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A Catalog of U.S. Renewable
Technology Vendors for Developing
Country End-Users

Catalog Examples and Preliminary Project Plan

Biomass Energy Research Association

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Technology Vendors for Developing
Country End-Users

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Catalog Examples and Preliminary Project Plan

prepared for

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by the

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Abbreviations

U.S.AID	U.S. Agency for International Development
U.S.DOE	U.S. Department of Energy
U.S.DOC	U.S. Department of Commerce
CORECT	Committee on Renewable Energy Commerce and Trade
BERA	Biomass Energy Research Association
U.S.ECRE	U.S. Export Council on Renewable Energy
SEIA	Solar Energy Industries Association
REI	Renewable Energy Institute
NWEA	National Wood Energy Association
PSIC	Passive Solar Industries Council
AWEA	American Wind Energy Association
IGT	Institute of Gas Technology
PV	Photovoltaics

I. INTRODUCTION

The purpose of this report is to outline the proposed content and plan for the publication of A Catalog of U.S. Renewable Technology Vendors for Developing Country End-Users. The report conforms to the Statement of Work for Purchase Order No. DHR-5730-0-00-6030-00 issued by the U.S. Agency for International Development (U.S.AID) and includes both the candidate vendors' catalog and preliminary project plan deliverables called for in that statement of work.

The effort to prepare a renewable vendors' catalog is a direct consequence of the deliberations of the Education Subcommittee of the Committee on Renewable Energy Commerce and Trade (CORECT). CORECT was mandated in 1985 by an act of Congress to enhance the sale of U.S. renewable industry products overseas. The Departments of Commerce and Energy and the Agency for International Development were charged with the responsibility of fulfilling the aims of the legislation and AID assumed lead responsibility for the Education Subcommittee. After reviewing a number of potential activities that would enhance the awareness of Less Developed Country (LDC) end-users towards U.S. renewables technology, the subcommittee selected the vendors' catalog as one of its two principal initiatives. (The other effort concentrates on a brochure describing the technology options available for end-uses of particular importance to LDCs.) Because of the complexity of the tasks associated with the preparation of a renewables vendors' catalog, the current planning effort was undertaken to develop a clear perspective of the make-up of such a catalog and to identify those resources that can contribute to the effort.

The results of this planning effort represent the collective views of a broad base of contributors that included representatives of industry, the trade associations, the donor community, U.S. government agencies and individuals and firms that are especially well acquainted with renewable technology applications in LDCs. Many of these contributors served as members of the Oversight Committee that met periodically to review the progress of the study and to discuss the issues that arose. Although a broad range of opinions have been expressed on many viewpoints, the examples and plan presented represent a general consensus for the most part. Significant differences are noted where they exist. This study also revealed a high level of interest by many U.S. firms and a widely expressed need for a high-quality and informative publication of credible U.S. renewable technology vendors. Although the prime purpose of the vendors' catalog is to enhance the sale of U.S. renewable energy technologies, the process of catalog preparation will also help the U.S. industry develop an informed perspective of U.S. strengths and weaknesses in the international renewable technology marketplace. We have attempted to keep the ensuing discussion brief and to-the-point

and rely upon the appended materials to supply details concerning the various elements of the study (e.g., sample listings, minutes of Oversight Committee meetings).

Tasks

The preparation of the vendors' catalog plan involved the following for tasks:

- (1) Definition and scope of the catalog,
- (2) Identification of issues related to catalog content and preparation,
- (3) Determination of preliminary catalog contents and formats,
- (4) Preparation of a preliminary plan.

The report describing the candidate vendors' catalog (task 1-3) and the preliminary project plan (Task 4, elements of task 2) are consolidated into this single report and are presented in Sections II and III.

II. CANDIDATE VENDORS' CATALOG

This section describes all pertinent aspects concerning the content of the catalog and the format for presentation. Planning involved the initial determination of the intended scope in terms of technologies, corporate profiles and audience followed by the resolution of a great number of issues associated with the catalog and its preparation. Once a general consensus was reached concerning the many issues involved, elements of a "dummy" catalog were prepared including an example table of contents and sample listings for a range of vendors that meet the selection guidelines established.

2.1 Definition and Scope of Catalog

The discussion of the catalog planning effort is best initiated with a presentation of the conditionalities established by the principal intended sponsor of the catalog--the Education Subcommittee of CORECT. The project's scope had been defined through several discussions during the meetings of the subcommittee and in subsequent discussions with the subcommittee's Chairman, Dr. Jack Vanderryn and members of his staff.

Only U.S. vendors qualify for inclusion. Since CORECT was mandated to promote U.S. interests, no foreign companies are to be included. The only possible exception to this rule is if a foreign firm controls a U.S. subsidiary that employs primarily Americans and that has a majority of American shareholders. Only one photovoltaic manufacturer which is controlled by an Israeli firm has been identified that might qualify for inclusion.

Technologies to be included are solar thermal, photovoltaic, wind and biomass energy. Geothermal, ocean thermal and hydroelectric technologies are to be excluded. It was generally felt that the latter are considered more as projects; large-scale construction efforts that may employ many contractors and the procurement of equipment from numerous sources. Technologies included will, for the most part, involve the sale of discrete small- to medium-scale units intended for specific end-uses.

Vendors will be selected. The catalog will not list all U.S. renewable technology vendors nor will it admit vendors solely on the basis of the company's willingness to pay a fee. Although an exhaustive search will be undertaken to identify all the possible vendors, only a limited number (50-70) of vendors will be selected for inclusion. (Selection guidelines and procedures are described in Section 2.2 on Issues.) Export sales of U.S. renewables products have suffered greatly from past misdeeds; all too many U.S. companies offered products that failed to perform to specification and many manufacturers have refused to provide any training, repair or parts supply services to LDC customers. The bad reputation of the U.S. renewables industry can only be corrected (no pun intended) if the companies promoted are credible and stand by their products.

The customer is the audience. Since the objective is to enhance U.S. product sales, then the catalog should be directed to the needs of the potential customer who will purchase the equipment or system for a specific end-use. The most likely customers will be industrial firms, utilities and government programs and projects seeking renewable energy systems or major components. The catalog should, therefore, be oriented to provide information important to the decision to purchase and should be organized so the reader with a specific end-use application in mind can find the product he needs.

Limited funds are available. No appropriation was set aside for the production of a vendors' catalog. It is, therefore, necessary to devise the lowest cost strategy possible while preserving sufficiently high standards in content and production quality to make the catalog a worthwhile endeavor. Since funding is harder to obtain from most sources than ever, it appears that in-kind contributions of manpower through cooperative assistance from the associations and industry will be the best way to minimize catalog publication costs.

2.2 Issues Related to Catalog Content

Within the constraints described in the previous section, many uncertainties still remained to be resolved before a coherent plan for a vendor's catalog could be formulated. Some issues were of overriding importance and had to be settled before other related issues could be addressed. The conclusions of catalog planners regarding each issue are reviewed.

2.2.1 Selection of Vendors

Two closely related issues are associated with vendor selection. One is the overall degree of selectivity sought and the other is the criteria to be employed to achieve the desired degree of selectivity. There was universal agreement that some sort of selection process should be employed but there was a wide range of opinion concerning the degree of selectivity.

Degree of Selectivity

The most manageable measure of defining the degree of selectivity was in terms of the number of vendors that would be included in the catalog. The general consensus was that the catalog should list 50-70 vendors. Planners then examined the spectrum of vendors in each of the four technology categories and roughly estimated the number of credible vendors that could be identified for each. The results are shown in the following table:

Potential and Credible Vendor Estimates

	<u>Existing Vendors</u>	<u>High Credible Vendors</u>
Solar Thermal	116	12-17
Photovoltaics	54-70	15-20
Biomass	200+	15-20
Wind	30	10-12
Total	<u>400-416</u>	<u>52-69</u>

At this point the number of highly credible vendors estimated is little more than a guess. However, these figures were submitted to the Oversight Committee and to representative associations (SEIA, US-ECRE, REI, AWEA, NWEA) for comment, and most felt that the "guesstimates" were reasonable. In the case of those technologies having fewer companies (wind, PV), a fair degree of precision was possible while there is much more uncertainty in the case of biomass and solar thermal.

Liabilities of Selectivity

The criteria then had to be formulated that would achieve the goal of 50-70 vendor listings while eliminating under-qualified companies. Although many were in favor of a selective process, it soon became clear that the degree of selectivity sought set the proposed catalog apart from most previous efforts. Many past publications were sponsored by trade associations as vehicles for promoting sales for all of their membership without qualifications. Many of these associations (AWEA, NWEA, SEIA) felt that they would be subject to legal liabilities if they were to participate in a selection process that discriminated between

members. Several Oversight Committee members felt that catalog sponsors might also be subject to such liabilities. However, legal counsel has advised the planning staff that if "the basis of a claim by a potential plaintiff is as a taxpayer, the courts have held that, generally, individual taxpayers or companies do not have standing to sue the Federal Government on issues related to its use of tax revenues unless the government, as sovereign, waives its sovereign immunity." As long as the staff assembled to organize the vendors' catalog is autonomous of trade association status and is independently exercising its discretion in selecting vendors for inclusion, there is no potential basis for liability.

Selection Guidelines

After much discussion it was further decided that it was virtually impossible to formulate at this time quantitative criteria that would achieve the desired level of selectivity. Planners, instead, elected to formulate the following "guidelines" to enumerate the attributes sought in a qualified vendor rather than to establish a rigid screening apparatus:

Guidelines for Vendors' Catalog

<u>Item</u>	<u>Turnkey Vendor</u>	<u>Equipment Vendor</u>
Overall Vendor Characteristics		
Current annual sales	\$1 Million*	\$1 Million*
Time in business (years)	5 Minimum/ 10 Desired*	5 Minimum/ 10 Desired*
Offers financing	Desired and expected	Desired but not expected
Specific Capabilities		
Vendor is located/represented abroad		
- In developed countries	Critical	Desired
- In developing countries	Desired	Not expected
Vendor Offers Overseas Warranties		
- Full warranties	Desired	Desired
- Limited warranties	Critical	Desired
Vendor offers training		
- Full on-site	Desired	Desired
- Limited on-site or in U.S.	Critical	Desired
Past Experience/Performance		
Previous renewable installations		
- In developing nations	Desired	Desired
- In U.S. or developed nations	Critical	Critical
Number of Installations in all Locations	5 Minimum*	5 Minimum*

*A significant number believe these quantitative standards are too stringent.

A significant number of Oversight Committee members and project staff believed that the quantitative guidelines would eliminate too many companies if rigidly enforced. This, coupled with the lack of confidence by association representatives in the values to be assigned, led planners to conclude that it would be best to revise selection guidelines after the initial industry questionnaire surveys are completed and one has established a reliable basis for the analysis.

Vendor Categories

Candidate vendors were also divided into two categories-- those offering turnkey systems and those selling equipment. Although the catalog will not segregate entries on the basis of this classification, each entry will be so identified. The distinction was made because it was felt that vendors of turnkey systems had to be evaluated more strictly because the LDC customer would be more reliant upon the vendor for project success.

Listing Fees

The use of a listing fee as a means to raise money for the catalog and to screen out uninterested vendors was discussed. Most felt that a fee of \$50-100 would be reasonable but, if only 50-70 vendors are included, fee income would not contribute substantially to supporting the costs of catalog publication. Also, a modest fee would probably not have much value in screening out companies that are not prepared to make a commitment to LDC markets. The fee would have to be more like \$1,000 before it would be a useful source of income and means of screening. However, the companies would not have any means of judging whether the catalog would succeed in bringing in new sales and would be skeptical that the expense was justifiable, and small companies might have trouble even coming up with the money. It was, therefore, decided that listing fees would not be charged for the first edition of the catalog. Planners propose that CORECT agencies fund the initial catalog edition, listing fees could be charged for subsequent editions if a track record of sales could be established. (Coded response addresses were suggested as one means of tracking sales resulting from catalog distribution.) If agency funding was not forthcoming, planners might return to the listing fee concept to support a catalog but such an action will necessitate another stage in the process to determine how much money could be raised and would probably limit the prerogatives of selectivity that could be exercised by catalog staff.

Exceptions for Start-Ups

In general, the selection guidelines enumerated will tend to discriminate against small start-up businesses. However, there are several such businesses that only recently began operations but that are entirely dedicated to the production of systems and

equipment for developing country markets. Their products are are designed specifically for LDC conditions and appear most worthwhile. It was felt that such companies should be given special consideration. If careful scrutiny satisfied evaluators that the company had a good product, was well-run and had good prospects for success, then such guidelines as years in business and sales records would be relaxed. Such companies would, however, be identified as start-ups in the vendor listing.

Discretionary Powers

The use of selection guidelines rather than strict screening criteria already implies that the catalog's editorial staff will exercise broad discretionary powers and will be solely responsible for making vendor selections. Recommendations by others will be entertained on a strictly informal basis. Trade associations will not play any role in vendor selection other than to identify vendors and gather basic data. The decision-making team will also have the right to investigate the past performance of vendors on warranties, service and repair, and on training if the editor feels it is necessary to resolve any doubts about the inclusion of a particular vendor.

2.2.2 Target Audience

A minor issue had to be resolved concerning the catalog's audience. Although the audience is clearly potential customers, these customers can be either sophisticated or not and the format of the catalog will differ for each. Unsophisticated customers such as individual farmers or village-level buyers are best served by a catalog that provides extensive background information on the function and uses of the various technologies, and that explains vendor products in simplistic terms. The more sophisticated user of the catalog would probably regard such additional discussion superfluous and a nuisance and would be inclined to consider the catalog less professional. Most felt that the majority of sales would be to the more sophisticated industrial and governmental end-users and recommended that the catalog not attempt to be a teaching instrument but should, instead, concentrate on a concise explanation of the facts and background of each technology and company. However, in order to ensure that a coherent overall perspective is conveyed of the technologies the United States has to offer, each major section of the catalog will begin with a background paper that reviews the technology options for meeting the end-use that section is devoted to. Thus, an educated but unsophisticated reader should still be able to understand the general attributes of the technologies represented.

2.2.3 Product Qualifications

It has already been noted that listings will consist of both turnkey systems and equipment suppliers, but the latter category could potentially cover a broad range of products from individual parts and components to major subsystems. Some suggested that the catalog be a true "yellow pages" and list everything but strong objections were raised. The two principal problems were the logistical difficulties of an LDC end-user contacting a broad spectrum of parts suppliers to be able to assemble a system, and the second problem is the sophistication needed by the end-user to select the necessary components and assemble such a system. It was therefore decided that equipment listings would be restricted to major components or subsystems, leaving some discretion to the editor to judge the suitability of products for inclusion.

2.2.4 Scope of Service Listings

It was felt that the catalog should also attempt to present U.S. technical and other consultative resources but the potential scope of such listings is enormous. Most felt that stringent requirements should obtain; that only firms with proven experience in LDCs should be listed. Since there is no central clearinghouse for such firms, the best way to compile a listing is by advertising the opportunity in association newsletters, by conference announcements and through agency publications and the Commerce Business Daily. Respondents would then be screened by the editorial committee for inclusion and, if selected, each company would receive a three-five line listing of its qualifications in a designated section of the catalog.

2.2.5 Inclusion of Advertising

Advertising is often prevalent in vendor directories and can be an important mechanism for raising the funds needed. However, the limited number of vendors to be listed has major implications for advertising. It was generally agreed that it would not be prudent to allow vendors to advertise who were not listed in the catalog. If only listed vendors are allowed to advertise, then the funding potential of advertising would be small. Also, since plans call for quite detailed vendor listings, it is unlikely that additional information would be conveyed by advertisements. Thus, if the Vendors' Catalog becomes an agency-sponsored effort, advertisements should probably not be included. However, if federal funding for the catalog is not forthcoming, advertising should be reconsidered as a vehicle for catalog financing. As with the imposition of listing fees, the inclusion of advertisements might result in substantial changes in the nature of the catalog since the U.S. renewables industry would then become the chief source of support.

2.3 Preliminary Catalog Contents and Formats

This section will review the proposed composition of the catalog, the system of organization and the formats of the vendor listings. The basis for including many of the elements to be described has already been provided in the discussion of relevant issues.

2.3.1 Content and Organization

The following generic outline describes the major divisions proposed for the catalog.

GENERIC OUTLINE OF CONTENTS OF VENDORS' CATALOG

- | | | | |
|----|--|-----------|-------------|
| 1. | TITLE PAGE | - - - - - | 1 page |
| 2. | INDEX TO CONTENTS | - - - - - | 1-2 pages |
| 3. | INTRODUCTION | - - - - - | 3-4 pages |
| | - Purpose of the Catalog | | |
| | - Acknowledgements | | |
| 4. | SOURCES OF INFORMATION IN THE UNITED STATES | - | 4-5 pages |
| | - Names, addresses, contacts and phone numbers for renewable associations | | |
| | - Names, addresses, contacts and phone numbers for other associations representing technologies not included in catalog, i.e., geothermal, hydro, etc. | | |
| 5. | SOURCES OF CAPITAL FOR RENEWABLE ENERGY INSTALLATIONS ABROAD | - - - - - | 4-5 pages |
| | - Sources of capital for U.S. firms selling abroad | | |
| | - Sources of capital in the U.S. for foreign governments and companies purchasing U.S. renewable energy equipment | | |
| 6. | VENDORS' PRODUCTS AND SERVICES | - - - - - | 50-70 pages |
| | Products | | |
| | - Divided into individual sections each dedicated to end-use markets (i.e., electric power, process heat, mechanical power, transportation fuels, auxiliary equipment) | | |

- Each product section to be preceded by a survey article describing the operation of U.S. equipment in practical applications both in the United States and abroad
- Service company listings in alphabetical order with listings coded for quick recognition of company capabilities

7. CROSS INDEXES - - - - - 6-7 pages

- Alphabetical listing of companies by name, by technology, by systems, components and services

The first three sections are self-explanatory. The fourth section provides general sources of information in the United States on renewable technologies. This was believed valuable because many LDC readers of the Vendors' Catalog will not be serious customers but may become interested in the technologies represented and would like to learn more. However, vendor companies do not like to handle general requests that are not directly relevant to an impending sale. Planners, therefore, intend to direct general inquiries to the associations that are best prepared to respond to such needs. Much information on renewable technologies and government R&D programs is already available for dissemination in response to such requests. This section will also include associations for technologies not represented in the catalog so that all possible modalities for addressing a given end-use need will be accessible to the reader.

The section on sources of capital for LDC projects will address one of the principal limitations encountered by vendors in the stimulating overseas sales. Interest rates in LDCs are notoriously high and since many U.S. renewable technologies have high capital costs per unit of production, they are at a disadvantage when competing with local approaches that may be terribly inefficient but that involve little capital investment. Countries such as Japan and Brazil that have been successful in developing export markets for their equipment owe much of their success to the credit available through their central banks. The proposed section will be prepared by a Washington-based financial services firm (the Washington Capital Markets Group and East-West Financial Services are the lead candidates) and will review available international and U.S. public and private sources of credit and equity investment capital and project financing strategies. Appropriate references for following up on the options presented will also be included.

Section six is the key section of the Vendors' Catalog. Approximately 50-70 pages will be devoted to 50-70 vendor listings (average 1 page per listing). A detailed discussion of vendor listing formats is presented in Section 2.3.2. The major divisions of section six will be organized by end-use and subdivisions will be organized by technology. The following tentative listing of divisions and subdivisions was developed by project staff.

CATALOG DIVISIONS AND SUBDIVISIONS

SYSTEMS PRODUCING HEAT ENERGY

Space Heating and Cooling and Water Heating

- Solar Thermal Domestic Space Heating Systems
- Solar Thermal Domestic Water Heating Systems
- Solar Thermal Institutional Heating and Cooling Systems
- Biomass-fueled Heating Furnaces and Institutional Boilers

Industrial Process Heat

- Solar Thermal Heat for Industrial Use
- Biomass-fueled Industrial Boiler Systems
- Biomass-fueled Gasifier/Boiler Systems
- Anaerobic Digestion Systems Producing Biogas for Boilers

ELECTRIC POWER AND COGENERATION SYSTEMS

- Wind Generator Systems
- Photovoltaic Systems
- Solar Thermal Electric Power Generation
- Biomass-fueled Steam Power Plants
- Biomass-fueled Engine Generator Sets
 - Thermal Gasification (Producer Gas) Systems
 - Anaerobic Digestion (Biogas) Systems

SYSTEMS PRODUCING MECHANICAL POWER

- Biomass-fueled Steam Engines
- Biomass-fueled Stirling Cycle (Heat) Engines
- Water-Pumping Windmills
- Photovoltaic Pumping Systems

SYSTEMS PRODUCING TRANSPORTATION FUELS

Fermentation Systems for Ethanol Production

Distillation Subsystems

Fermentation Subsystems

Saccharification Subsystems

Biogas Compression and Storage Systems for Vehicles

Producer Gas Generators for Vehicles

AUXILIARY EQUIPMENT

Harvesting Equipment

Transportation Systems

Storage Systems

Handling Systems

Energy Storage Devices

Heat Energy

Electric Power

A number of the above categories may not, in fact, be employed if insufficient vendors exist under the category to warrant the category's inclusion. There may be some headings for which no qualified vendors are identified.

Each section will be initiated with an overview of U.S. technologies now employed in the United States and abroad to meet the specified end-use. This introduction is intended to provide the reader with an understanding of the utility of U.S. technologies in general and of the comparative merits of alternative approaches for meeting that end-use in different circumstances. Every effort will be made to incorporate quantitative indices of system performance and economics although a number of contributors to this planning effort believe that the ability to offer generic determinants of system economics will be quite limited. These surveys will be prepared by the technical advisors of the catalog project staff in consultation with experts in LDC end-use applications. (Resources mobilized by Meridian Corporation in its efforts to prepare an end-use brochure should also prove valuable to this effort.)

The final segment of Section Six will provide a listing of technical service firms available in the United States that have experience in either project formulation, engineering, assessment

and management or in the maintenance and repair of equipment in LDCs. These listings will be brief (3-5 lines), will be coded by capability, and will be limited to qualified firms that have notified the catalog staff of their desire to be included.

The last major section will consist of cross indexes that list companies in alphabetical order, and by technology, and by any other means deemed useful by the staff for ready reference purposes.

2.3.2 Listing Formats

A number of options for presenting the listings have been reviewed. Rather than prepare sample listings for each option, the planning team first sought a consensus from the Oversight Committee concerning the best approach to each listing and then prepared a portfolio of sample listings (17 companies) in accordance with the preferred approach.

Listing Headings

Any number of headings and subheadings could be employed. At one end of the spectrum, only a few key headings might be employed while at the other, the listing could be in outline form with many subheadings to be filled in for each company. To better determine the most appropriate approach, catalog planners collected information for 27 companies and attempted to work up this data in various ways. (See Appendix C for a list of companies.) The information provided was highly variable from company to company and strongly favors promotional general descriptions rather than a precise presentation of relevant facts. Even when a questionnaire is employed to elicit specific information, respondents will not answer many questions and will present technical and economic data using a wide range of units and conventions. This makes it difficult to use a format consisting of many subheadings because it would make the entries for many vendors appear incomplete. Also, vendor information presented in a narrative fashion is much more readable than is a collection of discrete factual units. For these reasons, planners recommend that only two major headings be employed: Equipment or Systems Characteristics and Company Experience and Operations. These are the principal interests a prospective customer would have and encompass the two basic classes of information that would be collected. The use of only two headings does not imply imprecision in the listings that will be prepared. Substantial detail has been requested in preliminary contacts with vendors (see Appendix D) and much more in-depth data will be solicited in the questionnaire prepared by SEIA that is to be distributed to vendors in the first phase of catalog preparation (see Appendix E). After selecting a short list of vendors for inclusion in the catalog, further telephone and direct contacts with project staff will be employed to fill remaining gaps. The average listing is expected to be one page

in length but this will vary depending on the number of products the vendor offers. Each listing will begin with the company address, telex number and the appropriate contact person and the telephone number.

Pictures and Diagrams

The following range of options can apply:

- Option A: A photograph or illustration for each company listing.
- Option B: Illustrations only when needed to clarify product and/or when provided by vendor.
- Option C: Illustrations only in introductory pages for each technology.
- Option D: No illustrations except on cover.

Although illustrations and photographs can add considerably to publication costs, there was widespread sentiment that their omission would lead to a bland and unattractive catalog. Figures included with the vendor listings can also be very informative. In this regard, illustrations are often more valuable than photographs in conveying an understanding of a system or subsystem. However, color photographs of operating installations (especially those in LDCs) have definite PR value. It was decided that the catalog should have 2-3 color photos in each end-use section introduction and should have either a color photo or black and white illustration for each vendor that can supply the staff with good quality photos and figures. Also, the catalog cover should be of very high quality with well-designed color illustrations.

Length of Listings

There was universal agreement that vendor listings should not exceed two pages in length. As noted, the actual length will vary from vendor to vendor. It was felt that it was unrealistic to assume a fixed length, i.e., one page, per vendor since there would be gaps for some and other vendors for which essential information would have to be omitted for the listing to fit. Thus, listings will be of an appropriate length and will follow one another.

Indexes

The final cross-reference section will also list companies in alphabetical order and by technology. It was suggested that each page of the catalog should have the division and subdivision headings at the top to make it easier to turn to the desired section. Also suggested was the idea of having color coded tabs for each page. Planners intend to incorporate the page heading

suggestion into the catalog's format but will reserve judgment on color-coded tabs until an estimate of the added cost can be obtained.

Information for Inclusion

Vendors were cooperative in providing information in most areas including field performance data, experience in LDCs, guarantees and servicing provided and procurement and sales policies.

The section on "Equipment or System Characteristics" would include a description of each of the principal types or series of equipment or systems provided by the firm; each description would include quantifying numbers on system size, fuel or other inputs, and energy outputs (in BTUs, HP, KWe, etc.).

The section on "Company Experience and Operations" would indicate the firm's history, general track record, its experience with renewable energy systems, and its present or potential pattern of operations in regard to developing countries. The information to be included in the text would cover the firm's years in business, present volume of business, approximate number of renewable energy systems installed (in the United States, in other developed countries, and in developing countries, examples of specific projects in developing countries, major type of business (equipment sales or turnkey installations), business affiliations (subsidiary of parent company, licensing agreements, joint ventures, etc.), provisions for installation and service, extent of training of personnel (on site or in United States), guarantees and warranties, etc.

Price Data

The only area where vendors were reluctant to provide information was in product prices. This is a sensitive issue with many firms, especially where relatively large systems and site-specific designs are concerned. Most vendors indicated a strong preference to negotiate price with prospective customers. In general, U.S. equipment tends to be more expensive and the prepublication of prices gives competitors an opportunity to underbid U.S. firms. However, some vendors, most of whom were offering "packaged" products, were willing and actually preferred to list prices. Although catalog sponsors have expressed a strong preference for prices to be listed, it is beyond the power of catalog staff to impose this requirement if a vendor does not wish it. If only those firms willing to list prices were accepted, there would be insufficient entries to make a catalog viable. However, every effort will be made to encourage vendors to provide such information voluntarily.

2.3.3 Sample Listings

After having decided on the listing format outlined in the previous section, sample listings were developed for the 27 firms selected as examples. Although these examples included a greater percentage of credible firms than the general vendor population, 17 of the selected firms provided sufficient information to prepare a coherent sample listing. The sample listings for these firms appear in Appendix F.

This concludes the discussion of the content and organization of the catalog (Deliverable #1 in the Statement of Work).

III. PRELIMINARY PROJECT PLAN

This section reviews the steps that will have to be taken to publish the catalog previously described and will estimate the costs for these steps. A number of issues concerning publication must first be addressed before the estimated costs can be presented. Because of the need for a high quality publication at the least possible cost, it is also important to investigate the contributions of expertise and support that can be realized through collaboration with renewables trade associations and the industry.

3.1 Issues Related to Production

Catalog Scope

The catalog size is estimated to be 100 pages based upon the mandated 50-70 company listings. It is hoped that the catalog will eventually become a self-sustaining and permanent element of U.S. export marketing efforts. This cannot be done until a sales track record has been established that provides an incentive for listed companies to support the costs of catalog preparation. It is expected that CORECT will have to support virtually all cash expenditures associated with the first issue. The lag time for catalog distribution and use will be considerable and it is unlikely that the impact of the catalog on export sales of U.S. products can be determined until two years have passed. Thus, biennial publication of the catalog appears appropriate. Some vendor listings might not change from edition to edition and it has been suggested that looseleaf inserts should be used to update the original catalog. However, the cost of providing looseleaf binders initially would be considerable and the logistics of keeping far removed catalogs current are uncertain at best. We, therefore, recommend that the entire catalog should be re-published for each subsequent edition.

In accordance with sponsor wishes, at least 5,000 copies of the catalog should be printed. An earlier study on the distribution of directories to LDCs recommended 20,000 copies but this seems at least twice too many to catalog planners.

Publication in multiple languages may be desirable. Although many technical people around the world are able to read English, greater utilization of the catalog would be achieved if it were published in other languages as well. The cost of translation into other romance languages such as French and Spanish is \$10-12/page in the Washington area. A 100-page catalog would, therefore, cost \$1,000-\$1,200 for the translation. Also, if fewer copies of the catalog in each language were published, the publication cost per unit would go up somewhat. Each translated version would also have to be laid out separately since the length of the text would vary. Editing (primarily proof reading) the foreign language versions would be a challenge and would add to the costs.

Printing and Distribution Costs

The following parameters were employed in soliciting quotations from potential publishers:

Perfect binding
 Varnished paperback cover (80 lb), four color photos
 Page count - 100 (70 lb glossy)
 Page size - 8 1/2 x 11 inches
 Color photographs in text - 50
 Figures in text - 25
 Typeset
 Number printed - 5,550

The inclusion of color photographs and the high quality that is desired precludes many small printers and "desk top publishing" operations. Quotations from printers with the necessary capabilities were compared and the publishing department at the Institute of Gas Technology in Chicago came in with the most attractive estimate. This was essentially an "at cost" estimate offered to BERA because of the close working relationship between BERA and IGT (Dr. Klass, BERA's President, is the Vice President for Education at IGT). The following should be considered rough estimates at this time (they may be revised downward depending upon the exact content of the catalog):

Graphics, Editing, Typesetting	\$ 5,800
Materials and Printing	<u>17,500</u>
Total Publication Cost	\$23,300
Bulk Shipping Costs	
(10 oz directories \$.75/directory surface rate)	\$ 4,160

It may be possible to reduce shipping costs if U.S. AID elected to undertake the distribution of the catalog itself. It would be relatively easy to distribute the catalog to AID missions and U.S. Embassies through the existing network. However, this would not be a very well-targeted effort and the catalogs might not get beyond the AID offices if local employees were not motivated to distribute them. Certain mailing lists associated with AID-supported activities, such as the Bioenergy Systems Reports that were published until recently, could provide a more direct access to end-users. The mailing list for these reports is about 600 people long which would be a good start although many of the listings are for university faculty members who cannot be considered the prime target audience. The mailing list for the Biomass Users Network (BUN), which will shortly be publishing a newsletter, may be another good source of direct contacts. Although many Washington-based organizations consider their mailing lists proprietary, planners estimate that 1,500 current LDC listings can be gleaned from the mailing lists of cooperating organizations (BERA, IGT, US-ECRE, SEIA, REI). If catalog organizers were to distribute 2,000 copies and AID distributed the rest, then only \$1,500 would have to be paid out for that purpose.

Manpower Requirements

Earlier estimates of editorial time required have been revised downward from three to two man-months based upon feedback from catalog organizers and Oversight Committee members. Also, the requirement that the editor devote full-time effort to the catalog during the performance period has been relaxed. This was done because few candidates for the job could neglect all other activities and there was no absolute need to work continuously as long as a significant level of effort (i.e., half-time) was maintained. The overall amount of effort was reduced because many felt that there would not be enough listings to warrant three months, but one must remember that the editor also has lead responsibility for reviewing vendor profiles and selecting those to be included. Planners believe it is possible to find qualified individuals with editorial experience and also with a good background in at least one of the technical areas. However, the editor's technical expertise will have to be augmented by at least two-three additional technical consultants with backgrounds complementary to the editor's such that all subject technologies are competently evaluated. The technical consultants would also be expected to prepare the introductory overviews needed for each end-use section. Other expertise may also be needed to properly address LDC end-use needs, but specific requirements cannot be specified at this time. There is a clear need for an expert from the international finance community to prepare the section on project and equipment financing. Since BERA will be overseeing the Vendors' Catalog project, a significant amount of management effort will be required but these costs will be covered by BERA's management fee. The projected effort requirements and costs are summarized in the following table.

Catalog Staff Effort

<u>Member</u>	<u>Effort</u>	<u>Salary Rate</u>	<u>Total Cost</u>
Editor	40 days	\$250/day	\$10,000
Technical Consultants (2-3)	10 days each	\$250/day	7,500
Financial Consultant	5 days	\$400/day	2,000
			<u>\$19,500</u>

Cost Sharing and In-Kind Services

Investigations indicate that there is little chance that other sources will support actual cash expenses of the catalog. This being a strictly pro-U.S. marketing effort precludes assistance from any donor agency or foundation source. Only the agencies charged with implementing CORECT have any mandate aside from industry and trade associations to support such a national promotional activity. Since CORECT sponsors have definite views concerning the nature of the catalog that differ from the views of many industry and trade association representatives, the make-up of the catalog can be expected to vary substantially depending upon the source of funding. The present content and format was developed on the assumption that CORECT would pay all cash costs of the catalog project. The reasons for excluding listing fees and advertising from this first issue of the catalog have already been reviewed. Also, it is impossible to charge a price for the catalog and expect any widespread distribution that would serve the purpose of a catalog.

Thus, the most promising ways of reducing catalog project costs are by reducing the scope of the catalog (i.e., eliminate foreign language versions), by having AID assume certain responsibilities (i.e., catalog distribution), and by in-kind contributions of manpower. This latter option appears the most plausible approach to achieve significant cost reductions without unduly detracting from a quality product.

The editorial function is essential to a good catalog and planners cannot foresee that the in-kind contribution of more than half of the editorial time to be a realistic proposition. However, the officers of BERA including its President, Dr. Klass, and Dr. Klausmeier are prepared to assist with editorial duties and with cooperation from the other organizations involved in the catalog planning effort could collectively contribute 20 days of editorial services if needs be. Since there is more latitude in the technical consulting requirements, perhaps two-thirds of such efforts could be provided by in-kind assistance from individuals provided by BERA, U.S.-ECRE, REI and the other associations. Although efforts have been made to find someone to write the finance section pro bono, no such commitment has been made at this time.

Despite the possibility of significant in-kind contributions of effort, catalog sponsors must understand that using in-kind services will complicate project management, will increase the variability in catalog content and will most certainly increase (probably double) the time required to assemble the Vendors' Catalog. Planners cannot guarantee that the quality of the catalog will not suffer to some degree by heavily relying on in-kind services but will not go so far as to say a good product cannot be produced by a largely voluntary staff. BERA and U.S.-ECRE are prepared to undertake the Vendors' Catalog project whether there be full or only minimum funding.

3.2 Budget

Based upon the previous discussion, the following budget is presented for consideration:

VENDORS' CATALOG BUDGET

<u>Item</u>	<u>\$ Amount</u>	
	<u>Full Funding</u>	<u>Minimum Funding</u>
Vendor Survey (to be conducted by U.S.-ECRE)	9,000	5,000
Staff Effort		
Editor	10,000	5,000
Technical Consultants	7,500	2,500
Financial Consultant	2,000	2,000
Overhead (materials, supplies, telephone, postage)	5,000	4,000
Graphics, Editing, Typesetting	5,800	5,800
Materials and Printing (5,550 copies)	17,500	17,500
Distribution Costs (% of total)	4,160 (100%)	1,500 (40%)
Foreign Language Editions (2 languages, added cost for same total number of copies)	10,000	--
BERA Management Fee (% of expenses)	<u>8,510 (12%)</u>	<u>3,900 (9%)</u>
Total	\$79,470*	\$47,200

*Would be \$93,670 with a 20% contingency fee.

The full and minimum funding amounts represent ranges and present a basis for further discussions with catalog sponsors. Some industry and trade association contacts believed that listing fee and advertising revenues could actually support the cost of a vendors' catalog but, if this avenue were pursued, CORECT would have little say in the nature of the catalog and the catalog would be much more of an unselective directory publication. Also, an additional planning stage would be needed to survey the industry to verify that there would be sufficient revenues to support the cost of the directory.

3.3 Action Plan

The process of preparing the catalog will consist of the following actions. Responsibilities are noted and will be divided between the paid staff under BERA's supervision and U.S.-ECRE (U.S.-ECRE will be a subcontractor to BERA).

1. Search, interview and hire editor. Candidates proposed so far include:
 - Paul Bente - Former Executive Director of the Bioenergy Council, now retired
 - Peter Benson - Former Program Manager at Gas Research Institute, currently an independent consultant
 - James Easterly - Consultant at Meridian Corporation
 - Jack White - Former head of editing department at IGT, now retired

Also, Messrs. Mahin and Gutstein of the planning project staff should be considered candidates for catalog project positions. In general, officers in trade associations are excluded from consideration for the editor position because of the potential conflicts arising from the functions proscribed for the editor. However, technical advisory assistance from association personnel, especially pro bono assistance, presents no such conflicts and will be greatly appreciated. BERA and U.S.-ECRE welcome additional suggestions from sponsors and other associations for qualified candidates for the editor position.

2. Publicize upcoming effort in trade publications, newsletters and periodicals--U.S.-ECRE, STAFF, Oversight Committee members
3. Develop list of technology vendors in the U.S.-SEIA and U.S.-ECRE
4. Prepare, distribute and collect industry questionnaires (see PV survey in Appendix E) - SEIA and U.S.-ECRE

5. Collate raw data to develop industry profile and to establish cutoffs in the quantitative determinants for each technology area to achieve the level of selectivity desired (50-70 firms) - STAFF
6. Screen candidates, collect additional information where needed to clarify decisions, make final selections - STAFF
7. Prepare listings for selected firms, collect additional information as needed, possibly contact past customers if questions arise, send draft listings to vendors for comment and correction - STAFF
8. Prepare introductory white papers on status of each technology in the United States, including generic discussion of best end-uses and system economics - STAFF and invited professionals.
9. Prepare section on methods of financing available and financial service firms - Washington Capital Markets Group or East-West Financial Services
10. Prepare listing of firms offering technical and other consulting services - STAFF from active inquiries
11. Prepare catalog layout, complete all illustrations, commission cover - STAFF with professional services as needed
12. Printing - Publishing company under contract or a publishing department of a cooperating institution such as the Institute of Gas Technology
13. Distribution - 5,000 copies will be published in the first round; 3,000 copies will go to U.S.AID for distribution to AID missions, embassy attaches and country contacts; 2,000 will be sent to mailing lists, e.g., Bioenergy Systems Reports, VITA, Biomass Users Network, U.S.-ECRE and BERA contacts.

This concludes the report on the preliminary plan and budget for publishing the Vendors' Catalog. BERA is pleased to have been provided the opportunity to assist U.S.AID and CORECT in this worthwhile endeavor and offer continued cooperation in efforts to create a Vendors' Catalog. BERA appreciates the assistance offered by U.S.-ECRE, SEIA and REI and look forward to further collaboration as the preparation of the catalog proceeds.

APPENDIX A

MINUTES

Renewable Energy Technologies Vendors Catalog
Oversight Committee Meeting 1
IGT Office, 1:30 P.M.
August 28, 1986

Attendees:

Marty Gutstein (Crown Technology)
Don Klass (BERA/IGT)
Will Klausmeier (Syvatex Corp.)
Pauline Labrie (representing Fred Morse, DOE)
Linda Ladis (SEIA)
Carlo LaPorta (representing Walter Hesse - Entech Corp.)
Dean Mahin (BERA/International Energy Projects)
Ann-Marie Merrall (BERA)
Sam Schweitzer (AID) - Represents the Sponsor
Judy Seigel (Meridian Corp.)

Individuals invited to participate but not able to attend meeting: Phil Badger (TVA), Mike Bell (PSIC), Barbara Flynn (REI), Thomas Gray (AWEA), Matt Mendis (World Bank), Bennett Miller (AGI). Jim Peebles (Information Resources Inc.), Malcolm Ream (Solarex), Scott Sklar (Export Council on Renewable Energy), Henry Steingass (AID), Jerry Storey (Ultrasystems).

As much as possible, these minutes are presented in the same format followed for the meeting. Basically the format is one of: presentation of issues, summary of discussion, and recommendations. Due to time constraints, all issues were not discussed at the meeting.

Constraints of Catalog Not Subject to Debate

No discussion was generated regarding the decision to limit the catalog to solar thermal, pv, wind, and the biomass technologies. However, a question was raised with respect to including only U.S. vendors in the catalog. Although it was agreed that all companies cannot be accepted, suppose a foreign held company has substantial operations in the United States? Reaction indicated there is a need to consider such cases. In general, it was felt that some discrimination will need to be applied on some level. If a subsidiary had sizeable U.S. operations, i.e., if U.S. jobs are at stake, then the firm should be included.

ISSUE 1 - Priority Audience for Vendors' Catalog

Four audiences were identified by the Planning Committee: the highest priority was given to (1) industrial firms seeking renewable energy systems or components and (2) utilities and government public works seeking renewable energy systems.

Discussion

A question was raised as to universities being included in audience. The response indicated they are a market for renewable energy systems and would be included in a government/quasi-government audience. This subject actually generated additional discussion regarding the definition of audience. Does audience refer to audience or recipients of the catalog. Concern was expressed with regard to how to write for the end-user. It is an important issue, products can be listed and extensive technical specifications can be written.

It was stated that the intention of the catalog is for use by end-users in making decisions based on application needs. The catalog is not intended as a training manual. An example was given where mismatches have occurred in the past non-technical purchasing agents made decision with very little appreciation for end-use.

Recommendation

The highest priority audience for the catalog should be industrial firms, utilities, and government public works and other government/quasi-government organizations seeking renewable energy systems.

ISSUE 2 - Selection of Vendors

A full range of options for selecting vendors was considered by the committee. Their recommendations were to select (1) only vendors meeting minimum criteria as an operating company that provides equipment or services of potential utility to LDCs, and (2) only vendors with demonstrable interests in LDCs as evidenced by their willingness to pay a listing fee and to supply the information needed to produce the listing.

Discussion

Issue 2 is a key issue for the catalog and it generated a great deal of discussion. Concern was voiced on defining U.S. vendors, relaxed vs. strict criteria, impact of criteria on vendor participation, legality and liability of a listing fee, and the impact of a fee on participation.

The question was raised, What is a U.S. vendor? Also, are there guidelines governing who should and should not be included in the catalog, such as only U.S. vendors as defined by statutes (because of sponsorship by government agency).

Minimum criteria was seen as essential; however, concern was noted as to how far the selection criteria process should go. A very strong suggestion was made by the AID representative that strict criteria be imposed in an effort to build and maintain a

credible U.S. industry reputation overseas. A good track overseas was seen as highly desirable by most participants but some felt it is not absolutely essential as long as the vendor had a good track record somewhere. This catalog effort requires a need for serious players, one individual stated: a need for companies that do well as evidence that they are able to sustain their efforts abroad. It was pointed out that the renewables market abroad is very shaky right now and it is crucial to be cautious of our actions to market renewable products overseas.

The AID representative pointed out that strict criteria should be imposed initially. These criteria might include the requirements for supplying off-the-shelf products and the services to install and maintain the systems. A good reputation requires dollars, dedication, and resources. As the market opens perhaps then the criteria can be relaxed.

While acknowledging the merits of strict criteria in maintaining a credible catalog and a U.S. reputation abroad, several participants representing the associations and vendors felt a need to look at the drawbacks of strict criteria. Imposing a restriction such as a track record of sales overseas, seriously lowers the number of candidates for the catalog. A few companies were cited as having good prototypes but no sales overseas

In view of the differing opinions on the strictness of the selection criteria, a suggestion was made that perhaps there is a need to take another step before deciding upon the selection criteria. The Catalog Planning Committee suggested that the industry be surveyed in an effort to understand the spectrum of companies and products. How many companies would qualify if the criteria were strict as opposed to more relaxed? The AID representative indicated the use of a survey was probably not necessary and suggested an evaluation of the industry through discussions with associations.

The legality of AID setting the criteria and/or selecting the vendors was viewed as an important issue because they will probably be subsidizing the first issue. AID is legally not able to select vendors, therefore an outside organization must develop and impose the criteria. A suggestion was made by AID that they can set the philosophy, but a panel or working group comprised of associations and industry should develop the criteria and select the vendors. Alternatively, one suggested the editor of the catalog could be provided with guidelines for vendor selection or a publishing company could enter into a contract with AID to establish the criteria. The first suggestion was favored most.

Generally, the listing fee was not a point of debate, although a question was asked of the liability of the sponsor. Should a company become upset because they were not included in the catalog and had chosen to pay the listing fee, would the sponsor be held liable to the vendor? In response, it was felt

that the editor can reserve the right to return the fee if it is stated up front.

The amount of the listing fee was briefly discussed. Most felt the fee should not be much more than \$50-\$100 or some companies may choose not to participate in the catalog effort. A sliding fee was suggested as a possibility. It was also stated that being a new document with no proven circulation, the fee could be a problem to some. Reminder was made that circulation to U.S. Embassies, missions, etc. was a market not normally available. One individual suggested a fee of \$1000 as a means of obtaining vendors with serious interest and indication of their financial resources. This seemed too much to the others.

For those companies who are not able to pay a listing fee, for whatever reason, it was noted that the Department of Commerce offers funds to companies wanting to market abroad. Therefore, should a company be serious about a pursuit of the overseas market, a way is possible. Further, the listing fee is tax deductible.

Another suggested alternative to the listing fee is the use of advertising for those who do not meet the listing criteria but may want to enter the market.

Finally, it was said that initially a low listing fee for the catalog may be necessary, but as sales are generated and the catalog becomes more commercial, then the fee can be raised to support subsequent catalog issues.

ISSUE 3 - Types of Products

The catalog Planning Committee considered many types of products for inclusion in the catalog and the suggestions are (1) suppliers of turnkey systems, and (2) vendors of major system components or subsystems.

Discussion

The catalog should also include manufacturers and suppliers of parts, i.e., a type of yellow pages. Strong exception was noted to this approach, especially if one considers the position of LDCs. Very often LDCs lack the experience or resources to locate parts suppliers. In addition, often the end-users in LDCs lack the expertise and information needed to design, install, and maintain systems or even to evaluate suppliers.

It was stated that the intention of the catalog is to be a menu of uses for applications, not a parts catalog. Further, if all suppliers were to be listed, the size of the catalog would be too large. Additionally, it was said that the suppliers of parts that are not unique to renewable systems probably would not be interested in paying a listing fee.

As in issue 2, again there was a strong suggestion by the AID representative that the vendors to be listed in the catalog should be willing to take the lead for the entire system and be responsible to track down parts suppliers and provide all that is needed to maintain the system. It was noted that the number of companies may be fewer, but credible.

Recommendation

Accept the Planning Committee recommendation. Further recommendation may be needed depending upon results of the industry evaluation proposed in issue 2.

ISSUE 4 - Scope of Service Listings

Many listings were considered for the catalog and the Planning Committee recommended the following to be included: (1) companies with experience in areas of probable relevance to LDCs, and (2) companies willing to take overseas assignments, and (3) companies willing to pay a listing fee.

Discussion

A need was expressed to define "consultant" -- is it individuals and/or firms, does it include A/E firms? Consultant is defined as firms and includes A/E firms.

Much of the discussion was directed by the response to the type of criteria proposed and discussed in issues 2 and 3. A strong suggestion again was made by the AID representative that the vendor be responsible for providing services or finding firms that can provide the necessary services for operation/maintenance

Further, it was stressed that service firms should also have experience in LDCs and should also have experience with renewable energy projects in LDCs.

Financial services were considered especially important and there was agreement that a special effort be made to include a good listing or have vendors provide financing or help seek financing for clients.

Recommendation

The recommendation for the scope of service listings will be based on the results of the proposed type of selection criteria discussed in issues 2 and 3. If strict selection criteria are applied, then vendors should also take responsibility for offering or providing services required to install and maintain purchased systems.

ISSUE 5 - Organization of Catalog

The Planning Committee recommended the use of a hybrid structure--major divisions by end-use and subdivisions by technology.

Discussion

The comment was made that, yes, listings should be by end-use. As well, there could be a cross-reference index by technology.

Recommendation

Organize by end-use.

ISSUE 6 - Detail of Listings

A combined approach was recommended by the Planning Committee: (1) describe important characteristics in a concise listing; provide references for more information combined with (2) allowing vendors to provide additional information in paid advertising.

Discussion

In view of the prior discussions regarding strict criteria for vendor selection, should provide greater detail than originally thought.

A suggestion was made that quantitative data such as energy data, should be included in the listing. If a company has a history of LDC installations, this type of data bears considerable discussion, particularly if it is evidence of a vendors track record.

Although quantitative data may be useful, it was noted that some companies may be "scared off" by the need to provide such data. In response, it was suggested that a general discussion of quantitative data, i.e., range of energy delivered may be included in the introductory paragraphs that precede each end-use section.

Recommendation

Generally accept recommendations of the Planning Committee, but investigate different levels of detail for vendor listings. Include quantitative data if vendor can provide it as evidence of his track record overseas.

ISSUE 7 - Options Re Advertising

The Planning Committee recommended advertising adjacent to listings.

Discussion

Little discussion was generated, although there was a brief mention that since the catalog may be highly selective, advertising may not be compatible with this end.

Recommendation

ISSUE 8 - Drafting of Listings

A recommendation was made by the Planning Committee for the editor to prepare listings using the vendor's response to a checklist or questionnaire.

Discussion

There was little discussion on this issue, but it was generally considered the only logical way.

Recommendation

Accept the Committee recommendation.

ISSUE 9 - Pricing of Products and Services

Two recommendations were made by the Planning Committee: (1) exclude prices and (2) include reference sources of price lists for off-the-shelf equipment.

Discussion

There was some disagreement among the meeting participants regarding the inclusion of pricing information in the catalog. An association representative pointed out that most companies don't like to divulge cost data. Additionally, companies may not want to publish their costs for fear their costs may be compared by foreign companies as a negotiating point. On the other hand, should a company wish to include such data, they should be able to do so.

Recommendation

Exclude price data unless vendor specifically desires to include it.

ISSUE 10 - Catalog Pricing

The Planning Committee recommended seeking a purchase order from AID for a catalog which will be distributed free of charge.

Discussion

Not discussed.

Recommendation

ISSUE 11 - Funding Catalog Costs

The Planning Committee recommended exploration of many funding options including listing fees paid by vendors, advertising rates paid by vendors, purchase of copies by AID, other sales, direct subsidy of publication costs by AID, and contributions by other agencies and renewable energy associations.

Discussion

AID will probably purchase the first issue, therefore the first issue probably will be free. If AID must provide a grant then they must justify it. This would be the most difficult approach and was not recommended.

Recommendation

Needs further discussion. If strict criteria is imposed for selecting vendors then the need for AID subsidy is greater.

Action Items of Planning Committee before September 25 Meeting

- Develop set of selection criteria (perhaps 2-3 types) based on suggestions from meeting discussion and speak with associations in effort to assess potential responsiveness of companies to criteria and determine approximate number of companies who may qualify under various criteria. Also attempt to evaluate level of support of associations for approach to developing criteria and selecting vendors.
- Proceed with sample listings by companies. Write up sample descriptions of varying levels of detail.

APPENDIX B

MINUTES

Renewable Energy Technologies Vendors' Catalog
Oversight Committee Meeting 2
IGT Office, 10:00 A.M.
September 25, 1986

Attendees:

Phil Badger - TVA
Marty Gutstein - Crown Technology
Will Klausmeier - Sylvatex Corporation/BERA
Pauline Labrie - DOE
Carlo LaPorta - Entech
Dean Mahin - Bioenergy Systems Report
Eleana Marchesa - PSIC
Ann-Marie Merrall - BERA
Denise Pado - SWEA
Judy Seigel - Meridian Corporation

As much as possible, these minutes are presented in the same format followed for the meeting. Refer to meeting agenda.

ITEM 1 - Review Minutes of First Meeting

Issue 4, Scope of Service Listings, should stress using companies that can prove product reliability and service.

ITEM 2 - Discussion of Findings Concerning Selection Criteria

As presented in the first Oversight Committee meeting, two categories of vendors were discussed for inclusion in the catalog: (1) turnkey vendors and (2) equipment vendors. It was pointed out that the criteria developed for selecting vendors for the catalog are meant to be guidelines. Further, the guidelines for selecting turnkey vendors will be somewhat more strict than those for selection of equipment vendors because of the extent of equipment and services provided. The guidelines cover such characteristics as annual sales, years in business, offer of financing and specific capabilities such as representation abroad, overseas warranties (extent), extent of training, past experience and performance and number of installations abroad.

It was stressed that the selection process is meant to be a bona fide process not just a way to screen out turkeys. Some of the criteria developed thus far have already been felt to be too strict and require changes. For instance, the imposition of the \$1M annual sales for vendors was explained as being considered a "shot in the dark" figure and probably being too severe and would seriously limit the number of vendors.

The final selection criteria cannot really be established until the results of the data collection efforts are completed as the first step in developing the catalog. The criteria will be based on sound information rather than guesswork. For instance, there are some companies who meet very well the qualitative data; however, the quantitative data, i.e., number of years in business, may screen them out. In addition, there are some companies that were specifically started to provide products for developing countries, but, unfortunately, they have less than five years of experience. It was pointed out that the vendors may need to be evaluated on a case-by-case basis, again applying the criteria as guidelines not rigid rules.

A question was raised regarding the decision to include service firms. In response, Will Klausmeier suggested that it is very difficult to determine who they are and how to solicit and select them. Although it was felt they should be included, the process must be very selective and each must be required to have experience in developing countries.

There are so many one-man service firms and no representative body, how does one find out who they are? Some suggestions to solicit and list service firms were: include service firms through the catalog advertising; publicize catalog and requirements in the CBD and wait for responses; or interested firms can request (application) and submit forms if interested. Another suggestion was to reach service firms through association publications. To minimize additional pages to the catalog, the service firm listings could be prepared in a code format or be limited to a 3-5 line summary.

Through discussions with associations, it was found that there would be a great deal of difficulty with associations being involved in the selection process, but their input and perspective is important. Understandably, they do not wish to pass judgment on their membership. Further, not only could the situation generate irritation among members of the associations, but they may also be liable to a lawsuit. In view of this, it was pointed out that the preparation of the catalog must be tightly controlled by the editor and publisher.

The sponsor of the catalog, AID, stresses the need for a process that is selective and one that will result in presentation of companies that best represent the U.S. industry.

ITEM 3 - Implications of Level of Selectivity on Number of Listings, Advertising, and Catalog Funding

Based on the selection criteria developed thus far, approximately 50-70 companies would qualify for listing in the catalog. The number qualifying was determined through conversations with

associations. Although it was done very unscientifically, some meeting participants who had been through this experience felt the estimates were fairly accurate.

The implications of the level of criteria on advertising in the catalog was considered almost a moot point. If the advertising was limited to vendors that are to be included in the catalog, there would be too few and the income would not contribute much to the cost of the catalog.

Further, it was said that if the listings were in great detail the advertising would actually cover almost the same material. Therefore, generally it was felt that advertising would not do much for the catalog.

All seemed to agree that if listing fees were required to cover the cost of the catalog with only 50-70 companies qualifying, the fees would have to be unreasonably high. Funding the publication based on fund-raising activities, i.e., efforts of associations, was also felt to be a potential problem because the memberships would need to be tapped and only some companies would meet the qualifications.

Again, it was noted that the associations would not be involved directly in the selection process; however, they will be listed in the introductory material as a source of generic data on the technologies.

Will Klausmeier suggested that since AID will probably be funding the first issue, we will need to conform to their requests and expectations for strict selection criteria. To develop a self-sustaining publication, future issues may require a listing fee. As a means of documenting the sales generated from the catalog, a code could be used in the mailing address. With this tracking system, vendors may then support application of a listing fee for the next issue.

ITEM 4 - Listing Options and Draft Listings

The Catalog Planning Committee (BERA) recommended the listings be in text form with only two major headings: (1) equipment or system characteristics and (2) company experience and operation. The information collected from the vendors would be difficult to put into a rigid format. As a means of presenting the state of the art or general discussion of the technologies, "white papers" will be used as an introduction to each section. All agreed this approach was best.

Several options were considered for using photographs and illustrations in the catalog. It was suggested that good photographs often are difficult to obtain, especially ones that

show the system and how it works. On the other hand, the importance was stressed of using quality photographs as evidence of a first-class publication. Further, a suggestion was made for using photographs only in the introductory sections as examples of systems or the technologies. Illustrations should be used in the listings where needed. All seemed to accept this approach.

Also, all agreed that no more than one to two pages should be dedicated to any one company and each company listing should follow one after the other with no space in between. The alternative of one page per company was considered not feasible because it might be difficult in some cases to hold it to one page, not knowing how many different systems or equipment a company may offer.

Additionally, it was pointed out that a cross reference index is important. Listings should be by company, end-use and technology. Color coding the edges of the pages may help to indicate the various sections or technologies.

Will Klausmeier indicated the sponsor of the catalog stresses the use of pricing information in the catalog. However, Will suggests it is just not possible if companies absolutely refuse to provide pricing data. Others felt it is dangerous to include it as selection criteria. However, it may be possible to suggest ranges. There is merit to using ranges within the introductory sections, using proper caveats, of course. It was noted that other organizations such as Earthscan have been able to present generic kinds of data on costs of installations and inputs.

Some participants were concerned about price data being stated for universal application, and ultimately being misleading. In reaction, it was felt that AID (sponsor) is probably seeking data that can be used as a rule of thumb or will trigger a response in the reader. The price data can be used as a term of reference for one to know what they can buy and what it might cost. An example of the type of price data might be as follows: 30MW trough electric system for \$3000/kW delivered over a 20-year life cycle (15 - 25¢/kW).

At the close of the meeting concern was still expressed regarding the use of generalized price data. As well, there was concern that the price data may make one technology appear more attractive than another. Some wondered how the vendors would feel about this potential. One expressed the document is not the appropriate place to present the technologies in this way.

ITEM 6 - Key Steps and Players in Assembling the Catalog

In discussing the initial step of publicizing the upcoming publication efforts in the CBD, the question was raised of the liability or legality of not using a listing fee. Would it present a question of liability since the catalog will essentially be paid for by the government and selection of vendors may be strict? Several participants suggested that it is important for an attorney to be consulted with on this issue and a determination should be made before trying to publicize and solicit vendors for this effort.

A preliminary discussion by Will Klausmeier with a private attorney suggested it would not be a problem, but the DOE representative indicated it must be government attorney who makes the determination. A participant suggested that one way to circumvent the problem is to officially list the publisher/editor as BERA. further, the government is "off the hook" as long as someone else selects the vendors. However, the question of BERA's liability still remains.

Will Klausmeier indicated that AID agreed to seek a legal opinion. In any case, the qualifications or guidelines must be published clearly up-front. One suggested this kind of selection process may be construed as the government interfering in the marketplace, if the government is the sole publisher/sponsor.

Acknowledging the unresolved issue of the listing fee, Will said the final report of this planning effort should clearly state that AID will pursue resolution of the liability question. A formal opinion is needed to proceed.

Once again Will stressed the need for the effort to be tightly controlled by the editors and consultants involved in this publication effort. Great effort must be taken to document and reveal all criteria and application of those criteria to evaluating and selecting each company/vendor.

ITEM 7 - Preliminary Budget

Not much discussion was generated regarding the budget; however, a participant indicated that perhaps BERA should charge a fee. Further, one said the legality issue could be resolved by BERA waiving the 5% fee. By doing so, this would be considered BERA's contribution to the publication cost, and therefore a joint effort.

Suggestions were made to seek a publication similar to the one we anticipate and get cost estimates from a graphic designer to verify the budget estimates. It was also suggested that perhaps having the document printed by the government printers may save some dollars.

In conclusion, Will Klatsmeier indicated the final report of this planning effort would be prepared by the end of October. The report will present to the sponsor the recommendations of the Oversight Committee and issues still to be resolved. Again, the issues seen as yet unresolved or still under question are the legality of not charging a listing fee, including price data in the listings, and budget estimates.

APPENDIX C

SUGGESTED FIRMS FOR INCLUSION IN SAMPLE LISTINGS FOR RENEWABLE ENERGY VENDORS' CATALOG

I. SOLAR

1. Solar Thermal Space Heating with Flat-Plate Collectors
U.S. Solar Corporation, Hampton, Florida
2. Solar Thermal Water Heating with Flat-Plate Collectors
Amcor Group, Canoga Park, California
3. Solar Thermal Systems with Concentrating Collectors
(Industrial and Institutional Applications)
Entech, Dallas, Texas
4. Solar Thermal Electric Power Generation (?)
Luz International, Encino, California (?)
5. Photovoltaic Arrays and Modules
Solarex, Rockville, Maryland
6. Complete Small Photovoltaic Power Systems
(Remote Applications)
Solar Electric Systems, St. Petersburg, Florida
(ARCO Solar Distributor)
OR: Another firm selected from SEIA PV survey data
7. Photovoltaic Water-Pumping Systems
Solar Electric Specialties Company, Willits, California
(ARCO Solar Distributor)
OR: Another firm selected from SEIA PV survey data

II. WIND

1. Small Wind Generators
Bergey Windpower Company, Norman, Oklahoma (1 kW)
OR: Whirlwind Power Company, Duluth, Minnesota
(2,4, and 9 kW)
2. Medium Wind Generators
Enertech Corporation, Norwich, Vermont (25 and 40 kW)
3. Large Wind Generator Systems
Flowind Corporation, Pleasanton, California (?)

4. Water-Pumping Windmills
Heller-Aller Company, Napoleon, Ohio
OR: Dempster Industries, Beatrice, Nebraska

III. BIOMASS

1. Biomass-Fueled Furnaces
G & S Mill, Northborough, Massachusetts
2. Biomass-Fueled Packaged Boilers
Ray Burner Company, San Francisco
3. Biomass-Fueled Heat Gasifiers
Forest Fuels Manufacturing Company,
East Swanzey, New Hampshire
OR: Buck Rogers Company, Industrial Airport, Kansas
4. Wood-Fired Steam Generating Plants
Ultrasystems, Fairfax, Virginia
5. Equipment for Wood Fuel Harvesting and Preparation
Morbark Industries, Winn, Michigan
6. Equipment for Wood Fuel Storage and Handling
Laidig, Inc., Mishawaka, Indiana
7. Biomass-Fueled Steam Engines
Skinner Engine Company, Erie, Pennsylvania
OR: Combustion Systems Associates,
Sausalito, California
8. Biomass-Fueled Stirling Cycle (Heat) Engines
Stirling Technology, Inc., Athens, Ohio
9. Anaerobic Digestion Systems Producing Boiler Fuel
Badger Company, Cambridge, Massachusetts
10. Anaerobic Digestion Systems for Electricity Generation
Perennial Energy, Inc., Dora, Missouri
11. Alcohol Fuel Plants or Equipment
F. C. Schaefer, Baton Rouge, Louisiana
Katzen Associates, Cleveland, Ohio
Publiker Industries, Philadelphia, Pennsylvania
Vulcan Cincinnati, Cincinnati, Ohio
Howe-Baker Engineers, Tyler, Texas

APPENDIX D

Checklist for telephone interviews with firms which may be included
in sample listings

What is the present extent of your sales of products or services in developing countries?

Can you provide data on the number of units sold (total, overseas, or just in developing countries); approximate total number of countries; examples of a few developing countries?

Have major projects or sales been funded by the Agency for International Development or its U.S.AID Missions? (If so, get some details.)

What is the main pattern of the firm's overseas business?
Equipment sales only? Design and installation of turnkey projects? Both?
Licensing of technology? Joint ventures?

How is the overseas business conducted? Direct from HQ?
Through overseas trips by HQ personnel? Through overseas representatives or agents? Through licensees or joint venture partners?

What is your present assessment of the extent of the potential for expanding the market for your products or services in developing countries?

How would you describe the extent of your interest in expanding this market?

What means are you now using to reach new overseas customers?

Would you be willing to consider paying \$50 to \$100 as a listing fee in order to contribute to the costs of the catalog?

What is your general reaction to the idea of purchasing additional space for advertising in the catalog?

Which of your products or services have (or would have) the greatest (potential) market in developing countries?

Will you send us up-to-date brochures on these products or services, from which we can extract information for a sample listing of your firm?

Can you cite a few facts of a typical actual installation in a developing country which was designed and installed by your firm and/or uses your equipment? (or provide by mail).

What person should be listed as the primary contact for overseas sales?

Do you have a telex number?

Do you need to see the sample listing before it is included in our proposals to AID?

APPENDIX E

PV INDUSTRY DATA FORM

The Solar Energy Industries Association is preparing a directory of the US photovoltaics industry for foreign buyers. For your company to be included in the directory, you must provide us with the information and material asked for below. Filling out the form, however, does not automatically assure your company's inclusion. We reserve the right to review the material presented and will decide what to include based on our design criteria, space availability and counsel of the directory's advisory board.

The purpose of the directory is to promote U.S. PV products and companies internationally and to identify American companies with international sales experience and products ready for such markets. To repeat, the directory will highlight commercially available products from firms with the capability to export and support overseas sales. The directory will be distributed through US commercial offices in our embassies around the world and will include the following information:

1. A brief discussion of the state of the art of US PV technology and an essay on forthcoming advanced technologies.
2. Detailed description of the primary PV cell/module manufacturers and marketers of complete PV systems.
3. A listing of manufacturers, assemblers, wholesalers, and distributors of PV components and services.
4. A bibliography of public and private sources for additional information.

The list of questions concerning your company that follows will provide us with the information to include in the international PV directory. Please answer all questions thoroughly and feel free to submit any other pertinent data related to the listed categories. Promotional information cannot serve in lieu of this questionnaire. This is a fast-track project, so please complete and return the questionnaire in two weeks. In no case will we accept forms after August 15, 1986.

Section I GENERAL INFORMATION (Please type all sections)

Your name _____ Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Telephone () _____ Telex _____

Name of company CEO _____

REMINDER: MUST BE RETURNED BY AUGUST 15, 1986

Name of international sales manager _____

Year company was established _____.

Is your company public _____ private _____?

Is your company incorporated in the US? yes _____ no _____

Is your company headquartered in the US? yes _____ no _____

Does your company manufacture products in the US? yes _____ no _____

Within the past three years, has your company been (or is it currently) a party to any investigation or other proceeding in which it has been (or is) charged with unfair methods of competition, unfair or deceptive business practices, violations of consumers protection laws, violations of federal or state securities or antitrust laws, negligence due to defective products, fraud (including tax fraud), misrepresentation, or any similar violations of law or breaches of duty?

Yes _____ No _____

Within the past three years, has your company been the subject of bankruptcy or reorganization proceedings?

Yes _____ No _____

Is your company's financial condition sound, and is it capable of meeting its obligations?

Yes _____ No _____

Is there any litigation or proceeding, pending or threatened, which could result in a materially adverse change in your company's financial position?

Yes _____ No _____

Please list any private or public memberships held by your company.

Has your company ever participated in overseas ventures?

Yes _____ No _____

List of overseas offices or representatives - please include name of contact person, address, telephone, and telex.

Project Descriptions- Please describe any recent (ongoing or concluded within the past 1-3 years) overseas projects your company has participated in as a prime contractor or principal supplier. Each project submitted for inclusion must include photographs, preferably in color, although glossy black and white photographs will be accepted.

Please provide a listing of countries (w/applications) where your company has completed projects. (Attach a separate page if needed.)

(Return to SEIA August 15, 1986)

Please describe briefly (200 words or less) your company's specific expertise or unique capabilities as they relate to the products you manufacture.

Logo- Please submit a copy of your company's logo which is camera ready.

Please rank in importance your company's primary activities.

_____ Manufacturer of PV cells/modules

_____ Manufacturer of PV manufacturing equipment

_____ Retailer of complete PV systems

_____ Wholesale PV sales and distribution

Complete Systems _____

Components _____

_____ Manufacturer of BOS components

_____ System design and packaging

_____ Engineering services - If this is the only option provided by your company please attach a brief description of available services.

(Return to SEIA August 15, 1986)

IMPORTANT: PLEASE READ CAREFULLY

To complete the remainder of the questionnaire, please complete those sections applicable to your company.

If your business produces PV production equipment or cells and/or modules, please complete Section II (blue). If your manufacturing company also markets complete systems, then complete Section III (green).

If your primary business is not manufacturing but marketing of complete PV systems for export proceed to Section III (green).

Manufacturers of BOS components please complete Section IV (yellow) only.

If your company provides only engineering services please submit a brief description of services available (approx. 100 words).

SECTION II MANUFACTURERS

What products does your company manufacture?

A _____ Cells Type(s) _____

B _____ Modules Size range _____ to _____ watts.

C _____ PV manufacturing equipment

Please list the products you manufacture that are available for export.

<u>Product name</u>	<u>Product no.</u>	<u>Brief description</u>
---------------------	--------------------	--------------------------

Please list available experimental products.

(Return to SEIA August 15, 1986)

1

What other services does your company offer?

Service agreements _____

System installation _____

Financial assistance _____

Joint venture licensing _____

Engineering services _____

Other _____

Please suggest three key documents that you recommend for the bibliography to be included in the Directory.

(Return to SEIA August 15, 1986)

SECTION III MARKETERS OF COMPLETE SYSTEMS

What type of PV systems do you sell?

A _____ Standardized systems (kits)

B _____ Customized systems

If you provide customized systems please list the types. If not, continue and fill in the standard systems descriptions.

Standard system descriptions (List principal systems)

1. Applications _____

Model number/name _____ Size _____

Output _____

Special product features _____

Maintenance requirements _____

Warranty _____ years

Engineering/installation services yes _____ no _____

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2. Applications _____

Model number/name _____ Size _____

Output _____

Special product features _____

Maintenance requirements _____

Warranty _____ years

Engineering/installaton services yes _____ no _____

3. Applications _____

Model number/name _____ Size _____

Output _____

Special product features _____

Maintenance requirements _____

Warranty _____ years

Engineering/installation services yes _____ no _____

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4. Applications _____

Model number/name _____ Size _____

Output _____

Special product features _____

Maintenance requirements _____

Warranty _____ years

Engineering/installation services yes _____ no _____

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SECTION IV MANUFACTURERS OF BOS COMPONENTS

What PV products or components do you manufacture?

A _____ Trackers

B _____ Inverters

C _____ Batteries

D _____ Controllers

E _____ Monitors

Other _____

(Return to SEIA August 15, 1986)

PV INDUSTRY DATA FORM: ADDENDUM A

SEIA WILL INCLUDE A SECTION IN THE DIRECTORY ON THE USE OF PHOTOVOLTAICS IN THE UNITED STATES.

PLEASE PROVIDE US WITH A BRIEF LISTING OF YOUR MAJOR PV PROJECTS IN THE UNITED STATES. WE WOULD ALSO BE INTERESTED IN ESTIMATED COSTS AS WELL AS A BRIEF DESCRIPTION.

APPENDIX F

BIOMASS-FUELED FURNACES AND BOILERS (1)

RAY BURNER COMPANY, 1301 San Jose Avenue, San Francisco, California 94112.
Telephone: (415) 333-5800. Telex: 34-0276. H.O. Ebson, Assistant Sales Manager

1. System Characteristics

Ray Burner manufactures and installs packaged biomass boilers which can burn wood chips, hogged wood residues, bark, sawdust, sander dust, shavings, rice hulls, cotton wastes, nut shells, and other pulverized biomass. Fuel moisture content must be below 20% and particle sizes must not exceed $\frac{1}{4}$ " (.62 cm) square by 1" (2.5 cm) long. The packaged unit includes a fuel metering system. Fuel is conveyed pneumatically into the furnace by a fuel transport blower. It burns partially in suspension and partially on a forced-draft, air-cooled grate. Oil and gas firing is used for startup. Boilers have a three-pass, horizontal firetube design. Boiler efficiency is 80%. Heavier fly ash particles are captured in a cyclone and reinjected into the furnace for reburning. A forced draft fan provides underfire combustion air and air for flyash reinjection. The Ray Burner boilers are available in ten models ranging in size from 50 to 1200 HP.

2. Company Experience and Operations

Ray Burner has over 100 years experience with combustion systems, especially burners for oil and gas furnaces. The first Ray Burner fibrous waste boiler was built in 1972. The company has installed about 40 biomass boiler systems in the U.S. and several developing countries. Those in the U.S. normally use some type of wood fuel. A 100 HP boiler in Sri Lanka burns a residue from coconut husks, coir dust, to produce steam for electricity generation. A unit in a factory in Taiwan burns several biomass fuels for the generation of process steam. Coconut husks will be burned soon in a Ray Burner boiler in a coconut mill in Fiji; electricity will be generated in a steam engine/generator system. A power plant fueled with rice husks began operation in 1986 at a ton ton/hr rice mill in the Philippines; the Ray Burner system burns 1.5 tons of husks per hour and produces 9,400 lbs/hr of steam at 250 psi. The steam is used in a non-condensing turbine generator to produce 315 kW of gross power; net power output is about 260 kW.

The firm provides turnkey installation of its boiler systems using local contractors supervised at the site by a Ray Burner representative. Turnkey installation is also available for producing 50 kW to 2.5 MW of electric power using a Ray Burner biomass boiler and either a steam engine/generator set or a turbine generator.

BIOMASS-FUELED FURNACES AND BOILERS (2)

LAMBION USA, INC., 3801 Gaskins Road, Richmond, Virginia 23233. Telephone: (804) 270-3001. Telex: 752056 LAMBION USA. William M. Glasheen, Director of Engineering.

1. System Characteristics

Lambion USA specializes in wood-fired boiler systems for industries and institutions. A typical Lambion solid-fuel boiler system includes a steel fuel bin with a screw conveyor, a variable-speed inclined grate furnace, a preheating firetube boiler, manual or automatic ash removal, an air heater, a multiclone for particulate removal, and an induced draft fan.

2. Company Experience and Operations

Lambion USA, an American company, is 50% owned by Maschinenfabrik A. Lambion of Arolsen-Wetterburg, West Germany, manufacturers of solid-fuel furnaces, industrial boiler plants, and related equipment. Lambion furnaces have been installed in a number of larger rice mills and in various other facilities in developing countries; they are used in 1 to 2 MW electric power plants fueled with rice husks at large rice mills in the Philippines and in Suriname.

Lambion USA has installed wood energy systems in various industries and institutions in the eastern U.S. including a college, a hospital, and a prison. Although the activities of the American firm have been confined to installations in the U.S., the company is prepared to undertake biomass energy projects in developing countries in cooperation with the affiliated firm in Germany. As in the Lambion USA projects in the U.S., such overseas projects would utilize some equipment built by Lambion in Germany and some components manufactured by American firms.

BIOMASS-FUELED FURNACES AND BOILERS (3)

THE G & S MILL, INC., 75 Otis Street, Northborough, Massachusetts 91532.
Telephone: (617) 393-9266. Dave Keenan, Vice President (Sales).

1. Equipment and System Characteristics

G & S Mill manufacturers furnaces and boiler systems burning stick wood, pulverized wood, and other biomass. The systems are used for space heating, process heat for drying, hot water, and other applications using hot air or low-pressure steam. The firm produces five sizes of cylindrical fireboxes of boilerplate steel with outputs ranging from 600,000 to 2,000,000 BTU/hr (632 to 2,108 MJ/hr). All models can be manually fed or automatically stoked with pulverized fuels using a G & S Mill automatic stoker. Model MC 136 accepts stick wood up to 5' (1.5 m) long. G & S Mill also offers eleven models of firebox boiler systems consisting of a G & S Mill steel firebox boiler, combustion base, and automatic stoker system; the boiler ratings range from 8 HP to 212 HP.

2. Company Experience and Operations

G & S Mill units are used in about 150 industrial facilities in North America and Central America. All systems are guaranteed for one year against defective material or workmanship. The firm is interested in licensing agreements with firms in developing countries for the manufacture of its equipment.

A sister firm, KW Energy Systems, offers small biomass-fueled industrial cogeneration systems producing from 30 to 300 kW(e); these systems, which are suitable for retrofitting on existing boilers, include a G & S Mill firebox as well as turbines by Coppus Engineering of Worcester, Massachusetts.

BIOMASS-FUELED STEAM ENGINES & STEAM ENGINE SYSTEMS (1)

SKINNER ENGINE COMPANY, P. O. Box 1149, Erie, Pennsylvania 16512. Telephone: (814) 454-7103. Telex: 91-4481. Ronald Misko, Project Engineer, Steam Engine Group.

1. Equipment and System Characteristics

Steam Engines: Skinner offers seven models of low-speed (600 to 300 RPM) vertical steam engines ranging in output from 14 to 310 maximum BHP at full load. Each engine is manufactured for a specific customer. The engines operate with inlet steam at from 100 to 350 psig (70,300 to 246,000 kg/m²); steam is exhausted at from 50 psig (35,150 kg/m²) to full condensing.

Electric Generating Sets: Seven generating sets using a single Skinner engine are available with outputs from 10.4 to 78.3 kW(e); four duplex models using two Skinner steam engines are available with outputs from 97 to 201 kW(e). Steam can be generated by burning wood, rice husks, bagasse, coconut husks, or other biomass in manually-loaded or automatically-fed furnaces.

2. Company Experience and Operations

Skinner Engine Company has manufactured steam engines for more than 100 years. At present Skinner systems are providing electric power at six sites in developing countries. Typical applications provide power for biomass-processing mills, other rural industries, and/or adjacent villages. A system at a coconut plantation in Fiji produces 60 to 70 kW of electric power for use in a coconut processing facility. Skinner provides equipment for installation by a qualified firm in the developing country or arranges turnkey installation of the biomass energy system by a U.S. engineering firm.

BIOMASS-FUELED STEAM ENGINES AND STEAM ENGINE SYSTEMS (2)

COMBUSTION SYSTEMS ASSOCIATES INC., P. O. Box 1125, Sausalito, California 94066.
Telephone: (415) 332-1139. R. W. Winskill.

1. Equipment Characteristics

COMSAI offers 5 HP and 10 HP steam engines and a 20 HP engine unit consisting of two of the 10 HP engines mounted on a single base. The 5 HP model is a single-cylinder, two-stroke engine; exhaust heat is recoverable with an air heat exchanger for use in drying or with a water condenser to produce hot water. The 10 HP model is a compound two-cylinder, four-stroke engine with a water-cooled condenser; the exhaust steam is suitable for rice drying or other moderate temperature drying.

2. Company Experience and Operations

COMSAI was established in 1985 by executives from the Ray Burner Company of San Francisco, a manufacturer of biomass boiler systems (See listing p. __). The COMSAI engines, based on modernized versions of traditional small steam engines, have not yet been installed in a developing country. While employed earlier with Ray Burner Company, present COMSAI personnel installed a 15 kW village power system in Fiji utilizing a 20 HP Skinner steam engine which is operated with steam generated by burning coconut husks.

COMSAI customers are offered a custom package consisting of an engine manufactured by COMSAI, engineering designs and specifications for a boiler system using equipment manufactured in the developing country to the maximum extent feasible, procurement from American suppliers of equipment not available in the developing country, and other necessary services to complete the system.

BIOMASS-FUELED STEAM POWER PLANTS (1)

ULTRA POWER, INC., Eastern Operations Office, 10382 Democracy Lane, Fairfax, Virginia 22030. Telephone: (703) 385-3910. Robert P. Kennel, Senior Vice President.

1. System Characteristics

Ultrapower, a subsidiary of Ultrasystems Inc., packages all aspects of the development, implementation, and operation of wood-fired cogeneration systems and small wood-fired power plants under a single management entity. The firm provides feasibility studies, environmental analysis, fuel availability studies, design, engineering, construction, financing, and operation of the plants.

The Ultrapower systems utilize proven wood harvesting and handling techniques. Although residues from lumber mills and other forest products industries are used when available, the primary fuel is wood chips produced by the whole-tree chipping technology developed in recent years to support the paper and pulp industry. Ultrapower contracts with regional chipping contractors to supply wood chips to its plants using feller-bunchers, grapple-skidders, and whole tree chippers. The wood fuel is burned in conventional grate or fluidized bed boilers to produce high-pressure steam; the steam is used in turbine generators for electrical production.

2. Company Experience and Operations

Ultrapower designed and supervised construction of three 11.3 MW wood-fired plants which are now in operation under Ultrapower management in California and a 25 MW plant which is nearing completion in California. The company designed and is supervising the construction of two 28 MW wood-fired power plants in Maine which will be operated by an electric utility company with partial ownership by Ultrapower. Plants planned and designed by Ultrapower are constructed under turnkey contracts by Ultrasystems Engineers and Constructors, another Ultrasystems subsidiary, or by other contractors.

Although Ultrapower has no projects outside the United States at present, the firm would welcome inquiries concerning wood-fired power plant projects in developing countries. The parent firm, Ultrasystems Inc., is a high-technology company involved with the development and operation of waste-to-energy and cogeneration power plants, with the design and construction of environmental control programs, and with a broad range of defense and space systems programs. Ultrasystem's total contract revenues in the fiscal year ending 1/31/86 were \$149,167,000

BIOMASS-FUELED STEAM POWER PLANTS (2)

P.R.M. ENERGY SYSTEMS, INC., P. O. Box 473, Stuttgart, Arkansas 72160.
Telephone: (501) 673-4444. Telex: 536-455 PRODUCERS, STGT. Ronald W. Bailey, President.

1. System Characteristics

PRM Energy Systems is a subsidiary of Producers Rice Mills, Inc. which operates a large rice mill at Stuttgart, Arkansas. The firm is marketing a combustion system which burns rice husks, other agricultural residues, or wood fuels to produce process steam, process heat, or electric power. Two of the PRM Energy Reactors are now in use with rice husks as fuel at the PRM mill in Arkansas. One burns 3500 lbs (1587 kg) of rice husks per hour to supply 15,000 lbs (6800 kg) per hour of steam at 125 psig (87,875 kg/m²) for the parboiling process at the mill. A second unit burns 5,000 lbs (2268 kg) of rice husks per hour to produce a hot gas stream at 2200°F (1200°C) which is used in a huge rotary rice dryer. A fuel feeder system controls the flow of fuel to the reactor to meet the specified energy (BTU or MJ) requirements. The patented King-Chastain Energy Reactor is basically a cylindrical steel shell, reduced in diameter in the upper portion and lined with a high temperature castable refractory. The combustion process is carried out on a fixed bed with a unique method of mechanical fluidization of the fuel which requires less underfire air than the usual fluidized bed combustion system. The mechanically agitated furnace gives precise two-stage combustion control and eliminates ash slugging problems. Ashes are removed by one or two water-cooled ash discharge screws and are conveyed to an ash packaging system. The ash by-product can be sold as an absorbent or insulator; ash from the PRM systems in Arkansas is being used in the steel industry as insulation for moulds.

PRM Energy Systems offers five sizes of systems which include turbine generators and could be used with rice husks or other biomass fuels for electric power generation in developing countries. The models would produce 277 kW, 436 kW, 541 kW, 733 kW, and 1,133 kW of net electric power respectively. The feed rates for these systems range from 1.0 to 10.0 tons per hour. The PRM systems can use rice husks, wood chips, sawdust, peanut hulls, cottonseed hulls, and other waste productions.

2. Company Experience and Operations

Producers Rice Mills, Inc., a cooperative organization established in 1943, operates one of the world's largest rice processing complexes which handles about 10 million bushels annually. The combustion systems described above have been operating at the PRM mill since 1982 and have resulted in very large savings in fuel costs and substantial income from ash sales.

PRM Energy Systems is prepared to provide turnkey installations in developing countries, in cooperation with local or regional contractors.

STIRLING CYCLE EXTERNAL COMBUSTION ENGINES

STIRLING TECHNOLOGY, INC., 9 Factory Street, Athens, Ohio 45701. Telephone: (614) 594-2277. Craig Kinzelman, Vice President.

1. Equipment Characteristics

Stirling Technology offers ST-5 biomass-fueled Stirling engines rated at 5 HP at 650 RPM. Suitable biomass fuels include wood, wood pellets, sawdust, rice husks, rice straw, cotton wastes, peanut shells, weeds, and hay. The engine is supplied with either a two-stage wood burner or a cyclone burner for small-particle fuels. There are several options for waste heat recovery using heated water from the engine's cooling loop. Applications of the engine include water-pumping, grain milling, and electricity generation (3.0 to 3.5 kW).

2. Company Experience and Operations

Stirling Technology was founded in 1983 to introduce a simple, lower power, biomass-fueled Stirling cycle engine to the alternative energy market. Its founders have over 15 years of engineering and marketing experience in the Stirling engine business as a result of their work with Sunpower Inc., also of Athens, Ohio, which has been the prime contractor or subcontractor for a number of Stirling engine research projects funded by the U.S. Government. One of these projects, funded in 1982 by the U.S. Agency for International Development through the Asia Foundation, involved the development of a small Stirling engine to provide shaftpower for small rice mills and other rural applications in Bangladesh. The development and testing of this prototype led to the formation of Stirling Technology Inc. and to the development of the commercial ST-5 model described above.

The ST-5 engine is being manufactured in India under a joint venture between Stirling Technology and Stirling Dynamics Private Ltd. of Madras. At present, all sales except in India are through Stirling Technology in the U.S. An Asian office in Singapore is planned. Stirling Technology is interested in developing licensing arrangements for the manufacture of these engines by firms in other developing countries.

EQUIPMENT FOR WOOD FUEL HARVESTING AND PREPARATION

MORBARK INDUSTRIES, INC., Box 1000, Winn, Michigan 48896. Telephone: (517) 866-2381. Telex: 227-443. Jerry Morey, Vice President.

1. Equipment Characteristics

Morbark produces a wide range of equipment used for the in-forest production of whole-tree wood chips including equipment for the cutting and handling of trees and for the production, delivery, and handling of the chips.

Chip harvestors (mobile wood chippers): The Morbark line includes ten models. The largest chips trees up to 30" (76 cm) in diameter. Medium-sized models chip trees with diameters up to 22" (55 cm) or 27" (68 cm) and produce 600 tons of chips in eight hours. The Superbeaver model, designed for small diameter trees and brush, produces 100 tons of chips in eight hours.

Feller-Bunchers (mobile units for cutting trees): The Mark IV model feller-buncher cuts up to 450 small trees per hour.

Other Equipment: Morbark also produces grapple-skidders (mobile units for transporting trees and logs) and a wide variety of equipment for conveying, screening, and reclaiming wood chips including a hydraulic truck dumper.

Combustors and gasifiers: In 1986 Morbark introduced a line of combustors and gasifiers suitable for converting oil and gas fired boilers to burn wood chips. These Morbark units can produce up to twenty million BTU/hr and include Morbark fuel feeding and fuel storage units.

2. Company Experience and Operations

Morbark equipment is widely used in the United States to produce wood chips for the paper and pulp industry, for industrial and institutional wood energy systems, and for wood-fired electric power plants. Morbark products have been sold in Eastern Europe, Africa, South America, and Asia. Equipment and service is supplied to customers in Asia through a Morbark manufacturing subsidiary in New Zealand and a Morbark parts and service organization in Australia. Contract facilities to provide Morbark parts and service have been established in Hungary and in Ghana. Morbark is planning facilities in Brazil and/or Chile. Initial requests for information concerning equipment or services should be directed to the home office listed above.

ANAEROBIC DIGESTION SYSTEMS TREATING AGROINDUSTRIAL WASTEWATERS

BACARDI CORPORATION, GPO 26368, Jacksonville, Florida 32218. Telephone: (904) 757-1290. Telex: 56-505. Dr. George H. Dorion, Vice President

1. System Characteristics

Bacardi Corporation offers anaerobic treatment systems for agroindustrial wastewaters based on technology developed at the firm's large rum distillery in Puerto Rico. Rum is produced from cane molasses; the stillage which remains after the rum is distilled from the fermented "beer" contains 35,000 to 42,000 parts/million (ppm) of BOD and 80,000 to 105,000 ppm of COD. Studies conducted with participation by the U.S. Environmental Protection Agency (EPA) indicated that anaerobic treatment technology using the "anaerobic filter" concept offers the most advantages for the treatment of this wastewater.

Following bench-scale tests and the successful operation of a 3,000 gallon (11.3 m³) pilot plant, a full-scale 3.5 million gallon (13,247 m³) digester was built in 1981-82. The tank is 120' (36m) in diameter and 42' (13m) high. It is filled with 350,000 ft² (9912 m²) of plastic packing media consisting of alternating flat and corrugated sheets of vinyl plastic. The media are made in 2' x 2' bales rising to a height of 30' (9m) within the tank. The total surface area provided for the immobilized microbes is approximately 300 acres (121 ha). The plastic media are submerged in stillage which flows in at the top; eight 5.0 HP pumps draw the stillage from eight ports at the bottom of the tank and recirculate it back to the top of the tank.

The digester receives over 490,000 gallons (1514 m³) of stillage per day and produces over 1.5 million ft³ (42,480 m³) of biogas per day; the gas contains 50% to 60% methane and is used as a boiler fuel in the distillery. The gas production rate is over 4.0 m³ of gas per m³ of digester volume, which is more than five times that of most biogas plants used in developing countries. The system removes 85% of the BOD and 70% of the COD in the stillage. BOD and COD removal rates differ with the type of wastewater; BOD removal as high as 95% can be achieved with some wastewaters.

The Bacardi anaerobic technology would be suitable for any agroindustrial plant producing wastewaters with medium to very high concentrations of dissolved BOD; it can be used when a part of the BOD is in the form of suspended solids. Effluents which can be treated include stillage from distilleries using cane molasses or beet molasses, pharmaceutical fermentation wastes, paper mill wastes, spent grain liquors, cheese whey, chemical wastes, food packing wastes, meat packing wastes, winery wastes, corn products wastes, brewery wastes, and others. A plant using the Bacardi Corporation process at the Miles Laboratories pharmaceutical plant in Indiana has consistently exceeded guaranteed BOD and COD removal rates.

2. Company Experience and Operations

The digestion system at the Bacardi Corporation distillery in Puerto Rico, the world's largest distillery, was the world's largest anaerobic plant as of 1983 in terms of BOD and COD loading. An exclusive license to utilize this digestion technology in India has been issued by Bacardi Corporation to Larson International Inc., 44 Saginaw Drive, Rochester, New York 14723. Larson, an environmental engineering firm, has built an initial digestion system at a plant in India which produces industrial ethanol from sugarcane molasses; the unit will process 225,000 liters of wastewater per day. Larson will install similar systems at three larger ethanol plants in India. Bacardi Corporation is seeking additional opportunities to utilize its unique experience with anaerobic wastewater treatment to meet treatment and energy needs of agroindustrial plants in developing countries.

WATER-PUMPING WINDMILLS (1)

DEMPSTER INDUSTRIES, INC., P.O. Box 848, Beatrice, Nebraska 68310. Telephone: (402) 223-4026. Telex: 701447 DEMPSTER UD. Joyce Ehmke, Export Sales Manager.

1. Equipment Characteristics

Windmills: Dempster manufactures five size of water-pumping windmills coupled to reciprocating cylinder pumps. The models have galvanize' steel fanwheels with diameters of 6', 8', 10', and 14' (1.83, 2.44, 3.65, and 4.26 m). The gears run in an oil bath which is changed annually. The windmill is installed directly over the well or water source; a wooden or steel pump rod is connected to the pump. Water is pumped into a ground level tank or elevated storage tank; the pumping elevation determines the windmill diameter required. Windmill speed is controlled by an internal expanding brake; the mill can be pulled out of the wind manually by a pullout rod or the customer can purchase a windmill regulator which removes the mill from the wind when the tank is full and turns it back into the wind when the water level drops below 5" (12.5 cm). Complete windmills, not including towers, cost from \$1160 for the 6' model to \$4870 for the 14' model.

Towers: Dempster provides six models of steel towers. Those with heights of 22', 28', 33', or 39' (6.77, 8.53, 10.05, and 11.88 m) are suitable for mills with diameters up to 10'; towers with 30' or 40' height (9.14 or 12.19 m) are suitable for 12' and 14' diameter mills. Tower prices range from \$864 to \$2268.

Pumping Capacities: The pumping rates are influenced by windspeed, pumping elevation, diameter of mill, cylinder sizes, and length of pumping stroke. A 6' windmill with a 2" cylinder and 5" stroke pumps 130 gallons (.49 m³) per hour from a 95' elevation with a windspeed of 15 miles per hour. A 12' windmill with a 3" cylinder and 12" stroke pumps 463 gallons (1.75 m³) per hour from an elevation of 125' with a windspeed of 18 to 20 miles per hour.

2. Company Experience and Operations

Dempster Industries has manufactured water-pumping windmills for 108 years. Its equipment was widely used in rural America early in this century prior to the rural electrification program of the 1930s. Some Dempster windmills have been sold in developing countries including Somalia, Morocco, and Sudan. Dempster does not provide overseas installation or service. If a customer provides full information on well characteristics, wind speed patterns, and pumping requirements, Dempster will calculate the size of windmill required. The customer may order packages of replacement parts necessary for a 2-year or 10-year period of operation. The Dempster windmills are warranted for one year against defects in materials and workmanship and to perform according to Dempster specifications when properly operated and maintained. This warranty provides replacement of the defective part but covers no other costs or damages.

WATER-PUMPING WINDMILLS (2)

THE HELLER-ALLER COMPANY, INC., Perry and Oakwood Streets, Napoleon, Ohio 43545.
Telephone: (419) 592-1856. Max Kelley, President.

1. Equipment Characteristics

Windmills: Heller-Aller manufactures four models of "Baker" back-geared windmills with multiblade fanwheels. The models have fanwheels with diameters of 6', 8', 10', and 12" (1.83, 2.44, 3.04, and 3.65 meters). Pumping capacities range from 100 to over 1,000 gallons per hour (.37 to 3.7 m³/hr) depending on windmill size, diameter of pump cylinder, pumping elevation, and wind velocity. The fanwheels rotate on ball bearings; power is transferred to the vertical pumping shaft by gears running in a pool of oil. The windmill's vane is automatically self-governing and takes the windmill out of gear when the wind reaches an excessive velocity.

Heller-Aller also distributes "Fiasa" windmills with 6', 8', 10', 12', 14', and 16' diameter fanwheels; the wheels rotated in replaceable babbitt-type bearings which have been extensively used in the U.S. for many years.

Towers: The firm provides 12 models of galvanized steel towers from 15' to 60' (4.5 to 18.2 m) and steel stub towers for mounting new windmill heads on existing steel towers or on wooden towers.

Pumps: Heller-Aller offers a wide range of iron and brass cylinder pumps suitable for use with their windmills. Models are available which will fit in well casings with diameters of at least 3", 3.5", and 4.5" (7.62, 8.89, and 11.43 cm).

2. Company Experience and Operations

Heller-Aller is a small firm with 25 to 30 employees; it has manufactured water well equipment for farms and homes including water-pumping windmills for 100 years since 1886. Its windmills were very widely used in rural America prior to the extensive rural electrification program of the 1930s. The machines have been sold in a number of developing countries. One hundred machines were sold to Nigeria in the early 1970s. In recent years most overseas sales have been in Central America. Volunteers for Technical Assistance (VITA) chose 23 Heller-Aller windmills for a USAID-funded project in Honduras.

Heller-Aller can provide turnkey installation of its windmills and towers in developing countries using one of several available American contract technicians, each of whom has many years of experience with windmill installations. The firm has no licensing agreements or joint ventures with firms in other countries.

SMALL WIND GENERATORS

BERGEY WIND POWER COMPANY, INC., 2001 Priestly Avenue, Norman, Oklahoma 73069.
Telephone: (405) 364-4212. Mike Bergey, Vice President.

1. System Characteristics

BWC 1000 Series: These 1.0 kW wind generators have 9.2' (2.8 m) diameter rotors connected directly to low speed permanent magnet alternators. Units are available (a) with an inverter providing either 115V, 60 cycle AC power or 230V, 50 cycle AC power, or (b) with the EMS-4 Energy Management System to provide DC power for battery charging with voltage outputs from 12V to 120V DC.

BWC EXCEL Series: These 10.0 kW wind generators have 23' (7.8 m) diameter rotors. Units are available with (a) an inverter providing 240V, 60 Hz AC power for utility interconnection or (b) with a VCS-10 Voltage Control System to provide 120V DC power for battery charging.

Both Series: All BWC units are designed to eliminate unnecessary parts and requirements for regular maintenance. Rotor blades are made of a fiber reinforced plastic which reduces cost, increases strength, and reduces corrosion in comparison with aluminum blades. Low speed permanent magnet alternators are driven directly by rotors, eliminating the need for oil changes or gearbox replacements. BWC wind turbines are designed to survive unattended in wind speeds up to 54 m/s (120 mph); at wind speeds above 13.4 m/s (30 mph) the "Autofurl" overspeed protection system, using aerodynamic and gravity forces, turns the rotor partially out of the wind. BWC offers three types of towers; guyed towers, lattice free-standing towers, and tapered tube free-standing towers.

2. Company Experience and Operations

BWC has its origins in the wind energy research at the University of Oklahoma throughout the 1970s. Deliveries of the BWC 1000 series wind machines began in 1980; over 500 of these 1 kW units have been sold, and they have operated for a total of over 8.5 million hours. The BWC EXCEL series was introduced in 1983; over 300 of these 10 kW units have been delivered.

BWC units have been installed in over 20 countries including India, China, Egypt, Tunisia, Kenya, Oman, and Antigua. Recently BWC was chosen for a contract for 1 kW wind machines by the Government of India from among about 38 bidders. The firm believes that widespread overseas use of small wind systems will require local manufacture of the equipment. BWC has licensed Aero Power Private of India to produce its machines and is presently negotiating several similar agreements in other countries. Most BWC sales have not involved installation or service; in the future, turnkey installations will be available in some areas through BWC licensees or joint ventures.

LARGE WIND GENERATORS

FLOWIND CORPORATION, 21249 72nd Avenue South, Kent, Washington 98032.
Telephone: (206) 872-7080. Dr. Irwin E. Vas, President

1. System Characteristics

Flowind currently manufactures 150 kW and 250 kW vertical axis wind turbines; the 250 kW model has a 62' (19 m) diameter rotor. In 1982, the firm offered 120 kW models; forty 175 kW models were installed in a windfarm in California in 1983. Critical components are located at ground level, with easy access for maintenance. Safe shutdown in high winds is provided by three independent braking systems controlled by a microprocessor. Flowind is now developing machines capable of producing 450 kW.

2. Company Experience and Operations

Flowind's primary business is the production and installation of 150 and 250 kW wind turbines in large windfarm projects in the western United States. By early 1985 it had installed over 300 large units in such projects. Flowind had provided equipment for wind projects in the Caribbean area funded by the U.S. Agency for International Development through the Caribbean Development Bank. Negotiations are in process for sales of Flowind units in India, China, Spain, Israel, and Taiwan. Flowind will sell machines without responsibility for installation or service, or will provide turnkey installation supervised on the site by two or three Flowind employees. The firm can provide a maintenance contract covering training of local maintenance personnel and periodic maintenance checks by Flowind technicians.

FLAT-PLATE SOLAR COLLECTORS AND SOLAR WATER HEATING SYSTEMS

U.S. SOLAR CORPORATION, PO Drawer K, Hampton, Florida 32044. Telephone: (904) 468-1517. Telex: 887242 (US SOLAR HAMP). Steven K. Gorman, Vice President (Marketing).

1. Systems Characteristics

Flat-plate collectors: USSC "Eagle Sun" collectors have rigid anodized aluminum frames certified to withstand 181 miles/hour winds. The firm offers 21 sizes of collectors with all-copper absorber plates and 14 sizes of collectors with copper tubing bonded to aluminum fins.

Ramped solar water-heating systems: USSC open-loop solar water heating systems include USSC collectors, USSC storage tank, circulating (electric) pump, expansion or water storage tank, differential temperature controller, fluid circulating components, mounting hardware, and installation manual. Pump turns on automatically when collector temperature is higher than tank temperature. In draindown systems, collectors and exposed piping drain completely each time the pump is turned off to protect system against freezing.

Thermosiphon water-heating systems: In USSC's "Free Flow" thermosiphon systems, lighter heated water flows from the collector to a tank just above the collector; no pumps or controls are required. These systems are available with three sizes of collectors and tanks.

Low-cost water heater: USSC's "Sunflare" water heater consists of a glass-lined steel tank which is heated by reflections from a curved aluminum solar reflector.

2. Company Experience and Operations

USSC was started by three equal partners in 1977. The firm has drawn on the experience at the extensive solar energy research laboratory at the nearby University of Florida at Gainesville. A partial listing of USSC solar installations includes 16 housing complexes, 8 community/governmental complexes, 6 educational institutions, 7 motels and hotels, 3 firms, and 2 hospitals. USSC systems are manufactured by licensees in Korea, Colombia, Brazil, and Egypt; other major markets include India, Philippines, Pakistan, Saudi Arabia, Peru, Iraq, Belize, and Panama. The firm has representatives or agents in 30 countries. USSC can provide turnkey solar projects including feasibility studies, design, engineering, project management, testing, and maintenance.

CONCENTRATING SOLAR COLLECTOR SYSTEMS WITH FRESNEL LENSES

ENTECH, INC., P.O. Box 612246, DFW Airport, Texas 75261
Telephone: (214) 456-0900. Walter J. Hesse, President

1. Systems Characteristics

Entech designs, fabricates, and installs linear and point-focusing concentrating solar collectors. The durable acrylic plastic Fresnel lenses are ultraviolet resistant and have a life expectancy of over 20 years. An electronically controlled two-directional tracking system continuously adjusts the collectors to obtain maximum solar radiation. Most of the collectors are used with photovoltaic cells to produce electricity; the collectors concentrate the sun's rays 22 times, thus reducing by a factor of 22 the area of photovoltaic cells required for a given level of power output. The modular Entech units can be produce as little as 1.5 kW or in large multi-Megawatt systems. Entech systems can provide only electric power, a combination electricity and heat, or heat only.

A system producing both electricity and heat was installed in 1982 at the Dallas-Fort Worth Airport in Texas; it includes 110 linear Fresnel collectors with a total collector area of 245 m². The system produces 25 kW of net electric power which is used in a continuously operating emergency lighting system and 140 kW of thermal energy which provides half of the hot water at 28°C used in a 850-bed airport hotel.

2. Company Experience and Operations

Entech was formed in 1983 when six employees of the solar energy technology division of E-Systems, a major defense contractor for the U.S. Government, purchased the majority interest in the solar division. While at E-Systems, the Entech staff built concentrating collector systems for Texas Tech University, for the Jet Propulsion Laboratory, for Sandia National Laboratories, and for the U.S. Department of Energy. After 1983 Entech completed nine E-Systems contracts for concentrating solar collectors with the Department of Energy and Sandia Laboratories. A system has also been built for the Tennessee Valley Authority. Entech is participating in a Department of Energy demonstration project which will provide 300 kW of electric power for an industrial plant in Texas. The firm recently won a bid for a 24 mW concentrator/photovoltaic power plant to be built in phases over five years at an Indian reservation in southeastern California provided that financing can be arranged.

Entech does not yet have overseas projects or business relationships. The firm is interested in licensing agreements with overseas firms to produce concentrating collector systems utilizing Entech technology.

PHOTOVOLTAIC SYSTEMS

SOLAVOLT INTERNATIONAL, 3646 E. Atlanta Avenue, Phoenix, Arizona 85040.
Telephone: (802) 231-6414. Telex: 249901 SOL UR. Clyde Ragsdale,
International Sales Manager.

1. Systems Characteristics

Solavolt International manufactures photovoltaic power modules and supplies complete systems and balance-of-system components. Photovoltaic cell efficiency is enhanced by state-of-the-art processes such as ion implantation and plasma patterning. The rigid mechanical construction of Solavolt's modules ensures reliable operation even in winds of 200 km/hr. Effective moisture barriers and a weather-resistant junction box protect systems in moist climates. Standard systems are available for water-pumping, lighting, and medical refrigeration. The water-pumping system includes a stainless steel pump which pumps 18 m³ of water per day from a depth of 30 m. The lighting system produces from 5 to 40 watts of power which is used in high-efficiency fluorescent strip lights and flood lights. The present standard medical refrigeration system includes a 0.135 m³ low-cost refrigerator with an output of 2 kg of ice per day.

2. Company Experience and Operations

Solavolt International was formed on October 1, 1981, when Motorola and Shell Oil Company entered into a partnership which combined their photovoltaic operations. In 1983 Solavolt received a contract from the NASA Lewis Research Center, funded by the U.S. Agency for International Development, to develop and test a small PV-powered medical refrigerator suitable for use in remote areas in developing countries. The Solavolt refrigerators were installed at ten locations in Honduras, St. Vincent, Ivory Coast, Burkina Faso, Egypt, Tunisia, Thailand, Mali, and Jordan. Four to seven SVI 40 Watt PV modules provide 12 V DC power to the batteries in each system; these systems include 0.085 or 0.104 m³ top-opening refrigerators.

Solavolt has an extensive international distribution network; inquiries should be directed to the firm's headquarters in Phoenix for forwarding to the appropriate overseas representatives. The firm provides a 1-year warranty on its standard lighting system, a 2-year warranty on the standard medical refrigerator system, and a 5-year warranty on its standard pumping system.

Contact List

1. H. O. Ebson, Assistant Sales Manager, Ray Burner Company, San Francisco, CA
2. William M. Glasheen, Director of Engineering, Lambion USA, Richmond, VA
3. Dave Keenan, Sales Manager, The G & S Mill Inc. (former Executive Director, National Wood Energy Association), Northborough, MA
4. Ronald W. Bailey, President, P.R.M. Energy Systems, Stuttgart, AR
5. Leo F. Bronson, Manager, Site and Fuel Development, Ultrapower Inc., Fairfax, VA
6. Ronald Misko, Product Engineer, Skinner Engine Company, Erie, PA
7. R. W. Winskill, President, Combustion Systems Associates Inc., Sausalito, CA
8. Craig Kinzelman, Vice President, Stirling Technology, Inc., Athens, OH
9. Jerry Morey, Vice President, Morbark Industries, Winn, MI
10. Jeffrey Dingle, Alliance International, Portland, ME
11. Buck Rogers, President, Buck Rogers Company, Industrial Airport, KS
13. Todd Bemenderfer, Sales Manager, Laidig, Inc., Mishawaka, IN
13. John Ashworth, Senior Associate, Associates for Rural Development, Burlington, VT
14. C. W. Moores, Vice President, The Badger Company, Cambridge, MA
15. Bob Sherwin, American Wind Energy Association, Washington, DC
16. Dr. George H. Dorion, Vice President, Bacardi Corporation, Jacksonville, FL
17. Steve Gorman, Vice President, U.S. Solar Corporation, Hampton, FL
18. Walter Hess, Vice President, Entech, Inc., Dallas, TX
19. Ram Shrivastava, President, Larson International, Rochester, NY
20. Dov Gazit, Amcor Group

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21. Steve Gorman, U.S. Solar Corporation
22. Mike Bergey, Bergey Windpower Co.
23. Joyce Ehmke, Dempster Industries
24. Diana Cushing, Enertech Corporation
25. Dr. Irwin Vas, FloWind Corporation
26. Max Kelly, Heller Aller Company
27. Don Klass, BERA/IGT
28. Pauline Labrie, representing Fred Morse, DOE
29. Linda Ladis, SEIA
30. Carlo LaPorta, representing Walter Hesse, Entech Corp.
31. Sam Schweitzer, AID, representing the sponsor
32. Judy Seigel, Meridian Corporation
33. Phil Badger, TVA
34. Mike Bell, PSIC
35. Barbara Flynn, REI
36. Thomas Gray, AWEA
37. Matt Mendis, World Bank
38. Bennett Miller, AGI
39. Jim Peebles, Information Resources Inc.
40. Malcolm Ream, Solarex
41. Scott Sklar, Export Council on Renewable Energy
42. Henry Steingass, AID
43. Jerry Storey, Ultrasystems