with a view to enhancing the effectiveness of solar energy research in developing countries and the commercialization of such research into industrial production. International cooperation would include joint ventures, joint research partnerships and other arrangements, suitable to solar energy technology. COSERA. Thus COSERA was seen at a high level forum composed of those working on solar energy research and applications and representatives of donors, both countries and institutions. It was envisaged that COSERA should function in a similar manner to the successful Consultative Group on International Agricultural Research (CGIAR).

The primary objective of COSERA is to identify through the collective interaction of its members, the priority needs in research and application, to promote wide-spread use of solar energy, in particular for the benefit of developing countries. In addition, COSERA should identify possible donor sources for the financing of such activity.

Over the last 5 years, COSERA has moved from its original focus on cooperative R+D to a wider range of issues such as; examining technological developments related to large scale manufacturing with centralized production and decentralized distribution, the idea being to bring down the prices sufficiently to open up the market. Linked to this, a methodological study was also undertaken for identifying the market potential for solar energy technologies in developing countries, as a basis for a comprehensive examination for current and future markets.

A further development, within the framework of COSERA, was a UNIDO proposal in 1991, for the establishment of Centres for Application of Solar Energy (CASE), in response to the need to bring solar energy to the market place commensurate with the primary state of maturity. It is being recognized that solar energy technologies lacked the critical mass of financial and human resources to carry the promising research results to the market place. Therefore, the overall objective of CASE was to bridge the gap between R+D institutions and the market place.

Based on the proposal by UNIDO and endorsed by COSERA, a Centre for Application of Solar Energy (CASE) was established in Perth, Western Australia in February 1994. The Australian Government provided a Trust Fund of AUS\$1,000,000 for a cooperative programme to promote applications for, and commercialization of, solar energy technologies in the framework of CASE.

The overall objective of CASE is to bridge the gap between R+D institutions and the market place. Its immediate objectives are:

- (i) to help R+D institutions, and enterprising individuals as well as organizations and companies, with innovative ideas in solar energy applications, to bring the results of their efforts to the level of economically viable solar-based products and systems;
- (ii) to help the emerging solar industry to penetrate world markets with reliable low-cost products and systems.

The CASE Centre in Perth will not undertake basic research or engage in manufacturing activities. But will:

- promote applications for, and commercialization of, solar energy technologies in developing countries;
- assemble a cohesive team of individuals, highly skilled in the areas of engineering, international finance, marketing, sociology and scientific research;
- establish and maintain links with organizations involved in research, development, finance, manufacturing and international trade;
- support the establishment of other Centres for Applications of Solar Energy and maintain communication interaction with these centres as they are established to form a cooperative network;
- become self-funding without compromising a position of impartiality or professional integrity;
- respond to requirements of developing countries for energy-related professional services.

3. *Future directions*

Firstly, we have received many expressions of interest for establishing other CASE Centres, both at national and regional level. For example, China, India, Jordan/Arab region, Morocco/France, South Africa/Southern Africa. When funding for these can be raised, we will carry out feasibility studies which will include, of course, an examination of their financial sustainability. In connection with the feasibility studies, CASE-Perth has indicated they would provide assistance.

More recently, we have prepared a proposal for a Global Network of CASE Centres. 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.

A continuing function of the UNIDO promotional programme, will be the monitoring of trends in the development of solar energy technologies and their implications for developing countries, through studies and expert group meetings. The new energy technology programme will also continue the promotion of more intensive research, development and demonstration of promising technologies in developing countries.

Many international organizations have programmes related to new and renewable energy, and in fact, the number has been increasing as the interest in renewables gains momentum because of the environmental concern. In particular, UNESCO has launched its "World Solar Summit Process", and the World Bank has also recently introduced a "solar initiative". It is therefore important for us to coordinate and cooperate with these other initiatives, but also to distinguish UNIDO's particular role in solar energy technologies. An area which is clearly within the UNIDO's mandate is the promotion of and interaction with the solar energy business community in the developing countries. This will include not only solar energy equipment producers, but also installers.

UNIDO and UNESCO have recently agreed upon a memorandum of understanding, identifying areas of cooperation, one of which is solar energy. In this connection, UNESCO has requested us, within the framework of the World Solar Summit Process, to take responsibility for the industrial aspects of solar energy. This reinforces the point above on the need for interaction with the private sector dealing with the manufacture, supply and installation of solar energy equipment, in both developed and developing countries. This will require the identification and contact with individual companies and/or associations related to solar energy technology, as well as electric power companies. A meeting will be required where the views of the companies in relation to promotion and development of solar energy technologies in the developing countries can be discussed and a common position presented to the World Solar Summit Process.

4. *Other related areas on new energy technology*

At the beginning of the 1990s, UNIDO received a number of requests from the developing countries for information on hydrogen energy technologies. Two expert group meetings for developing countries have been held on hydrogen energy technology, as well as several authoritative reports on the subject. One of these reports was by Prof. Nejat T. Veziroglu, from Clean Energy Research Institute of University of Miami, and included this advice: "Since the developing countries are starting to establish their energy infrastructure, they should take steps toward establishing the clean and permanent energy system - Hydrogen Energy System, so as to avoid the mistakes of the industrial countries in establishing their energy systems based on fossil fuels, which are not environmentally compatible and are causing enormous damage to the planet Earth".

A feasibility study has been completed for the establishment for an International Centre for Hydrogen Energy Technologies (ICHET). The Centre will promote and facilitate the introduction of hydrogen energy technologies in participating countries through studies, applied research and advisory services.

Hydrogen energy technology is closely linked to solar energy because hydrogen is only an energy carrier and the solar hydrogen root is considered perhaps the most promising.

UNIDO has promoted international cooperation on small hydropower development, since the late 1970s. The focus was on the development of indigenous energy in the developing countries and the local manufacturing of equipment. In cooperation with UNDP and ESCAP, UNIDO established the Hangzhou Regional Centre in China. At the end of last year, this Hangzhou Regional Centre was expanded to an International Centre by the Government of China, based on UNIDO's initiative. China is making available some US\$125,000 for us to undertake a cooperative programme among the developing countries. In addition to widening the geographical coverage, the new International Centre and its related network will provide an opportunity for an authoritative survey of hydropower potential in the developing countries which if realized would have a significant potential in reducing CO₂ and would therefore be of interest to GEF. We will prepare a proposal in this regard with the International Centre at Hangzhou for consideration by GEF.

Within its overall programme on marine industrial technology, UNIDO has carried out work on ocean energy. Ocean energy represents a large renewable energy resource which holds a considerable potential for solving the energy problem in the medium to long term for many small islands and remote coastal areas. Innovative technologies have recently improved the technical and commercial viability of ocean energy plants. As of today, the most promising ocean energy conversion technologies are ocean wave power and ocean thermal energy conversion. Under specific condition, other forms such as ocean current and marine biomass could have a significant potential. Recent activities include an international workshop on marine industrial technology in Madras, India, and an expert group meeting on development of ocean energy in Indonesia. In addition, UNIDO provided a paper to the UN Global Conference on the Sustainable Development of Small Island Developing States which included proposals on ocean energy.

World Solar Summit Process

**Boris Berkovski
(UNESCO)**

World Solar Summit Process - WSSP
Processus du Sommet Solaire Mondial - PSSM

International Workshop
The Role of Financing Organizations in the
Development and Deployment of Renewable Energy

World Bank, Washington, D.C. U.S.A.

15 - 16 May 1995

Panel 2 : New Initiative and Financing Mechanisms for
Renewable Electricity

World Solar Summit Process

by

Boris Berkovski

Chairman, International Organizing Committee, The World Solar Summit Process
Director, Engineering and Technology Division, Science Sector, UNESCO

The World Solar Summit Process

This campaign aims to :

- *enhance* understanding of the role that renewable sources of energy could play in preservation of the environment, in provision of energy services - particularly for rural and remote areas - and in contributing towards a solution to unemployment,
- *urge* non-governmental organizations to enter into partnership with, and make their knowledge and experience available to global and regional intergovernmental bodies as well as establish innovative programmes for the promotion of use of renewable energies,
- *favour* the access, transfer and sharing of knowledge on renewable energies by establishing a global information networking system using state-of-the-art communications technology,
- *promote* and *harmonize* cooperation in training and research, as well as in the transfer of research disclosures to industry at the regional, inter-regional and international levels,
- *demonstrate* how wide use of renewable energy is a cost-effective and rapid way for many developing countries to reduce energy cost, save foreign exchange and stretch the energy supply base without heavy investment,
- *identify* and *define* selected strategic projects of global importance for inclusion in the World Solar Programme 1996-2005, which will trigger wide use of renewable energy technologies, equipment and goods,
- *seek* approval of the World Solar Programme 1996-2005 by a Summit at the highest level of government to be organized in September 1996.

THE WORLD SOLAR SUMMIT PROCESS

GENERAL CHART

THE WORLD SOLAR PROGRAMME

1996 - 2005

World Solar Summit Process - WSSP
Processus du Sommet Solaire Mondial - PSSM

Strategic Projects

Leading Document
to be submitted for approval to

The World Solar Summit
Harare, Zimbabwe
September 1996

Strategic Projects. A few carefully selected projects of exceptional quality and outstanding universal value in the field of renewable energy policy, legislation, research and technology demonstrations to be performed collaboratively by all participating countries of the WSSP in 1996-2005. Such projects will encourage nations to promote the design, manufacture and commercialization of solar energy technologies and devices. The Strategic Projects will be oriented towards helping the developing nations in particular to overcome disadvantages which they suffer in the fields of energy supply and environmental protection. All geographical regions participating in the WSSP through the Regional Solar Councils have been invited to submit feasibility studies for two or three Strategic Projects to be undertaken in their regions. Some of the Strategic Projects have already been identified.

THE WORLD SOLAR PROGRAMME

1996 - 2005

World Solar Summit Process - WSSP
Processus du Sommet Solaire Mondial - PSSM

World Plan of Action

**Leading Document
to be submitted for approval to**

**The World Solar Summit
Harare, Zimbabwe
September 1996**

World Plan of Action. This is a selection of high priority renewable energy projects at the national or regional level to be executed between 1996 and 2005. These projects shall be of exceptional quality and, as such, worthy of strong national and also international support. They will be identified on the basis of nominations submitted by Governments. It is planned that 300 projects will be selected for the inclusion in the World Plan of Action.

This Leading Document will be submitted for approval to the Summit of Heads of State and Government to be held in Harare, Zimbabwe, September 1996.

THE WORLD SOLAR SUMMIT PROCESS

WSSP

Regional High-level Expert Consultations:

- **Workshop** Solar Energy in the Mediterranean Region
UNESCO Headquarters, Paris (France), 12 - 13 July 1993
- **Workshop** Rural Electrification in the Mediterranean Region
Marrakech (Morocco), 25 - 29 October 1993
- **An Action Plan for Renewable Energy Sources in Europe**
Madrid (Spain), 16 - 18 March 1994
- **Symposium** New, Renewable and Solar Energies in Africa
Bamako (Mali), 16 - 20 May 1994
- **I Congreso Latinoamericano sobre Energías Alternativas**
Córdoba (Argentina), 27 - 29 September 1994
- **7th International Symposium on Solar Thermal Concentrating Technologies**
Moscow (Russia), 26 - 30 September 1994
- **5th Meeting of the Permanent Arab Committee for Renewable Energies**
Nouakchott (Mauritania), 27 - 29 September 1994
- **Solar Energy in the Caribbean**
Santa Lucía, 6 - 9 December 1994
- **Mediterranean Solar Council**
Sousse (Tunisia), 18 - 19 January 1995
- **Solar Energy Utilisation : Strategic Issues in Indonesia**
Jakarta (Indonesia), 23 - 26 January 1995
- **Solar Energy for Development, Culture and Environment**
Harare (Zimbabwe), 20 - 23 March 1995
- **Solar Energy in China**
Beijing (China), 11 - 14 April 1995

THE WORLD SOLAR SUMMIT PROCESS

WSSP

Scheduled High-level Expert Consultations of the World Solar Summit Process, 1995 - 1996

- **Mediterranean Workshop on Renewable Energy**
Hotel Ein Boquek by the Dead Sea (Israel), 22 - 25 October 1995
- **Asian Solar Summit**
Kuala Lumpur (Malaysia), 15 - 19 January 1996
- **Solar Energy in Russia**
Moscow (Russian Federation), March 1996
- **Mediterranean Conference on Solar Energy**
Marrakech (Morocco), April 1996

World Solar Summit Process Processus du Sommet solaire mondial

ASIAN SOLAR SUMMIT

Renewable Energies for Development,
Culture and Environment

Kuala Lumpur, Malaysia
15 - 19 January 1996

First Announcement

Under the auspices of
Dr. Mahathir Mohamed,
Prime Minister of Malaysia

H.E. Robert Mugabe,
Chairman of the World Solar Commission
President of Zimbabwe

UNIDO
International Energy Agency
Ministry of Science and Technology, Malaysia
Malaysian National Commission for UNESCO
Academy of French Speaking Engineers
Economic and Social Commission for Asia and the Pacific (UN/ESCAP)
Asian Bank for Development
Ente per le Nuove Tecnologie, l'Energia e l'Ambiente (ENEA)

Harare, Zimbabwe
20 - 23 mars 1995

Harare, Zimbabwe
20 - 23 March 1995

World Solar Summit Process Processus du Sommet solaire mondial

A SOLAR HIGHWAY FOR AFRICAN DEVELOPMENT

L'AUTOROUTE SOLAIRE VERS LE DÉVELOPPEMENT DE L'AFRIQUE

by

Boris Berkovski

Chairperson, International Organizing Committee, World Solar Summit Process
Director, Engineering and Technology Division, Science Sector, UNESCO

European Commission
International Energy Agency
Ministry of Transport and Energy, Zimbabwe
Ministry of Higher Education, Zimbabwe
Zimbabwe National Commission for UNESCO
Academy of French Speaking Engineers

Secretariat :

SC/EST
UNESCO
1, rue Miollis
75732 Paris Cedex 15
France
fax : 33.1.40.65.95.35

**World Solar Summit Process - WSSP
Processus du Sommet Solaire Mondial - PSSM**

WORLD SOLAR FUND

Draft Project Document

to be presented at the
Workshop on

**"Financing Photovoltaic Rural
Electrification in Developing Countries"**
(March 5 - 7, 1995)
Sala Commissione Tecnica, ENEA, Rome

by **Boris Berkovski**
Chairperson
International Organizing Committee
World Solar Summit Process

International Energy Agency Activities

**John Tilley & Eric Lysen
International Energy Agency**

Mission of the IEA PVPS

To enhance the international collaboration efforts through which photovoltaic solar energy becomes a significant energy option in the near future, both for OECD countries and developing countries.

Targets of the PVPS programme

- ① **Practical recommendations for improved design, construction and operation of PVPS by collecting, analyzing and disseminating information on their technical performance.**
- ② **Planning methods to evaluate and maximize the benefits of grid-connected PVPS to the electric grid and to the customers.**
- ③ **Technical guidelines for the interconnection to the grid of building integrated and other dispersed PV systems.**

Targets of the PVPS programme

- **Assessment of critical implications of large scale massive deployment of PV power systems.**
- **Assessment of mechanism and initiation of actions to undertake transfer of IEA-PVPS knowledge and experience to developing countries.**

Diffusion strategy of PV system applications

COMPETITIVENESS

IEA PVPS and Developing Countries

Possible mechanisms to encourage the deployment of PV power systems in developing and industrializing countries.

- **Collaboration with donor and financing organizations to improve institutional understanding of PVPS.**
- **Dialogue and information dissemination, using expertise of the PVPS agreement, to help identify barriers and solutions.**

IEA PVPS and Developing Countries

- **Seminars and workshops for donor and financing institutions to help enhance awareness of the potential of PVPS but avoiding direct involvement in development assistance activities**
- **Access to data of IEA information centres (CADDET, GREENTIE, ETSAP, etc.).**
- **Compilation and analysis of case studies (lessons learned from previous successes and failures of PVPS projects).**

IEA PVPS and Developing Countries

- **Assistance in developing guidelines for project selections by donor and financing organizations :**
 - ▶ **to ensure successful preparation, implementation, commissioning and operation of PVPS projects;**
 - ▶ **recommended practices.**
- **Provide advice to other international, global and regional organizations.**

**Scandinavian Program of Assistance
In
The Baltic Countries**

**Stefan Camitz
Department of Energy Efficiency,
NUTEK**

Fossil-fuel conversion and improved energy efficiency made quick, affordable and reliable in the Baltic states

Hans Nilsson, Stefan Camitz
Department of Energy Efficiency, NUTEK

1. SYNOPSIS

Energy Efficiency can be improved and Renewable energy sources more utilised in the Baltic states, if support could take local skills and conditions more into account.

2 ABSTRACT

Countries with markets in transition in Eastern Europe have largely been perceived as developing countries which are in need of foreign aid. Assistance has been tailored accordingly, with less regard of existing local skills. A skill which might be less familiar with market economy functions but have a good professional knowledge. The result seems to have been to much use of western experts and western hardware and less development of domestic markets to pull the changes. "Bankable" projects have been given priority and less interest put in activities to make projects affordable for the users. The Swedish experience, however, shows that an active handling of projects can foster markets for renewable energy and energy efficiency. Such markets are forming a ground for Joint Implementation and tradeable emission rights which will be forceful instruments in the future work for a sustainable energy system.

3. PERCEPTIONS OF THE THE REALITY

The transition of economies in eastern Europe is not easily understood. In most respects there is a lack of theory and empirical data to explain and calculate the changes. The economies are changing from being planned to being market based. They change from being ruled from one remote centre to being monitored from democratically governed regional and local authorities. When this happens there is a need for assistance which is readily provided from the western world. A lot of doubts have, however, been raised concerning the advice because of the overall lack in experience from such a swift transition. It needs to be recalled that the

growth of market economies in the west came slowly out of the agriculturally dominated societies having a relatively well working environmental balance (Sätre Åhlander, 1994).

Naturally, the perception of the reality governs the activities and the suggestions of all parties engaged in the improvement of these economies. The change towards a market economy is not necessarily a natural one. The "blueprints" for the transition are mostly based on an idealistic version of market economy functions either to be provided at short notice (by chock treatment) or to be used as benchmarks for the cures to be used. It is however more likely that all changes will be gradual and more evolutionary than revolutionary (Gligorov, 1993) since the circumstances in the countries concerned are very different from ours. An indicator, showing the need for transformation at a pace and the necessity for training, is the fact the many eastern european languages lack the words for simple financial transactions. The Russian language instead uses words related to power and hierarchy (Hedlund, 1993).

The institutions to assist the development (such as the multinational banks) have normally been set up and been working in somewhat different circumstances. Much knowledge has been gained in dealing with developing countries in the traditional sense (IBRD, 1993). The eastern Europe countries are, however, not developing countries. They have a high proportion of technically very well trained staff on all levels and a functioning, though worn down, infrastructure.

Technology transfer is another issue often mentioned, beside the market economy institutions, as a key to success. The European Union is setting up different agencies and undertaking several projects aiming at dissemination and transfer of technology. When acting on the field many of these are arguing a use of technologies which is overshooting the actual situations by far. Studies of technology transfer shows that such projects have to be carefully crafted to the prevailing situation (Martinot, 1994). Studies also from developing countries indicate that more emphasis should be put in enhancing the demand for renewables rather than in token changes in institutional framework (SEI, Newsletter Vol 8, No1)

4. OBSTACLES IN PRESENT HANDLING

The multilateral institutions have been criticised for bureaucracy and for being slow in their operations, much because of the limitations they have in their organisation and routines (Sigurdsson, 1995). There seem to be three major obstacles in the process of the institutions in getting more

energy efficiency and more use of renewable fuels on the market in countries with markets in transition.

- * Administration; The administration of loans and support from multinational organisations have to be simplified not to burden the lending institution unnecessarily. Most often the institutions channel the money through local banks which have to add their risk margins. The resulting rate of return will then be relatively high.

- * Project assessment and definition; The lending institutions have difficulties in defining the projects or portfolio of projects in terms valid to their own risk assessment. Most often an intermediary consultant, working out of conditions similar to those of the institution, is hired to make feasibility studies and tender documents. The result can be projects and/or procedures which are too standardised and not relevant to the local situation.

- * Risk level; The associated risk is often treated by risk sharing methods. More than one institution is called in to share financing of the projects to limit the risk exposure of each party involved. The result can be lengthy procedures to put a financing package together and still leave a project with a high risk.

To all these problems a closer cooperation between the multinational institutions and the operator (partner country), working closely to the project, could be a solution. The administration could be simplified by use of existing structures in the partner country. The project assessment should then use a partner consultant from the partner country to serve the receiving project and act as facilitator. The risk level would thereby be treated actively to be lowered.

Figure 1: Relations between partners in conversion projects

5. THE SWEDISH EXPERIENCE.

In April 1993 Sweden decided to assist the Baltic countries (Estonia, Latvia and Lithuania) in their efforts to improve the energy systems in terms of economy and reliability. In June 1993 it was further decided to expand the programme to the entire Baltic Sea area, thereby including Poland and Russia. The Swedish programmes aimed for improvements in the environment by targeting the use of fossil fuels and the inefficiencies in end-use of energy, as well as in the distribution of heat. By shifting from fossil fuel to biofuel, the release of carbon (tied in the fossils) is stopped. By increasing energy efficiency in end-use and distribution, the supply of primary fossil energy is lowered and hence the emission of CO₂. As a slogan and a simplification the programme is said to, "take away the dirty kilowatthours and reduce the wasted ones".

Very soon it was clear that, if there is to be an impact also for the future, the programme will have to be shaped to spread the improved technology on its own economical merits. The Swedish programme is able to give grants, but is basically formed to support business agreements by giving loans.

5.1 The setting.

Considering the magnitude of the problems in most of the economies in transition, where the dependence on imported fossil fuel is heavy and draining currency from the economy, and furthermore existing equipment often is old and badly maintained, it was necessary to establish some operative guidelines. Guidelines which should direct not only the present activities but also the following, whether they stem from this programme or not. We should preferably find a way to release an avalanche of new projects which could be justified on their own merits with low foreign assistance, if any at all.

The set of goals were established as follows:

- * Quick
- * Simple and affordable
- * Reliable technology

The use of these key words has shown to be of great importance both in shaping the projects and in communicating the programme to participants. **Quick** means that we do not want to engage in too big projects which call for complicated coordination or require lengthy feasibility and design work. **Simple and affordable** means that the avoided cost of the formerly used fossil fuel pays for the new equipment and the new fuel in a reasonable time. **Reliable** means that the technology used should have proved to function well in earlier projects and that there will be no experimenting on the behalf of the receivers of the assistance.

When searching for projects, we started a process mainly to find the local responsible partner, a municipality or an energy company delivering heat to buildings where the cost has forced them to reduce the standard of delivery. We also made a point to choose the partners in cooperation with the energy ministry in the country but make sure that the ministry should not have to face negative consequences in case something went wrong with the project. All the detailed decisions should be in the hands of the owner of the plant who will get the support from our consultant in design, tender requests, evaluation and negotiation of tenders, commissioning and testing. Since all hardware is paid for by the plant owner by taking the loan, he has to appoint a local project manager from the beginning and face this responsibility. The project management support, as mentioned above, is given as a grant by the responsible Swedish administration (NUTEK).

All contracting for projects is open for full competition and it is the aim of the programme to have a substantial and growing share of work

undertaken by companies in the receiving countries, thus making full use of the potential advantage that differences in wages can give to the projects. The full competition in contracting of equipment has also shown result in low costs so far.

All work has also been followed by an independent evaluation team having participants from each of the countries.

5.2 Track record.

The first three conversion sites, Valga in Estonia (6 MW oil to 5 MW wood chips), Balvi in Latvia (4 MW coal to 2.4 MW wood chips) and Birzai in Lithuania (8 MW oil to 6.2 MW wood chips) were finally chosen in early June 93 and were put into operation 6-7 months later. All were equipped with preovens to fire wood-chips. The biofuel comes either from a local source, with which the owners have a three year optional contract, or from own chopping since all projects have also equipment for local fuel production. The converted boilers are all serving base load and the investments have been fairly equal and have an average cost <100 USD/kW (or <20 USD/ yearly MWh). The contracted biofuel has a price of 6-7 USD/MWh. The pay-back time is ranging from 3 to 5 years. The three projects have required in total investments of 11 MSEK which equals approximately 1.4 MUSD (1) and the results are predicted to be as follows (2).

<u>Item</u>		<u>Specific value</u>
Investment (USD)	1 400 000	-
Output (MWh/year)	75000	18.5 (USD/MWh)
Capacity (kW)	14000	100 (USD/kW)
CO ₂ -reduction (ton/year)	25000	
Sulphur reduction (ton/year)	155	
Dust reduction (ton/year)	36	-
NO _x reduction (ton/year)	21	-
Saved fuel cost (USD/y)	340 000	-

The investments are roughly 2/3 imported equipment and 1/3 domestic works (civil and building). Project management amounts to ≈10%.

By the end of 1994 further 8 conversions were carried out, giving a total of 11 since the start (3), and at least another 12 are under consideration (4) and will be put in operation during 1995. For those put into operation so far the following data are tracked, see the appendix for details.

<u>Item</u>		<u>Specific value</u>
Investment (USD)	5 480 000	-
Output (MWh/year)	253 000	21.7 (USD/MWh)
Capacity after (kW)	49 600	110 (USD/kW)
CO ₂ -reduction (ton/year)	80 000	
Sulphur reduction (ton/year)	700	

Some of the newer sites have been more demanding on capital since also some boilers have been exchanged for new ones.

The projects have further been extended with a set of improvements of district heating in ten places. In most cases these are dealing with installation of substations following a simplified concept. The much talked about high losses seems to be overstated and a lot of economical measures can be made without changing the pipes. In some cases it should rather be considered to introduce a new local heating plant instead of pipe replacement. If pipe replacement should be considered after all it should also take into account the advantages of lower local labour costs.

Figure 2: Comparison of pipe costs all costs included. (Data compiled and calculated by Peter Dannbring, ÅF-Syd, Malmö.)

In the catalogue of projects are also 6 projects to improve energy efficiency in buildings (5). Both multi-family houses, schools and hospitals. The technology in these cases will be simple insulation (of roofs), reducing draught from windows, adding panes to windows, improving control of heat in the building distribution, improving hot tap-water distribution, heat exchanging in substations and adding metering to monitor the result and enhance maintaining possibilities. The first one, Mustamäe in Tallinn, Estonia, is estimated to save 30% of the energy use at an investment of 180 USD/MWh.

5.3 Profitability.

The dimensioning of the base load capacity for fuel conversion has followed standard rules, see figure 3. Since this often is a new routine to the local participants, and surprisingly also to some of the western actors proposing alternative solutions, the idea needs to be stressed. If conversion is undertaken also for boiler units operating above the optimum capacity these units can not justify their own costs. If the entire solution still is profitable the second unit has stolen profit from the first one.

Figure 3: Determination of optimal base-load capacity

The profitability of the projects is measured against the avoided cost of the fossil fuel, see figure 4. Admittedly there are great problems in having proper incentives since energy have been heavily subsidized in all the countries concerned. Nevertheless someone is paying for the fossils. There is then overall profitability if the new costs are less than those for a continued operation with fossil fuels.

Figure 4: Division of costs for a fuel conversion and comparison to the avoided cost.

The conditions for the loans given are favourable but equal to the terms used by the World Bank. It means an interest rate (6) at the level of 8%, a grace period of 2 years and a maturity period of 10 years. Security for the loans is required either as mortgage in the plant or as guarantee by the state. The big problem seems not to be the terms of the loan but the concept and procedure of borrowing/lending money since the ownership structure is either unclear or changing. During the grace period the loan will accrue according to the rate but the companies will be given time to consolidate their economy. The Swedish support will have the form of a loan where the repayments go into a revolving fund. So far, the entire project is tentative though the building of such a fund would be advantageous for the future.

The participation of the evaluation team has been of great importance since they have helped to bridge the cultural gap. There are a lot of issues where misunderstanding is a rule rather than an exception since we have different ways of calculating, organizing and preparing of projects. These cases have however easily been smoothed out since we have had multiple communication channels between Sweden and the local plant management.

6. THE PROCESS.

Even more interesting than the technology is the process of establishment. Our conclusion is that there is far too much of an **aid attitude** in most projects today. It is either assumed that "Market Economy", as we know it in the west, will be easily established as being a form of "natural way of life". Or it is assumed that shipment of knowledge or products will fill an empty gap. Our experience is that we are facing a learning process during which the proper institutions, supporting the market economy, will develop and will do so more as a result of cooperation which allows for trial and error. We would prefer to name this the **partnership attitude**.

Since we have been approached with many different suggestions for alternative projects we find it appropriate to mention what sorts of aid attitudes we have tried to avoid. There is of course in other areas, including some energy related, good reasons for aid but not to develop business relations.

The aid attitude results in a lot of projects emphasizing not the institutions of market economy but the signs of institutions. It is asked for quick adjustment of prices to a world market level, and hence projects are developed which are aiming at large scale installation of meters giving a projected economy with very short pay-back time. Since peoples' wages are not developed equally fast, the result could be counterproductive. People learn not to react on price signals but to disregard them and trick away the bill.

The aid attitude also develops projects where standardized solutions are developed and expected to be delivered in great quantities. This could very well be the case after some piloting projects but can be equally disastrous if applied only on assumption and with small possibilities to make the necessary adjustment to the local situation. Some projects with procurement of heat exchangers for buildings have shown such features. Finally the aid attitude brings about lots of reports and seminars where fancy technology is displayed but meets low demand, either because of high costs or of low reliability.

The aid attitude is sometimes disguised in a demand for new technology expressed by a high level representation from the recipient. The request can in some of these cases be built on a desire for new technology (which is good) delivered from companies which have not yet tried it sufficiently on their home ground (which is bad). The receiver might end up with a pile of equipment not working but showing a good intention.

The partnership attitude, as applied in the Swedish projects, builds on

the local specific situation, regarding economy and technology, and on the local ambition to participate. Since it is the local owner of the plant that will finally have to face the realities of the investment, its operation and its economy, it is also quite easy to get the necessary commitment. So far it has been an even bigger achievement to see how people are learning-by-doing, than to see the projects' physical appearance.

7. TOWARDS A CLEARINGHOUSE IN THE BALTIC SEA REGION

It must be emphasized that the entire project from the Swedish side is environmentally justified. From the receiving countries it has quite another dimension. The projects mean affordable and sufficient amount of heating energy. From this point of view it is also aimed to have a multiplicative effect. The pilot projects and their successors are to serve as **demonstration** objects. There have been seminars and training courses held in conjunction to the projects, and specific information material have been developed. The technology used so far is affordable and profitable compared to the use of oil and coal even if it was to be financed with locally obtained loans. Thus the Swedish projects can be releasing an avalanche once the institutions of the market economy are there.

There is a lot of interest connected to the possibility of Joint Implementation (JI) or Trade of Emission Rights (TER) as means in the Carbon Dioxide Abatement. Most models for these activities are based on assumptions of cost effectiveness and on vague draft structures for the institutions of implementation. There is still a lot of work to be done to elaborate the institutional structure and to find suitable technology to secure cost effectiveness and durability in the measures. Such work would greatly benefit from full-scale experimental work carried out with the clear goal to establish a long term form for cooperation.

Especially around the Baltic sea there is an urgency to find such solutions since many countries are sharing the environment and depends on it for future welfare and survival. The Nordic countries are all deeply involved in cooperative projects with countries on the east coast of the Baltic sea. There are good causes for better coordination between the countries and their respective operation agencies. Such coordination will have different perspectives in time, short/immediate, medium and long as described below:

- * The Immediate perspective.

- a. Better networking. All countries have a network of people and organisations which could benefit the others in their need to solve their tasks. Being able to take and check contacts is essential.

- b. Better knowledge. Ongoing projects could both by the experience they create and in their own right be of great interest to other countries in shaping their own ones.
 - c. Develop transition tactics. Since the markets in transition does not always perform properly (according to textbook ideas) there is a need to establish tactics for development of institutional capacity or mock-up institutional behaviour.
- * Medium time perspective.
- a. Shaping of projects could be better if they are using mutual knowledge. A project can intentionally be based on the other since countries have different possibilities to act.
 - b. Using Demo experience to link information into the large financing organisations and especially to persons on government level taking part in steering of such organisations
 - c. Develop instruments for future JI. If JI should work, there is a need to develop skills for assessment of projects, accounting principles, incentives, enforcement etc. Such must be done with extensive experiments to make sure that the final instrument will work properly.
- * Long perspective
- a. Create a "clearinghouse" where projects, companies, methods, persons etc meet and mingle to solve tasks based on the concepts of JI and of Tradeable Emission Rights.

8 END-NOTES

- (1) 1 USD=8 SEK
- (2) Based on measured values after installation. The Sulphur content in used oil has been astonishingly low, 1.3-2.4% compared to 3.5% predicted and quoted from local sources.
- (3) Estonia 4, Latvia 5, Lithuania 2.
- (4) Estonia 3, Latvia 2, Lithuania 2, Poland 2, Russia 2
- (5) Estonia 2 residential areas, Latvia 2 residential, Lithuania 2 hospitals
- (6) Actual STIBOR rate
- (7) Includes a new boiler
- (8) Only reconstruction of existing crate

9 REFERENCES

Sätre Åhlander, Ann-Mari. 1994. Miljöproblemen i en bristekononomi. Ekonomisk Debatt 6/1994.

Gligorov, Vladimir. 1993. Gradvis chockterapi. Ekonomisk Debatt 8/1993.

Hedlund, Stefan. 1993. Slutet för den ryska chockterapin. Ekonomisk Debatt 8/1993.

The World banks Role in the Electric Power Sector, IBRD 1993.

Martinot, Eric. 1994. Technology Transfer and cooperation. Draft summary of Ph.D. dissertation. August 1994

Stockholm Environment Institute. 1995. SEI, Newsletter Vol 8, No1)

Sigurdsson, Jon. 1995. Finansiering av miljö- och energiprojekt i Nordens närområden. Nordiska investeringsbanken, NIB, Helsingfors februari 1995.

-----Appendix -----

<u>Site</u>	<u>Country</u>	<u>Size (MW)</u>	<u>Investm. (USD/kW)</u>	<u>Pay-back (Years)</u>
Birzai	Lith.	6.2	81	4
Kazlu Ruda	Lith.	3	104	4
Balvi	Latv.	2.4	110	4
Slampe	Latv.	3	148	5.5
Aluksne	Latv.	5	142	4
Janmuiza (7)	Latv.	3	190	5.5
Ugale (8)	Latv.	3	64	2
Valga	Est.	5	96	4
Aardla	Est.	6	112	6
Haabneeme	Est.	6	99	5.5
Võrusoo	Est.	7	90	5.