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# SOLAR HEATING AND COOLING R & D PROGRAM COORDINATION

Final Report for the Period October 1, 1980—September 30, 1983

October 1983

Work Performed Under Contract No. AC03-80CS30512

TPI, Inc.
Bethesda, Maryland



Technical Information Center
Office of Scientific and Technical Information
United States Department of Energy

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FINAL REPORT

# SOLAR HEATING AND COOLING R & D PROGRAM COORDINATION

CONTRACT DE-AC03-80CS30512

October 1,1980 - September 30,1983

submitted to

U.S.Department of Energy

San Francisco Operations Office

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TPI, INC.

ENGINEERING CONSULTANTS

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# I. INTRODUCTION

This is the final report for the contract entitled, "Solar Heating and Cooling R&D Program Coordination Support," (DE-AC03-80CS30512) which was in effect for three years between September 30, 1983 - September 30, 1983. The objective of the project was to support the U. S. Department of Energy's international R&D activities in the solar heating and cooling area. The cooperative programs were of two types: bilateral (involving the U.S. and one other country) and multilateral (involving the U.S. and several other countries).

The multilateral programs supported under this contract were:

- International Energy Agency Solar Heating and Cooling Program
- NATO/CCMS Solar Energy Pilot Study

Solar heating and cooling projects under the following bilateral programs were supported:

- U.S./Mexico
- U.S./Israel
- U.S./Spain

TPI's assistance to DOE's Office of Solar Heat Technologies, the office responsible for the solar heating and cooling programs, consisted primarily of program management and coordination support, plus a smaller amount of technical support.

The solar heating and cooling projects have acquired the reputation of being some of the most effective and well-managed of DOE's international activities. TPI is pleased to have been associated with these efforts and proud of the contribution it has made to the success of these collaborative programs. This final report summarizes the work performed during the three years of this contract and the accomplishments.

# II. MANAGEMENT SUPPORT FOR MULTILATERAL SOLAR R&D PROGRAMS

This section discusses the support provided under the contract for the two multilateral solar heating and cooling R&D programs: The International Energy Agency (IEA) Solar Heating and Cooling Program and the NATO/CCMS Solar Energy Pilot Study (SEPS). For each program, some background information is provided followed by a review of the work performed by TPI.

## 1. IEA SOLAR HEATING AND COOLING PROGRAM

### BACKGROUND

The International Energy Agency was formed in November 1974 to establish cooperation among a number of industrialized countries in the vital area of energy policy. It is an autonomous body within the framework of the Organization for Economic Cooperation and Development (OECD). Twenty-one countries are presently members, with the Commission of the European Communities also participating in the work of the IEA under a special arrangement.

One element of the IEA's program involves cooperation in the research and development of alternative energy resources in order to reduce excessive dependence on oil. A number of new and improved energy technologies which have the potential of making significant contributions to global energy needs were identified for collaborative efforts. The IEA Committee on Energy Research and Development (CRD), composed of representatives of each member country and supported by a small Secretariat staff, is the focus of IEA RD&D activities. Four Working Parties (in Conservation, Fossil Fuels, Renewable Energy, and Fusion) are charged with identifying new areas for cooperation and advising the CRD on policy matters in their respective technology areas.

Solar Heating and Cooling was one of the technologies selected for joint activities. During 1976-77, specific projects were identified in key areas of this field and a formal Implementing Agreement drawn up. The Agreement covers the obligations and rights of the Participants and outlines the scope of each project or "task" in annexes to the document. There are now eighteen signatories to the Agreement:

Australia
Austria
Belgium
Canada
Denmark
Commission of the European Communities
Federal Republic of Germany
Greece
Italy
Japan
Netherlands
New Zealand
Norway
Spain
Sweden
Switzerland
United Kingdom
United States

The overall program is managed by an Executive Committee, while the management of the individual tasks is the responsibility of Operating Agents. The tasks of the IEA Solar Heating and Cooling Program, their respective Operating Agents, and current status (ongoing or completed) are as follows:

Task I Investigation of the Performance of Solar Heating and Cooling Systems - Technical University of Denmark (Completed).

Task II Coordination of Research and Development on Solar Heating and Cooling - Solar Research Laboratory - GIRIN, Japan (Ongoing).

Task III Performance Testing of Solar Collectors - KFA-Julich, F. R. Germany (Ongoing).

Task IV Development of an Insulation Handbook and Instrument Package - U.S. Department of Energy (Completed).

Task V Use of Existing Meteorological Information for Solar Energy Application - Swedish Meteorological and Hydrological Institute (Completed).

Task VI Performance of Solar Heating, Cooling, and Hot Water Systems Using Evacuated Collectors - U.S. Department of Energy (Ongoing).

Task VII Central Solar Heating Plants with Seasonal Storage - Swedish Council for Building Research (Ongoing).

Task VIII Passive and Hybrid Solar Low Energy Buildings - U.S. Department of Energy (Ongoing).

Task IX Solar Radiation and Pyranometry Studies - Canadian Atmospheric Environment Service (Ongoing).

The United States has played a major role in the leadership of the IEA Solar Heating and Cooling Program. The U.S. representative has served as Chairman and Vice Chairman of the Executive Committee and the U.S. Department of Energy has served as Operating Agent for three tasks. Technical experts from the U.S. have participated actively in all nine tasks.

## WORK PERFORMED BY TPI

### Support to the IEA Solar Heating and Cooling Executive Committee

Through its support to the Chairman and Vice-Chairman of the IEA Solar Heating and Cooling Executive Committee and interaction with the task Operating Agents, TPI played an important role in the smooth and effective operation of the

Program. (The Executive Committee is responsible for the management of the Solar Heating and Cooling Program and the nine tasks it comprises.) Timely and standardized reporting, meeting planning and follow-up, policy guidelines, and program assessment are areas in which TPI was heavily involved.

Some of the most important Executive Committee support activities undertaken by TPI are as follows:

- In preparation for each semi-annual Executive Committee meeting, TPI drafted and distributed detailed minutes and a list of action items. In addition, the meeting calendar, Executive Committee address list, and list of publications were updated regularly.

- TPI participated in the January 1982 meeting of the Operating Agents at which they reviewed the management of the program and made a number of recommendations for enhancing its effectiveness. A paper outlining these recommendations was drafted by TPI for submittal to the Executive Committee.

- TPI instituted a procedure for preparation of the annual progress reports required by the IEA Secretariat. A standardized format and list of topics to be covered were agreed upon. The Operating Agents drafted their task progress reports and sent them to TPI for editing. At TPI's initiative, the 1982 task reports were combined for the first time into a single report and material added on Executive Committee decisions and actions. This change was very well received by the Committee.

- TPI assisted in the drafting of a policy paper entitled, "Strategy and Framework for Activities within the IEA Solar Heating and Cooling Implementing Agreement." It covers program guidelines, methodology for identifying promising areas for cooperation, project selection criteria and procedures for initiating and concluding tasks.

- TPI drafted and revised the "Reporting and Information Dissemination Guidelines for the IEA Solar Heating and Cooling Program." This document defines the policy for information dissemination and handling and establishes guidelines for the preparation, review, approval and distribution of the various types of reports and information produced in that cooperative program.

- TPI drafted a paper outlining a possible program of IEA-sponsored monographs and how the activity would be implemented.

- TPI organized an IEA Executive Committee-sponsored Workshop on National Solar Heating and Cooling Programs held at the ISES Congress in Brighton, England.

- Two reports related to the Brighton Conference were edited and compiled by TPI: (1) a compilation of the papers presented on national solar heating and cooling programs and (2) papers on each of the IEA tasks presented by the Operating Agents.

- TPI assisted in the Executive Committee's Assessment of the Solar Program. The questionnaire was reviewed and modifications recommended. Later TPI prepared a summary of the findings of the Assessment.

## Information Dissemination

Two aspects of information dissemination are crucial if diffusion of results of international collaboration is to be achieved. First, the IEA program must be publicized so that the solar R&D community can be aware of the cooperative work underway and reports which have been completed. Secondly, reports must be made available to whom the results would be of interest. In order to help accomplish effective information dissemination, TPI was involved in the following activities:

- TPI prepared three issues of an IEA newsletter, IEA Solar Heating and Cooling Update. (The printing of the newsletter was cost-shared by the Executive Committee.) The purpose of the newsletter was to publicize the solar heating and cooling work underway within the IEA to a broad audience. The newsletter has been widely distributed internationally and been very well received.

- Sheila Blum (TPI) was one of the authors (along with P. Sens and F. Morse) of a paper presented at the August 1981 ISES Congress in Brighton, U.K. The paper gave an overview of all the cooperative activities of the IEA Solar Heating and Cooling Program.

- Ms. Blum also co-authored (with F. Morse and P. Sens) a paper on the results of the IEA program for the ISES Conference in Perth, August 1983. TPI also obtained a variety of slides to illustrate the paper and provided copies of the IEA newsletter and lists of IEA reports for handouts.

- A TPI-authored paper on the IEA cooperation was presented at the DOE Active Contractors' Review Meeting in September 1981.

- TPI worked with the U.S. technical representatives to develop appropriate distribution lists for IEA technical reports and the IEA newsletter.

## Liaison with U.S. Technical Participants

TPI was often utilized as a liaison between DOE and the U.S. technical experts participating in the different IEA tasks. Over the years an excellent working relationship was established with the technical participants which facilitated TPI's serving as a central point of contact for the international work. This allowed TPI to track progress in the various projects, keep DOE apprised of issues and concerns, and to obtain information required of the technical experts by DOE.

By way of example, TPI worked closely with the U.S. technical representatives in order to:

- Follow-up on action items
- Obtain information for DOE on annual funding requirements
- Work together on preparation of quarterly status reports for DOE
- Develop distribution lists for the dissemination of various IEA-generated information
- Assure adequate review of the drafts of IEA technical reports
- Help the experts in the preparation of IEA documents for which the U.S. was responsible.
- Brief new U.S. participants on the program, established procedures, and issues.
- Keep U.S. participants apprised of Executive Committee actions and decisions.

## Review Meetings, Status Reports and Briefings

One of TPI's major responsibilities was keeping interested and involved DOE managers and officials informed of the status of the IEA program and U.S. involvement. This was accomplished through program review meetings, status reports and briefing material, as follows:

- TPI organized for the Office of Solar Heat Technologies annual review meetings on the IEA Solar Heating and Cooling Program and the IEA Small Solar Power System (SSPS) project. The purpose of these meetings, attended by DOE program managers, invited industry representatives, and U.S. technical participants from each task, was to keep DOE and other interested parties informed of work underway, accomplishments, issues, and whether the work was consistent with U.S. objectives and priorities. The planning involved agenda preparation, obtaining a suitable meeting room, distributing invitations, issuing instructions to presenters, and preparing background material.
- TPI set up a procedure for quarterly status reporting to DOE by all lead U.S. technical representatives. A standardized format was developed for these reports. They have proved very useful in keeping the U.S. Executive Committee member apprised of the status of all tasks.
- At the request of DOE, TPI prepared numerous sets of briefing material on the IEA activities. These were used to brief various DOE officials (such as the DOE Deputy Assistant Secretary, and the Assistant Secretary, and Undersecretary of Energy) and others.

- TPI also helped set up and participated in many meetings held from time to time to review the status of a single IEA task.

- TPI periodically updated Project Data Sheets on the IEA Solar Heating and Cooling tasks for Marida, a contractor responsible for keeping updated information on all Renewable Energy international projects.

## Solar Industry Involvement

It was DOE's desire to have industry become more involved with the IEA work in order to have the benefit of their views and to maximize the usefulness of the international work to U.S. industry. One way TPI assisted in increasing industry participation was to fund the travel of SEIA-designated representatives to IEA Task III meetings. (Task III is of particular interest to industry because it deals with the area of collector performance testing.) The travel of the following industry representatives was covered under the TPI contract:

William Dokos
DSET
- (1) Task III Experts Meeting, Feb. 1981, Vienna
- (2) Task III Experts Meeting, Feb. 1982, Switzerland
- IEA/CEC Solar Simulator Workshop, Feb. 1982, Ispra, Italy

Byard Wood
Arizona State U.
- Task III Experts Meeting, Mar. 1983, Canada

In addition, TPI participated in several meetings between DOE and industry representatives to discuss the IEA work, the industry role, and the relation of the IEA activities to the International Standards Organization work. TPI drafted for DOE a position paper outlining the industry involvement in the U.S. participation in the Task III collector performance and standards-related activities.

Moreover, copies of IEA technical reports were provided to SEIA for them to distribute as appropriate. SEIA was also asked to review and comment on draft copies of a number of IEA technical reports.

Industry involvement is an area that could still be improved upon. The problem appears to stem from disinterest or disorganization on the part of SEIA. For example, the past two SEIA presidents have failed to respond to DOE requests to name an SEIA liaison person for IEA activities.

## Drafting/Review of IEA Annexes

During the course of the contract, two new tasks were initiated (VIII and IX) and several tasks were extended and additional work undertaken (II, III, VII). These actions necessitated either a new annex or modifications to the existing annex. TPI was directly involved in the preparation or revision of all the aforementioned annexes. In some cases, TPI participated directly in the drafting of the annex and in the others the role was one of review of drafts prepared by others. In all cases, TPI worked closely with the U.S. technical representatives in the task to which the annex pertained.

## Document Review, Information Gathering and Other Support

During the contract period, TPI responded to many DOE requests for document review and various information gathering activities. Examples of these kinds of activities carried out by TPI are:

- Compilation of statistics on Renewable Energy R&D programs and funding in IEA countries.
- Summary of various IEA/CRD and IEA/Renewable Energy Working Party policy papers.
- Review of DOE's International Solar Multiyear Plan.
- Information on international solar export activities and renewable energy use in LDCs.
- Compilation of information on solar technologies for a Renewable Enery Working Party Assessment.
- Review of various IEA reports and other international reports.
- Assessment of various IEA activities and recommendations regarding U.S. involvement.

In addition, TPI has provided assistance in U.S. involvement with various IEA workshops. For example, TPI organized and hosted a Task I modeling workshop held in Annapolis, MD during July 1981. More recently, TPI has worked with Charles Bankston in the planning and organization of an IEA workshop on Large Collector Array Performance to be held in 1984 in California.

## Assistance Related to IEA Task II

Task II, "Coordination of Solar Heating and Cooling R&D," has been concerned primarily with surveys related to solar heating and cooling programs and the

preparation of documents containing the results of the surveys. The following subtasks comprise Task II:

A - National R&D Projects

B - Dropped

C - National R&D Program Plans

D - Status of Solar Heating and Cooling Commercialization.

TPI was involved in the Task II activities as follows:

- The draft of the October, 1981 report on "National Solar Heating and Cooling R&D Plans" was edited by TPI for English accuracy.
- The three survey questionnaires were reviewed by TPI and other U.S. reviewers and extensive changes recommended.
- TPI tracked completion of the U.S. survey questionnaires (prepared by other groups) and assisted in the preparation of the U.S. input for the Subtask C and D surveys.
- The three completed Task II survey documents (Jan. 1983 versions) were each reviewed by a number of U.S. program managers and researchers. TPI synthesized the comments for each report and forwarded them to the Operating Agent.

## Planning and Implementation of IEA Passive Task (Task VIII)

Since many countries had become interested in passive solar, it was felt that a continuation of the NATO/CCMS Passive Applications Group would be desirable. The U.S. agreed to head such a project. It was unclear whether this cooperation should be under CCMS or whether a passive task should be established under the IEA Solar Heating and Cooling Agreement (this latter course of action was the one eventually selected). In addition, the specific activities in the passive area to be undertaken had to be decided upon and proposed to the cooperating partners, as well as whether it would be established as new work or as part of an existing IEA task. Finally, a major effort was required to draft an annex to the Implementing Agreement and initiate the task.

The activities undertaken by TPI in connection with a new international passive activity are summarized below:

- Several discussion papers outlining the options for a new passive project were prepared for DOE (discussing possible sponsoring organizations, scope of the project, leadership, etc.).

- Material was prepared for presentation to the Executive Committee reviewing various options. Three preliminary annexes were also drafted for Executive Committee consideration.

- As input into the planning for the new passive task, TPI worked with Booz Allen and Hamilton in the preparation of a report entitled, "International Passive Assessment."

- One of the preliminary annexes was revised and re-submitted for the review of those countries interested in participating.

- TPI assisted in the organization of the first three Task VIII meetings These were an experts planning meeting, a meeting of lead countries, and the first formal Task VIII meeting.

- The first Task VIII status report to the Executive Committee was drafted by TPI.

- TPI assisted DOE in attempting to establish cooperation between the IEA and the CEC in the passive area.

- TPI assisted DOE in connection with its co-sponsorship of the CEC/IEA International Solar Architecture Conference held in December 1982 in Cannes, France. TPI compiled an appropriate U.S. mailing list and distributed announcements of the conference. The conference was also publicized in various U.S. solar publications. At DOE's request, potential U.S. authors were contacted regarding submission of abstracts and possible participation in the conference.

## 2. NATO/CCMS SOLAR ENERGY PILOT STUDY

### BACKGROUND

During 1973-1978, over twenty nations participated in the NATO/CCMS Solar Energy Pilot Study, whose objective was to promote and accelerate the use of solar heating and cooling of buildings. The activities in this information exchange included (1) the regular reporting of national solar heating and cooling programs, (2) the development of a format for reporting the performance of solar heating and cooling systems, (3) the exchange of system performance reports, (4) the establishment of two specialized working groups for solar-assisted low energy dwellings and passive solar applications. By October 1978 all CCMS activities had been concluded with the exception of the "Passive Solar Applications Group" which continued through the end of 1980.

WORK PERFORMED BY TPI

The U.S., as lead country, was responsible for writing the Pilot Study's two required follow-up reports. At DOE's request, TPI drafted the CCMS Solar Energy Pilot Study's Second Follow-Up Report. It was reviewed by DOE, changes incorporated and then distributed to CCMS Headquarters and member countries in November 1981.

A number of discussions and planning sessions were held to review various options for continuing the international passive cooperation. Continuing under the CCMS umbrella was one possible approach covered in an options paper prepared for DOE by TPI. The final decision, however, was to conclude the CCMS work and initiate a passive project within the IEA.

# III. TECHNICAL SUPPORT FOR THE IEA

## BACKGROUND

TPI has been involved in the IEA Solar Heating and Cooling technical work through this contract in a number of ways. Dr. William Kennish served as one of the U.S. technical representatives to the IEA Solar Heating and Cooling Task I Experts Group until its recent completion. Through his participation in Task I, Dr. Kennish provided support in the areas of thermal performance reporting formats, solar system simulation, computer program validation, and validation methodology development.

In addition to the detailed technical support to Task I, TPI also provided technical input into the formulation and early activities in Task VIII, "Passive and Hybrid Solar Low Energy Buildings." Besides assisting in the drafting of the original annexes, TPI also provided format and survey development reports for Task VIII, Subtask 0. This work was accomplished by a subcontract to W. I. Whiddon & Associates, Inc.

Also in support of the international passive work, Dr. Kennish took part in the International Passive Cooling Working Group, the National Passive Cooling Working Group, and served as National Coordinator for the International Passive Cooling Conference.

At DOE's request, TPI has performed a technical assessment of the analytical work performed within all tasks of the IEA Solar Heating and Cooling program. In addition, TPI has provided technical reviews of IEA reports and provided general technical expertise.

Presented below are the more significant technical activities which were undertaken as part of this contract. More detailed descriptions of each piece of work can be obtained from the special reports prepared under this contract (found in the list of publications).

## WORK PERFORMED BY TPI

### Status Report on the Implementation of the IEA Reporting Format in the U.S. Solar Program

IEA Solar Heating and Cooling Task I issued in February 1980 a Reporting Format for Thermal Performance of Solar Heating and Cooling Systems in Buildings. Although the document provides considerable detail on the reporting of performance information, it was anticipated that few researchers would be able to use the format exactly as presented.

It was also recognized at the time of issuance that the format would require modification over time based on feedback from individuals using the format. To facilitate the modification (which would probably occur after two or three years of use) an annual review of the U.S. format implementation needed to be made. This study represented the first of those status reports.

The review identified a number of users of the document within the U.S. Included were:

- IEA Task VI Project (William Duff, CSU)
- CSU Solar House I
- Los Alamos National Laboratory document #LA-8622-MS, "Solar Heating and Cooling in the Los Alamos National Security and Resources Study Center."
- Two reports by Vitro Laboratories on National Solar Data Network sites (Saddle Hill Trust Lot 36 and South Dakota School of Mines)
- Development of a SERI reporting format.

In addition the reporting format was reviewed by NASA-Marshall.

## Domestic Hot Water Validation Study

TPI was an active participant in the IEA Task I validation study on the NBS DHW systems. In addition to helping formulate the project, TPI also provided a detailed reporting format for the participants to use in presenting their results. TPI also performed simulations of the four DHW systems and made the comparisons to the measured data. TPI obtained and reformatted the NBS data tapes for distribution to IEA members. In addition, TPI prepared a document providing detailed information on the design of the systems and data available.

As a follow-up to the first round of validation analyses, TPI organized a workshop in Annapolis, Maryland for the Task I participants. As a result of that meeting, TPI worked with NBS to obtain an additional week of detailed performance data on the single tank indirect DHW system. This data was used by the Task I participants (including TPI) to perform another validation study and a series of sensitivity studies.

To complete the Task I activities, TPI provided support in the preparation of the final IEA reports on the validation work.

## International Passive Solar Program Support

TPI provided technical support to the International Passive Solar Program in a number of ways. Dr. Kennish worked closely with the passive cooling working groups to insure that these activities were considered in the formulation of an IEA task on Passive Heating and Cooling. TPI also assisted in the drafting of the annex which eventually led to the formation of IEA Task VIII.

TPI (with the assistance of W. I. Whiddon and Associates, Inc.) prepared a series of documents for use by the Task VIII participants early in the program. These Subtask 0 reports included:

- Reference Building Specification Format
- Energy Use Data Report Format
- Reference Building Specification Format; Users' Guide
- Survey of U.S. Residential Energy Use
- Reference Building Specification Format; completed for U.S. Single family detached building.

## Review of IEA Solar Heating and Cooling Analytical Work

Over the years, the various IEA Solar Heating and Cooling tasks have undertaken a number of activities which involved analytical (simulation, validation, model development) work. To avoid duplication in future activities and identify areas requiring further attention, TPI was asked to review the work which had been undertaken to date. Virtually all tasks were discussed although the majority of such work had taken place in Task I.

## Study on Insulation and Storage

At DOE's request, information was provided on storage and insulation. The report was prepared by M.I.T. under a TPI subcontract. The report has been transmitted to DOE.

In addition to the specific projects described above, TPI provided technical consultation to DOE throughout the duration of the contract.

# IV. MANAGEMENT SUPPORT FOR BILATERAL R&D PROGRAMS

## 1. U.S./MEXICO SOLAR ENERGY AGREEMENT

### BACKGROUND

The U.S./Mexico Solar Energy Agreement was initiated in 1982 under the 1979 U.S./Mexico Memorandum of Understanding for Science and Technology Cooperation. The three solar R&D areas selected for cooperative activities were: passive solar design; collector and collector materials; and solar refrigeration. Each of these projects consisted of four to six research tasks. The cooperative research efforts primarily consisted of exchange visits, technology transfers (literature and computer) and computer simulation studies. The lead Mexican organization was the Solar Energy Group at the University of Mexico (UNAM). Various U.S. groups, including several national laboratories provided technical expertise. (See list on next page.)

### WORK PERFORMED BY TPI

Under the direction of the DOE Office of Solar Heat Technologies, TPI was heavily involved in the implementation of the U.S./Mexico projects. The support provided by TPI for the U.S./Mexico activities through the end of September 1983, is described below.

#### Liaison with U.S. and Mexican Technical Experts

TPI established regular contact with the program managers (Dr. S. Schweitzer, U.S. DOE and Dr. E. Sansores, Mexico - UNAM) and various project leaders. TPI maintained close contact with the U.S. and Mexican participants by tracking the progress of the projects and by transferring verbal and/or written information and requests. By facilitating communication among the research teams, taking care of nontechnical details and assisting in project management, TPI enabled the project participants to concentrate on the technical aspects of their research.

#### Assistance in Project Planning and Coordination

When the U.S./Mexico projects were in the proposal stages, TPI provided assistance in the writing of the project descriptions and task activities. After the projects were initiated, TPI met regularly with the U.S. program manager to review the status of the projects and to determine action to be taken by the project managers and participants.

## Arrangement of Technical Exchange Visits

TPI arranged the following exchange visits under the U.S./Mexico agreement:

From Mexico (UNAM) to U.S.

| Traveler | Host Organization | Date | Project |
|---|---|---|---|
| E. Ramos | ANL & Univ. Chicago | Sep. '82 | Evacuated Collector R&D |
| E. Ramos | LANL | Mar. '83 | Heat Pipes & Collector Research |
| A. Fernandez | Sandia, NM | Mar. '83 | Selective Coatings |
| E. Cardenas | TVA; Yale (D. Watson); Calif. (Peter Calthorpe); USC School of Architecture (Ralph Knowles) | Mar. '83 | Urban and Regional Planning for Renewable Resources |
| R. Best | Phillips Engineering and Carrier Corporation | Aug. '83 | Solar Refrigeration |
| A. Samano | SAI, Inc. | Sep. '83 | Solar Refrigeration Systems Analysis |
| R. Best | Carrier Corporation and LBL | Sep. '83 | Solar Refrigeration |

From U.S. to Mexico (UNAM)

| Traveler | Affiliation | Date | Project |
|---|---|---|---|
| H. Sobin | Univ. Arizona | Oct. '82 | Passive Design and Research |
| R. Harrigan | Sandia | Jan. '83 | Line Focus Collectors |
| K. Dao | LBL | Jan. '83 | Solid Absorbent Solar Refrigeration |
| R. Alvis | Sandia | Feb. '83 | Passive System Design and Controls |
| M. Choi | SAI, Inc. | Jul. '83 | Solar Refrigeration Systems Analysis |

The planning of these trips involved many activities. First, TPI communicated with the prospective traveler and host(s) to define the purpose of the visit and find a time which would be mutually accommodating. The U.S. travelers were sent a "Request for Foreign Travel Form" and informed of U.S. travel regulations. TPI contacted the host persons/organizations to set up meetings and activities and sometimes entered into consultant agreements with technical personnel not associated with the U.S./Mexico agreement. TPI made the flight and lodging arrangements for the Mexican researchers' trips to the U.S. In addition, TPI arranged cash advances for the Mexican travelers and sent detailed itineraries to all persons involved with the visits.

In accordance with a modification to its contract, TPI paid for all travel conducted under this cooperative agreement.

## Project Tracking, Reporting and Evaluation

TPI prepared monthly status reports for DOE which outlined the specific activities of each project. These reports were sent to all project leaders and participants and other persons as appropriate, such as the scientific attache at the Mexican Embassy.

In order to keep all communications (written and verbal) well organized, TPI established and maintained central data files which contained all pertinent materials relating to the projects, i.e., address lists, phone logs, all written communications, travel arrangements, budget information, etc.

TPI carefully tracked the spending of funds allocated to the organizations involved in the projects and provided DOE with periodic funding status updates.

## Technology and Literature Transfer

TPI assisted DOE in compiling comprehensive bibliographies of the relevant documentation on the project topics and subsequently transmitted a large number of these documents to UNAM.

For the passive solar design computer simulation activity, TPI prepared descriptions and gathered documentation on the DOE-2 and BLAST computer programs and transmitted this material to UNAM. The UNAM computer group decided that the DOE-2 program would be most applicable to their architectural practice. TPI arranged for the transfer of the DOE-2 tape and computer manual to UNAM.

### Consultant and Subcontract Agreements

TPI entered into consultant agreements with technical experts identified by DOE for reimbursement of costs associated with services rendered and travel: Ralph Knowles, Professor or Architecture; Harris Sobin, Professor of Architecture; Donald Watson, FAIA, Architect; Peter Calthorpe, Architect; Raymond Harrigan, Engineer (Sandia); and Robert Alvis, Technical Staff (Sandia).

For the systems analysis task of the solar refrigeration project, TPI entered into a subcontract with SAI, Inc. to perform the technical work. Through the exchange of documentation and technical visits, SAI provided UNAM with considerable information related to solar cooling systems analyses methodologies and the TRNSYS computer program.

## 2. U.S./ISRAEL SOLAR COOPERATION

### BACKGROUND

In 1980, DOE and Israel's Ministry of Energy and Infrastructure entered into an agreement in Energy Research and Development of Passive Climate Control Test Facilities. Most of the R&D activities of this three-year project have taken place in Israel at the Institute for Desert Research (Ben-Gurion University in the Negev). Research conducted at the Ben-Gurion University has centered on the collection and evaluation of data from passive cooling test cells, and measurement of their performance. Work has also been carried out on direct gain passive heating test cells and an enlarged test cell of an earth-covered building. As stipulated in the agreement, U.S. project funds were transferred to and spent in Israel. Unfortunately, the U.S./Israel agreement has not been truly cooperative because no additional funds were made available by DOE for related work in the U.S.

### WORK PERFORMED BY TPI

Because of the limited nature of this project, TPI's involvement in the project has been limited to: organizing the U.S./Israel closed symposium on passive cooling (June 1982, Berkeley, California); transferring documents and reports on the research performed in Israel to appropriate U.S. persons; and preparing U.S./Israel project status updates for various review meetings, e.g., most recently for a meeting between Israel's Minister of Energy and DOE Secretary Hodell in June 1983.

## 3. U.S./SPAIN ENERGY R&D PROJECTS

### BACKGROUND

The U.S. and Spain have been conducting cooperative science and technology programs since 1976 when the first U.S./Spain Treaty of Friendship and Cooperation was signed. In May 1983, a new treaty entered into force which provided for a continuation of bilateral sicence and technology projects. Funds were budgeted to DOE by the State Department for the energy research projects and the preparation of proposals initiated.

### WORK PERFORMED BY TPI

In September 1983, under DOE's direction, TPI prepared six project proposal forms for review by the U.S./Spain Program Secretariat. The preliminary proposals prepared by the proposed U.S. principal investigators were used as a starting point. It was also necessary to contact each principal investigator to obtain missing information and to request additional information required on the proposal application form. TPI also arranged for the translation of the forms into Spanish. TPI then sent the proposal application forms to the program manager in Spain and each U.S. principal investigator for their review.

Following DOE approval and sign-off, the proposals will be formally submitted for the consideration of the Secretariat. This will take place during October or November 1983.

## APPENDIX

## REPORTS AND PUBLICATIONS PRODUCED UNDER CONTRACT DE-AC03-80CS30512:

## SOLAR HEATING AND COOLING R&D PROGRAM

## COORDINATION SUPPORT

Results of the International Energy Agency's Program on Solar Heating and Cooling, S. Blum, F. Morse, and P. Sens, Proceedings of the 1983 ISES Solar World Congress held in Perth, Australia, August 1983.

IEA Reporting and Information Dissemination Guidelines, Internal Document prepared for the IEA Solar Heating and Cooling Program Executive Committee, April 12, 1983 (revised August 1983).

1982 Annual Report of the IEA Solar Heating and Cooling Program, edited by S. Blum, January 1983.

Solar Heating and Cooling Programme Update, edited by TPI staff. Semi-annual IEA Solar Heating and Cooling Program newsletter.

Strategy and Framework for Activities within the IEA Solar Heating and Cooling Implementing Agreement, Sheila Blum. Internal Document drafted for the IEA Solar Heating and Cooling Program, November 24, 1982.

Review of the IEA Solar Heating and Cooling Analytical Work, W. J. Kennish, TPI Special Report 82-06, September 1982.

Simulation Program Validation Using Domestic Hot Water System Data, O. Jorgensen, W. J. Kennish et al., prepared for Task I of the IEA Solar Heating and Cooling Program, August 1982.

National Solar Heating and Cooling Programme Overview, edited by S. Blum. Compilation of papers presented at the August 1981 International Solar Energy Society Solar World Forum, Brighton, U.K., December 1981.

IEA Programme Summary, edited by S. Blum. Compilation of papers on the IEA work presented at the August 1981 International Solar Energy Society Solar World Forum, Brighton, U.K., December 1981.

International Energy Agency Solar Heating and Cooling Research and Development Program, S. Blum, Active Solar Heating and Cooling Contractors' Review Meeting, Washington, D.C., September 9-11, 1981.

The International Energy Agency's Program on Solar Heating and Cooling, F. H. Morse, P. F. Sens, and S. Blum, Proceedings of the ISES Solar World Forum, August 1981.

Optimization, T. L. Freeman, O. Jorgensen, W. J. Kennish et al., prepared for Task I of the IEA Solar Heating and Cooling Program, June 1981.

International Passive Assessment, prepared by Booz Allen & Hamilton, Inc. with the assistance of TPI, June 1982

Status Report on the Implementation of the IEA Reporting Format in the U.S. Solar Program, W. J. Kennish, TPI Special Report 81-01, February 2, 1981.

Reports Prepared under Subcontract

Issues Relating to the Effective Use of Thermal Insulation and Thermal Storage in Buildings, Y. El-Sayed and M. Tribus, M.I.T., September 1983.

Reference Building Specification Format and User's Guide for Task VIII of the IEA Solar Heating and Cooling Program, W.I. Whiddon & Assocs., November 1982.

Identification and Evaluation of Potential Conservation, Passive and Hybrid Technologies for the U.S., for Task VIII of the IEA Solar Heating and Cooling Program, W.I. Whiddon & Assocs., July 8, 1982.

Survey of U.S. Residential Energy Use, for Task VIII of the IEA Solar Heating and Cooling Program, W.I. Whiddon & Assocs., May 1982.

Energy Use Data Report Format for Task VIII of the IEA Solar Heating and Cooling Program, W.I. Whiddon & Assocs., May 1982.

International Passive Assessment, prepared by Booz Allen & Hamilton, Inc. with the assistance of TPI, June 1982.