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March 1981

Industrial and Agricultural Process Heat Information User Study

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SERI

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A Division of Midwest Research Institute

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PREPARED UNDER TASK NO. 8420.11

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STUDY CHARACTERISTICS

Between 3 September 1979 and 13 October 1979 Market Opinion Research, Inc. of Detroit, Michigan—under subcontract to SERI—conducted telephone interviews with 86 distinct groups of solar information users taken from across the nine different technological areas. Approximately nine respondents were interviewed from each group. Interviews were based upon professionally reviewed and tested questionnaires that utilized a mixture of open-ended and closed-ended questions. The interviews took an average of 18 minutes to complete.

The respondents proved to be very cooperative. Considering the length and nature of the telephone interviews, it was surprising that only about 3% of the respondents terminated an interview or refused to be interviewed. This finding supported the interviewers' statements that the respondents were very interested in telling what they were doing in solar energy, in obtaining solar information, and in specifying what solar information would prove the most valuable.

SAMPLE SIZE

Studies of 86 groups, each interested either in one of nine specific solar technologies or in solar energy in general, provided an extremely broad view of the information needs of the solar community. Although the sample size of only nine respondents per group was small, the data still proved to be adequate for planning purposes. It was possible to determine the information most important to the respondents and the best channel for dissemination. A variety of valid statistical tests were performed, both to compare the priorities a group gave to different information items and to compare the priorities different groups gave to the same item (see Section 2.3 and Appendix E).

SOLAR INDUSTRIAL AND AGRICULTURAL PROCESS HEAT GROUPS STUDIED

The results of an earlier study identified the groups of information users constituting the solar process heat community [1] and determined the priority (to accelerate commercialization of solar energy) of getting information to each user group. In the current study only high-priority groups were included. Considerable effort (e.g.; library searches, phone calls, subcontractors) went into obtaining the names of people professionally involved with solar process heat. When the phone interviews were conducted, an elaborate screening process was used to guarantee that the potential respondent was truly involved in solar industrial or agricultural process heat.

In this report, results for both industrial process heat and agricultural process heat have been included. This was because of the vagueness (to the people interviewed) of the exact demarcation between the two processes. Respondents in the following 10 groups were queried about their need for information on solar process heat technologies:

- Solar Industrial Process Heat Researchers,
- Solar Agricultural Process Heat Researchers,
- Representatives of Manufacturers of Concentrating Collectors,
- Representatives of Manufacturers of Nonconcentrating Collectors,
- Plant Engineers involved with solar industrial process heat,

- Agricultural Engineers involved with solar industrial process heat,
- Industrial Engineers involved with solar industrial process heat,
- Educators teaching college-level courses which included information on solar industrial process heat,
- State Agricultural Office Representatives interested in solar agricultural process heat, and
- Cooperative Extension Service (CES) County Agents who will be needing information on solar agricultural process heat.

Further, results from Total Manufacturers of Nonconcentrating Collectors (who were asked questions principally about active solar heating and cooling) have also been included.

Groups desirable to study, but for whom adequate lists of names could not be obtained, included potential users. Several of the groups discussed in another report from this study [2] also indicated an interest in information on solar process heat (see Section 2.2.4).

RESULTS

In most cases the results from both groups of researchers were similar. Thus, in the following tables the data for Researchers have been combined. Similarly, results from Plant Engineers and Industrial Engineers have been combined.

Usefulness of General Types of Information

The most important result obtained from this study was the identification of the solar process heat information categories ranked the most useful by each group of respondents (see Table S-1). Industrial and agricultural process heat respondents in almost every group gave high ratings to information on:

- Cost/performance;
- Installation/operation costs;
- Climatological data;
- Tax credits, grants, incentives;
- Lists of information sources;
- Research in progress; and
- The state of the art.

Most notable, however, was the wide range of rankings the groups gave to the information items. For example, even for some of these generally high-ranked items, there were several groups who ranked the item 10th or worse. Similarly for the generally low-ranked items, there were often several groups ranking the item 8th or better. This underlines the need to design most information products on a group by group basis.

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Table S-2. VALUE ASSESSMENT OF SPECIFIC INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (I/APH) INFORMATION PRODUCTS

Specific Information Products	IAPH Researchers	Concentrating Collector Manufacturer Reps	Total Nonconcentrating Collector Manufacturer Reps	IPH Plant and Industrial Engineers	IPH Agricultural Engineers	IPH Educators	APH State Agricultural Office Reps	APH CES County Agents	All IAPH Respondents[b]
	Percent[a]	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent[b]
Bibliography of General Readings on IAPH Systems	44	0	10	44	78	33	50	33	33
Calendar of IAPH Conferences and Programs	50	50	46	22	33	44	38	33	40
IAPH System Diagrams or Schematics	44	38	46	50	67	56	75	67	52
IAPH System Design/ Installation Handbooks, Reference Tables	56	50	48	72	67	33	63	56	56
Manual Analytical Tools for IAPH System Design	67	75	46	61	78	67	38	44	58
Computer Analytical Tools (Models) for IAPH System Design	33	63	36	39	78	56	38	0	40
Lists of Local IAPH Experts[c]	39	63	69	17	44	33	50	67	48
Lists of IAPH Technical Experts	33	75	24	17	33	33	50	89	X[d]
Technical Descriptions of IAPH Systems	78	63	55	72	56	78	50	44	X[d]
Nontechnical Descriptions of IAPH Systems	0	13	21	44	11	44	88	89	X[d]
List of IAPH Information Sources	50	50	32	56	78	67	75	78	X[d]
Sample Size	18	8	29	18	9	9	8	9	108

[a]Percent is the percentage of respondents rating the item as "essential" or "very useful" (as opposed to "somewhat useful" or "not at all useful").

[b]Although a percentage is given for All IAPH Respondents, it may not be indicative of the percentage of the whole IAPH community interested in that item (since the proportion of each type of respondent in this study may not correspond to the proportion that group constitutes of the entire population).

[c]Local lenders, insurers, builders, engineers, installers, manufacturers, or distributors for IAPH systems.

[d]"X" indicates no overall percentage was calculated. For these items it may be necessary to develop different products/services for each group if their information needs are to be fully met.

Table S-3. SOURCES USED TO OBTAIN SOLAR INFORMATION (Percent[a])

Information Sources	IAPH Researchers	Concentrating Collector Manufacturer Reps	Total Nonconcentrating Collector Manufacturer Reps	IPH Plant and Industrial Engineers	IPH Agricultural Engineers	IPH Educators	APH State Agricultural Office Reps	APH CES County Agents	All IAPH Respon-dents[b]
Public Media									
Radio or TV	(33)[c]	25	(36)	NA[d]	NA	22	75	67	(43)
Periodicals, news-papers, or magazines	94	88	100	NA	NA	100	88	89	(95)
Private Solar-Involved Orgs.									
Private solar energy or environmental organizations	44	63	79	33	11	56	75	33	53
Internatational Solar Energy Society (incl. publications)	72	88	59	6	89	67	25	0	50
Solar Energy Industries Assn. (including publications)	44	88	72	6	22	22	38	22	43
Contacts with professionals									
Solar installer, builder, designer, or manufacturer	72	100	83	83	89	78	75	67	81
Workshops, conferences, or training sessions	100	88	79	56	67	89	75	56	77
Information Services									
Respondent's organizational library or local library	94	75	72	22	89	100	63	44	69
Commercial data base	22	25	21	6	67	22	13	11	21
Smithsonian Science Infor-mation Exchange (SSIE)	22	13	(9)	0	22	11	38	NA	(15)
Federal library or information center	61	100	45	33	44	56	75	22	51
Govt. Printing Office (GPO)	83	88	79	67	78	56	75	67	75
National Technical Infor-mation Service (NTIS)	61	63	48	22	56	78	38	0	45
Technical Information Center (TIC)	61	38	21	39	22	56	38	11	35
Government Solar-Involved Orgs.									
Directly from the U.S. Depart-ment of Energy (DOE)	83	88	72	44	78	89	75	89	74
National Solar Heating & Cooling Information Center	33	25	76	17	22	44	25	22	40
Regional Solar Energy Centers	22	25	59	6	22	33	50	0	31
State energy or solar offices	72	88	83	50	56	67	88	67	71
Other									
Some other state or local govt. office or publication	33	50	55	17	44	56	63	33	43
Public utility company (other than respondent's employer)	44	63	52	17	44	78	88	56	50
USDA, including CES	(100)	NA	NA	NA	NA	NA	100	100	(100)
Assn. of Energy Engineers (AEE)	NA	NA	NA	89	22	NA	NA	NA	(67)
Institute of Electrical and Electronics Engineers (IEEE)	NA	NA	NA	17	NA	NA	NA	NA	(17)
American Society of Agri-cultural Engineers (ASAE)	NA	NA	NA	NA	33	NA	NA	NA	(33)
State agricultural offices	NA	NA	NA	NA	NA	NA	NA	56	(56)
Sample Size	18	8	29	18	9	9	8	9	108

[a]Percent is the percentage of respondents who used the source to obtain any solar information in the past few years.
[b]Although a percentage is given for All IAPH Respondents, it may not be indicative of the percentage of the whole IAPH community interested in that item (since the proportion of each type of respondent in this study may not correspond to the proportion that group constitutes of the entire population).
[c]"(.)" means the question was not asked of all of the groups in this particular set of respondents. For example, "(44)" means that 44% of those who were asked had used that source. In no case were fewer than nine respondents asked.
[d]"NA" means the question was not asked of this particular set of respondents.

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Table S-5. INTEREST IN INFORMATION ON SOLAR AGRICULTURAL PROCESS HEAT (APH) TOPICS

Topics	APH Researchers	APH State Agricultural Office Reps	APH CES County Agents	All APH Respondents[b]
	Percent[a]	Percent	Percent	Percent[b]
Livestock Shelter Heating	56	88	78	73
Grain Drying	67	75	89	77
Crop Drying	67	88	78	77
Greenhouses	22	88	78	62
Food Processing	56	88	67	69
Sample Size	9	8	9	26

[a]Percent is the percentage of respondents interested in the application.

[b]Although a percentage is given for All IPH or APH Respondents, it may not be indicative of the percentage of the whole IPH or APH community interested in that item (since the proportion of each type of respondent in this study may not correspond to the proportion that group constitutes of the entire population). The data for Concentrating Collector Manufacturers and Total Nonconcentrating Collector Manufacturers is not included in All IPH Respondents.

Table S-6. ADVANCED INFORMATION ACQUISITION METHODS USED

Acquisition Methods	IAPH Researchers	Concentrating Collector Manufacturer Reps	Total Nonconcentrating Collector Manufacturer Reps	IPH Plant and Industrial Engineers	IPH Agricultural Engineers	IPH Educators	APH State Agricultural Office Reps	APH CES County Agents	All IAPH Respondents[b]
	Percent[a]	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent[b]
Computer Terminal Access to Data Banks	39	25	24	39	44	33	0	22	30
Microform (microfiche, microfilm sheets or rolls, COM, etc.)	39	38	10	17	44	33	25	0	23
Sample Size	18	8	29	18	9	9	8	9	108

[a]Percent is the percentage of respondents who used the method in the past year.

[b]Although a percentage is given for All IAPH Respondents, it may not be indicative of the percentage of the whole IAPH community interested in that item (since the proportion of each type of respondent in this study may not correspond to the proportion that group constitutes of the entire population).

- State Agricultural Office Representatives felt a strong need for information. Compared to other groups they were well aware of available information sources, yet their top-rated information need was "lists of information sources."
- County Extension Agents wanted basic cost data and nontechnical APH systems' descriptions to pass on to the people in their county. They obtained such information from agricultural sources.

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SECTION 1.0

INTRODUCTION

This report describes the results of a series of interviews with potential users of information on solar industrial and agricultural process heat. These two applications have been combined in one report because of the confusion among those interviewed as to the exact demarcation between the two processes. These interviews, part of a larger study covering nine different solar technologies, attempted to identify:

- the type of information each distinctive group of information users needed, and
- the best way of getting information to that group.

This section explains the background of the study, places this report in the context of the overall program, and describes the structure of this report.

1.1 BACKGROUND

The rapid, widespread commercialization of solar energy will be necessary if the United States is to meet the energy crises of the next 50 years. But the use of solar energy will never reach meaningful levels without both the recognition that information transfer is essential to commercialization and the deliberate development of systems for the transfer of information. For example: scientists need the latest solar research results to enhance their own efforts; engineers and installers need performance data to design solar systems; public interest groups need environmental impact data to support solar technologies against conventional energy alternatives; potential owners of solar energy systems need cost information to make purchase decisions; the general public needs basic information to weigh which public policies to support.

In 1974 the Congress, noting the importance of information transfer and recognizing the value to the solar community of an integrated, comprehensive data collection and information dissemination system, called for the implementation of a Solar Energy Information Data Bank (SEIDB). In The Solar Energy Research and Development Act (P.L. 93-473) Congress stated that the SEIDB should be established "for the purpose of collecting, reviewing, processing, and disseminating information and data . . . in all of the solar energy technologies."

The U.S. Department of Energy (DOE) has assigned the Solar Energy Research Institute (SERI) the task of serving as the lead center to fulfill this Congressional mandate to collect all types of solar-related information, to convert it into a user-oriented format, and to disseminate this information to the widest possible range of persons and groups with an interest in solar energy. These groups range from decision makers at all levels of government to manufacturers of solar products; from solar architects, installers, and service persons to home or farm owners; and from banks and financial institutions to scientists and researchers. In accord, SERI's Information Systems Division (ISD) is now in the process of collecting solar information, building data bases, and preparing and disseminating information through a variety of products and services.

The long-range objective of the SEIDB is a centrally coordinated network to ensure that all individuals concerned with solar energy have prompt and efficient access to whatever

information is necessary to support sound decisions. Ultimately this information will be accessible through a variety of means (publications, computer data systems, audiovisual products, the Solar Energy Information Center, inquiry and referral services, etc.) to serve the diverse requirements of the solar community.

1.2 SOLAR ENERGY INFORMATION DATA BANK PROGRAM PLANNING

In the past decade, information scientists have studied many organizations responsible for data collection and information product development. A consistent finding of this research is that a key to the successful, efficient operation of such an organization is to design the entire system with the potential information user in mind. It is essential that development of information products and data bases be targeted for specific users rather than merely developed spontaneously. The information users, their information needs, and the priority of those needs must all be identified before effective information products and services can be developed efficiently. To ensure that the SEIDB is responsive to the high-priority information needs of the solar community, the Information Market Research Section of ISD is performing the following tasks:

1. Defining the community of solar information users;
2. Setting priorities as to which groups of information users have the most important near-term information needs;
3. Determining the near-term information needs of the high-priority users;
4. Determining the information channels which can be effectively used to reach the high-priority users;
5. Determining what high-priority information needs are being met fully by existing products and services; and
6. Recommending additional, targeted, cost-effective information products and services to meet high-priority needs.

The results of the first two tasks are described in a previous document [1]. First, for each solar technology, those members or potential members of the solar community who will need solar information were identified; second, the relative importance of meeting the near-term information needs of each group of information users was described. This document provides guidelines to SEIDB planners as to who might be using the SEIDB and whose near-term needs are the most important.

The results of the third and fourth tasks are described in the current set of ten reports (see Section 1.3). These reports document the high-priority information needs and the most familiar information channels for each of 86 groups which were interviewed by telephone.

There have been a few previous studies which asked homeowners what solar information they needed, but this is the only known study to provide data on the solar information that such groups as researchers, manufacturers, architects, engineers, installers, lawyers, bankers, insurers, public interest groups, state energy offices, and agricultural extension agents themselves say they want.

The data from this study will be used along with other data to determine what new information products and services SERI, the SEIDB Network, and the entire solar infor-

mation outreach community should be preparing for and disseminating to the solar community. These data will include (but not be limited to): contacts with SERI specialists; review of the Annual Operating Plans, Institutional Plans, and Program Plans of DOE and SERI; reviews of other solar literature; development of an "information user profile" data base from mailing list response cards; information user panels; direct contacts with members of the solar community at conferences, training sessions, etc.; visits to headquarters of national associations of users; and feedback provided by users of existing information products. Since information needs and priorities will continuously change, these tasks will necessarily be ongoing.

1.3 REPORT CONTENTS

This solar industrial and agricultural process heat report is one of ten issued on the results of these studies of solar energy information users. The full set of reports covers:

- Photovoltaics
- Passive Solar Heating and Cooling
- Active Solar Heating and Cooling
- Biomass Energy
- Solar Thermal Electric Power
- Industrial and Agricultural Process Heat
- Wind Energy
- Ocean Energy
- Solar Energy Storage
- General Solar Energy

Section 2.0 of this report describes the type of study conducted and the resulting constraints. The method used to select these groups is also described in Section 2.0. Several groups discussed in another report from this study also indicated an interest in information on solar process heat. These groups are listed in Section 2.2.4. Sections 3.0 through 9.0 describe the results of studies of:

- Solar Industrial Process Heat Researchers and Agricultural Process Heat Researchers;
- Representatives of Manufacturers of Concentrating Collectors;
- Representatives of Manufacturers of Nonconcentrating Collectors;
- Plant Engineers, Industrial Engineers, and (nongovernment) Agricultural Engineers who had been involved with solar industrial process heat;
- Representatives of State Agricultural Offices who had been involved with solar agricultural process heat;
- Educators teaching college-level courses in solar industrial process heat; and
- Cooperative Extension Service (CES) County Agents who will be needing information on solar agricultural process heat.

Except for the Manufacturer Representatives, these respondents were asked specifically about their needs for information on solar process heat. Manufacturer Representatives were asked the same questions, but about active solar heating and cooling or solar systems generally. In each of these sections describing study results, a standard presentation format has been used.

The appendices contain a list of all 86 groups interviewed (including the technologies other than process heat). They also contain a description of how the study was developed, a copy of the letter of introduction, a sample questionnaire, a description of the statistical tests used, and the data from the studies of the industrial and agricultural process heat groups.

SECTION 2.0

STUDY DESCRIPTION

This section gives a brief description of the study. Appendix B gives additional information on how the study was designed and conducted. This section also explains how groups from the solar industrial and agricultural process heat community were selected as those to be sampled and gives a few comments on interpretation of study results. The study findings are reported in Sections 3.0 through 9.0.

2.1 STUDY CHARACTERISTICS

Between 3 September 1979 and 13 October 1979 Market Opinion Research, Inc. (MOR) of Detroit, Michigan—under subcontract to Solar Energy Research Institute (SERI)—conducted telephone interviews with 86 distinct groups of solar information users. Approximately nine respondents were interviewed from each group. Interviews were based upon professionally reviewed and tested questionnaires (see Appendix D); they took an average of 18 minutes to complete. The 86 groups, selected to cover 9 solar technologies/applications, are listed in Appendix A. The results discussed in this report are from the 10 of those 86 studies which dealt specifically with solar industrial or agricultural process heat.

Studies of 86 groups, each interested either in one of nine different solar technologies or in solar technologies in general, provided an extremely broad view of the information needs of the solar community. Although the sample size of nine respondents per group was small, the data still proved to be quite adequate for planning purposes. It was possible to determine which information was the most important to the respondents and what was the best channel for disseminating that information. A variety of valid statistical tests were performed, both to compare the priorities a group gave to different information items and to compare the priorities different groups gave to the same item.

The respondents proved to be very cooperative. Considering the length and nature of the telephone interviews, it was surprising that only about 3% of the respondents terminated an interview or refused to be interviewed. This finding supported the interviewers' statements that the respondents were very interested in telling what they were doing in solar energy, in obtaining solar information, and in specifying what solar information would prove the most valuable. It was also observed that the number of respondents answering "don't know" or not answering a question was quite low. Including those cases where the potential respondent could not be reached within three attempts (or before the required number of interviews was completed), where the respondent refused to be interviewed, where the respondent terminated the interview prematurely, etc., the completion rate for the entire study was about 75%. The completion rate for each individual group is given in the section in which that group is discussed.

2.2 GROUPS STUDIED

One of the most important tasks was the selection of the groups of potential users of solar information to be studied. Before this could be done, however, it was necessary to list the important groups constituting the solar industrial and agricultural process heat community and to develop a conceptual framework within which selections could be made.

2.2.1 Target Audiences, Classes, and Groups

An important information science concept in developing information products and services is that of the "target audience" or "target group." These are generally defined as a collection of individuals or organizations who have similar information needs and information-acquiring habits. People in the same group tend to need information on the same subjects, at a similar technical level, and within a similar timeframe. In developing an information product program, it is important to begin with a typology that assigns information users who have similar needs to common groupings. This allows development of efficient, targeted information products to meet identified needs of specific users, without inundating other members of the solar community with unneeded information.

In Solar Information User Priority Study [1] such a typology was developed. Under this system members of the solar community were placed in distinct "user groups." A set of user groups formed a "user class" and a collection of user classes formed a "target audience." For more precise definitions:

- A User Group is the most basic category of information users who can be combined together under a single definitive title (e.g., Civil Engineers). A single information user group should be addressable by many specific information products. The purpose of defining distinct information User Groups is to identify a single set of users who can be served by the same information product (e.g., a civil engineers' handbook).
- A User Class is a set of information user groups which exhibit many common distinguishing characteristics (e.g., Facility or System Designers). A single information user class should be addressable by many general information products. The purpose of defining separate information User Classes is to identify sets of two or more groups of users who can be served by similiar information products (e.g., solar heating and cooling system design models).
- A Target Audience is a set of information user classes which exhibit some common distinguishing characteristics (e.g., Researchers). A single target audience should be addressable by one or more distinct types of information products. The purpose of defining separate information-user Target Audiences is to identify broad sets of users who can be served by the same generic types of information products (e.g., research-in-progress newsletters).

Following this system, all solar information users fall within one or more of five Target Audiences. These Target Audiences are:

Researchers - those who are actively involved in researching, developing, and testing of new state-of-the-art technical developments in solar energy.

Applications Technologists - those involved in translating research results into marketable equipment and services. This classification includes manufacture, distribution, sales, design, installation, and maintenance of solar systems or components.

Facilitators - those whose decisions or actions directly aid (in either a positive or negative manner) the commercialization of solar energy. Thus, Congressmen would be Facilitators in that they have the ability to pass legislation giving incentives; lobbyists in that they can affect legislation; state energy offices in that they can initiate demonstration projects; and the Environmental Protection Agency (EPA) in that it can forbid construction of a manufacturing plant at a specific site.

Users or Prospective Users - those individuals or organizations who have already applied this type of solar energy technology in their operations or have a reasonable chance of doing so in the near future.

General Public - Individuals who are not likely to utilize solar energy in the near future. An important aspect of this audience is its ability to influence the course of solar development through political influence, pro or con.

Based upon this scheme, the solar process heat information user community has been defined. Table 2-1 enumerates the user groups comprising the solar process heat information community and shows into which target audience each falls [1].

2.2.2 Criteria for Selection of Groups to Study

From Table 2-1, it is rapidly evident that there are many user groups who will eventually be needing information on solar industrial or agricultural process heat. The problem was, thus, to select those groups to be included as a part of this study. To determine which groups would be studied, each group was evaluated with respect to the following selection criteria:

- Appropriateness of using a structured telephone interview to collect information from the group on information needs and habits,
- Relative priority of the group's short-range or medium-range information needs, and
- Availability of a sample frame for the group.

First, for many groups, a structured telephone interview was not an appropriate method for defining information needs. It was not practical to interview DOE or an organization like the Electric Power Research Institute, or to survey a group like Congressional committee staff which would be too busy to respond. Rather than defining the information needs of these groups by telephone interview, they will be contacted directly in FY 1981.

Second, only those groups with a high immediate or potential need for IAPH information were selected. Further, since fulfilling short-range information needs is critical, it was decided that in most cases those people who were already involved with solar process heat would be sampled. It was felt that these were the people who would be primary users of the SEIDB over the next few years. These groups had been identified earlier in the Solar Information User Priority Study [1].

Finally, for many of the groups, lists of persons to be interviewed could not be developed or acquired. In the absence of sample frames, studies of such groups were not possible. (For more detail on sample frame development, see Appendix B.)

2.2.3 Groups Included in the Solar Industrial and Agricultural Process Heat Study

After all decision criteria and constraints had been applied, it was determined that studies of the following 10 groups would be conducted to ask respondents about their need for information on solar industrial or agricultural process heat:

Table 2-1. SOLAR INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (I/APH) INFORMATION USERS

Target Audiences
User Classes
User Groups

1.0 Researchers

1.1 DOE-Funded Researchers or Developers
- Contractors
- National Laboratories

1.2 Non-DOE, Federally-Funded Researchers or Developers
- National Science Foundation (NSF)
- United States Department of Agriculture (USDA)

1.3 Non-Federally-Funded Researchers or Developers
- Universities
- Solar Manufacturers
- Trade Research Associations
- Independent Research Organizations
- Fuel Industry
- Chemical Industry
- Other Industrial Solar Uses
- State Agricultural Offices
- Agricultural Solar Users

2.0 Applications Technologists

2.1 IPH- and APH-Related Manufacturers
- Collector Manufacturers
- Component Manufacturers

2.2 IPH and APH Facility or System Designers
- Industrial Architects/Engineers
- System Designers/Engineers
- Architectural/Engineering Design Firms
- Mechanical Engineers
- Mechanical; Heating, Ventilating and Air Conditioning (HVAC) Engineers
- Agricultural Engineers

2.3 Builders, Developers, or Contractors
- General Contractors
- Architectural/Engineering Construction Firms
- Mechanical Engineering Contractors
- Construction Engineers
- Agricultural Engineering Contractors

Table 2-1. SOLAR INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (I/APH) INFORMATION USERS (Continued)

2.4 IPH and APH System Installers or Maintainers
- Installers
- Carpenters
- Plumbers
- Electricians
- Sheet Metal Workers
- Solar Maintenance Workers
- Construction Workers

2.5 IPH and APH Equipment Distributors

2.6 Technical Specialists for Utility, Government, Agricultural, Commercial, or Industrial Organization Using an IPH and APH System
- Operations Managers
- Planners

2.7 Farm Managers, Greenhouse Managers, Livestock Breeders

3.0 Facilitators

3.1 Legislators or Staff
- Congressmen
- Congressional Committee Staff
- State Legislators
- National Conference of State Legislators

3.2 Local Government Organizations
- County Government Officials
- Local Government Officials
- Municipal Planners
- Tax Assessors and Officials
- County Agricultural Offices

3.3 Government Solar-Active Organizations
- DOE—Conservation and Solar Energy (C & SE)
- DOE—Energy Information Administration (EIA)
- DOE—Energy Research (ER)
- DOE—Regional Solar Energy Centers (RSECs)
- DOE—Regional Energy Offices
- DOE—Energy Extension Service
- United Stated Department of Agriculture (USDA)
  - Cooperative Extension Service
- USDA-Other
- National Center for Appropriate Technology (NCAT)
- Tennessee Valley Authority (TVA)
- DOE—Federal Energy Regulation Commission
- International Energy Agency
- State Governors' Offices
- State Energy Offices

Table 2-1. SOLAR INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (I/APH) INFORMATION USERS (Continued)

State Solar Energy Offices
State Agricultural Offices
Municipal Energy Offices

3.4 Government Solar-Concerned Organizations
Food and Drug Administration (FDA)
Small Business Administration (SBA)
Internal Revenue Service (IRS)
Council on Environmental Quality (CEQ)

3.5 Nongovernment Solar-Active Organizations
Solar Trade Associations
Solar Professional Societies
Solar Public Interest Groups
Solar Lobbyists

3.6 Nongovernment Solar-Concerned Organizations
Public-Interest Organizations
Environmental Organizations
Chambers of Commerce
Nonsolar Professional Societies
Nonsolar Trade Associations
National Cattlemen's Association
Farmer Co-ops
Farmer's Education and Cooperative Union of America
American Farm Bureau Federation
Future Farmers of America

3.7 Regulatory, Codes, or Standards Community
Environmental Protection Agency (EPA)
Occupational Safety and Health Administration (OSHA)
American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
American National Standards Institute (ANSI)
Building Officials and Code Administrators (BOCA), Council of American Building Officials (CABO), International Conference of Building Officials (ICBO), Southern Building Code Congress (SBCC)
American Society of Mechnical Engineers (ASME)
Better Business Bureaus

3.8 Utility Community
Electric Power Companies
Gas Utilities
National Association of Regulatory Utility Commissioners
State Utility Commissions
Utility Trade Associations
Federal Power Marketing Agencies
Tennessee Valley Authority (TVA)

Table 2-1. SOLAR INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (I/APH) INFORMATION USERS (Continued)

3.9 Financial Community
- Bankers
- Venture Capital Brokers
- Government Loan Agencies
  - USDA - Farmers Home Administration (FHA)
  - USDA - Commodity Credit Corporation (CCC)
- Stock Brokers

3.10 Legal Community

3.11 Real Estate Community

3.12 Insurance Community

3.13 Educational Community
- High School Science Teachers
- University Faculty
- Vocational Instructors
- Career Counselors
- Seminar Organizers and Instructors

3.14 Information Intermediaries
- Federal Technical Libraries
- Industrial Technical Libraries
- Academic or Nonprofit Technical Libraries
- Public Libraries
- Federal Information Centers
- On-Line Information Services
- Bookstores
- Film Distributors

3.15 Media
- Newspapers or Magazines
- Technical and Trade Journals
- Television
- Radio
- Book Publishers
- Newspaper Farm Editors of America

3.16 Labor Organizations
- Steamfitters' Unions
- Construction Unions
- Sheet Metal Workers' International Association (SMWIA)

4.0 Users or Prospective Users

4.1 Government, Commercial, or Industrial Users
- Oil Companies
- Iron Foundaries

Table 2-1. SOLAR INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (I/APH) INFORMATION USERS (Concluded)

	Alumina Industry
	Cement Industry
	Stone, Clay, and Glass Products Industry
	Textile Mills
	Brewers
	Commercial Laundries
	Food Processing Industry
	Large Grain or Crop Drying Operations
	Commercial Greenhouses
	Forest Products Industry
	Other Industrial Process Heat Users
4.2	Farming Users
	Farmers, Ranchers
5.0	General Public
	Secondary School Students
	College Students
	Adults

- Industrial Process Heat Researchers,
- Agricultural Process Heat Researchers,
- Representatives of Concentrating Collector Manufacturers,*
- Representatives of Nonconcentrating Collector Manufacturers,*
- Plant Engineers who were interested in industrial process heat,
- Industrial Engineers who were interested in industrial process heat,
- Agricultural Engineers who were interested in industrial process heat,
- Representatives of State Agricultural Offices who need information on agricultural process heat,
- Educators teaching college-level courses in industrial process heat, and
- Cooperative Extension Service (CES) County Agents who will be needing information on agricultural process heat.

The results from these studies are reported in Sections 3.0 through 9.0. Groups considered for the study, but for whom adequate sample frames could not be obtained included such groups as potential users of solar industrial process heat and potential users of agricultural process heat.

2.2.4 Solar Process Heat-Concerned Groups Included in the General Solar Study

Additionally, as a part of the overall study a number of groups were queried about their need for information on solar energy in general, rather than on a specific technology like solar process heat. While it was determined that all respondents in these groups had some involvement with solar energy, for many of them it was likely that this involvement was not, nor would it become, a primary factor in their professional work. Rather, for most—if not all—of them, solar energy was a new but minor issue which they were beginning to address within the scope of their existing jobs. Because each of these groups had peripheral interests in more than one solar technology, yet had not become fully involved with any, they were asked for general solar information needs rather than technology-specific solar information needs.

The results of the general solar study are reported in another document [2]. For solar process heat the following seven groups were especially relevant because for each group at least five of the nine respondents indicated solar industrial or agricultural process heat was one of the areas in which they were "particularly interested in obtaining information":

- Public Interest Groups (APH, IPH),
- Utilities not known to have conducted solar experiments or demonstrations (APH, IPH),
- Real Estate Appraisers (APH, IPH),

*These Manufacturer Representatives were not asked specifically about process heat, but about solar heating and cooling generally. The results for both groups have been included for more than one technology in reports in this series.

- Information specialists at State CES Offices (APH),
- Agricultural engineering specialists at State CES Offices (APH),
- Insurers (APH), and
- Tax Assesors (APH).

The general solar energy report [2] also discusses the results of studies in which state solar/energy office representatives were asked about their general, rather than technology-specific, solar information needs. Ninety-four percent of these representatives were interested in solar industrial process heat information and 98% were interested in solar agricultural process heat information.

2.3 DATA INTERPRETATION

This subsection describes several points the reader should keep in mind in interpreting the data and results presented in the following sections.

2.3.1 Impact of the Sample Frames: Who was Sampled?

There were several ways in which the method of constructing the sample frames impacted the data. First, in some of the sample frames one geographic region was relatively over-represented, while another was relatively under-represented. For a study of sample size nine, however, such biases were generally not bothersome since the results were principally qualitative rather than quantitative.

Second, the sample frames were only as good as the sources. For example, the Smithsonian Science Information Exchange (SSIE) data base and DOE's Research in Progress (RIP) data base were principal sources in developing lists of researchers. The SSIE was not always current, often did not include the name of the correct principal investigator, and did not contain much of the nonfederally funded research. RIP had similar problems, varying greatly in quality according to which technology was involved. Each of these problems could cause biases as to which researchers were included and which were excluded from the samples.

Third, many arbitrary decisions were necessary in developing the sample frames. For example, it was important not to interview a respondent more than once, even if he or she was working in more than one technical area. Thus, if Researcher X at Company Y was listed as principal investigator both for one project in solar industrial process heat and for another in active solar heating and cooling, then X was arbitrarily assigned to one of the two technologies, usually to the one with the smaller set of names.

The most important advice for the reader is to study carefully the description of how the sample frame was developed for each individual group. Often a generic title was assigned to a group; the reader must review sample frame development carefully to understand just who was being studied.

2.3.2 Statistical Tests

The statistical tests used are described in Appendix E. In the following sections test results are reported only if the statistical tests were significant at the $P < 0.05$ level. Thus, if a test result indicated that a difference between two means was statistically significant ($P < 0.05$), it meant that there was a maximum of a 1-in-20 chance that the two means were not different.

2.3.3 Hypotheses Versus Conclusions

Because of the limitations of sample size it was not always possible to draw definitive conclusions. In certain cases, when definitive conclusions could not be drawn, the authors have instead formed hypotheses based upon the results.

2.3.4 Significance of Rankings

One of the most valuable results of this study was the development of a ranked list of information topics or products which would be useful to the members of each group (for example, see Fig. 3-1). Typically, statistical significance tests (see Appendix E) indicated that the four-to-six top-ranked items were rated significantly higher than the bottom four-to-six items. Thus, typically there was no statistically significant difference between the top-rated item and the second-rated item—or even between the top-rated and the fourteenth-rated item. If the sample size had been greater, the number of combinations in which one item was rated significantly higher than the other would also have been greater. Even if every sample size had been raised by a factor of 10, however, it is highly unlikely that all pairs of items would have had significantly different ratings.

How, then, should the reader treat two items which were not significantly different in rating? Was there any meaning to the ranking system?

Yes, the fact that there were statistically significant differences between the top-rated and the bottom-rated items established the validity of the ranking scale as a whole. Despite the fact that two ratings are not significantly different, they still have the statistical property of being the Best Linear Unbiased Estimators. For example, even if Item 1 (with a rating of 3.4) was not significantly greater than Item 2 (with a rating of 3.1), Item 1 should still be considered the more important need unless there is additional, outside information to the contrary. (In determining which information products to develop, of course, one must also consider additional factors such as the cost of the product, the proportion of the group which will be reached, and the degree to which the information need will be met.)

2.3.5 Alternative Measures of Usefulness

The ranking of selected information items (in usefulness to the respondent) was based upon the rating developed by assigning a "4" for each response of "essential," a "3" for "very useful," a "2" for "somewhat useful," and a "1" for "not at all useful;" summing the responses for the entire group; then dividing by the number of responses in the group. Using the rating was the preferable way to establish rankings within a group because it fully used the information on the differences between "essential" and "very useful," between "somewhat useful" and "not at all useful."

There were several alternative ways of comparing the usefulness of items, one of which was to calculate the percentage of respondents who classified the item as either "essential" or "very useful." Using this percentage was quite handy in considering how useful a product designed for more than one group would be. For example, both "a calendar (of solar events)" and "lists of local lenders (etc.)" were examples of information products that would be designed for many groups to use. In comparing the two potential products as to usefulness, this method (calculating for each item the percentage of the respondents who considered the item either "essential" or "very useful") provided a much more meaningful comparison than, for example, summing the ranks for all groups.

2.3.6 Combining Results From Different Groups

It should be pointed out that combining results from all solar process heat groups interviewed will not provide unbiased estimates of the total solar process heat community. First, the proportions of respondents from one group interviewed in this study may not correspond to the proportion of such persons in the entire community. Second, the peculiarities of each individual sample frame were responsible for varying degrees of bias for each group. Third, some of the important groups in the solar process heat community were not interviewed (see Section 2.2).

Great care should be exercised in interpreting results from a combination of groups. It is too easy to get the impression that one product can fully meet the needs of all groups when, in fact, it may only partially meet the information needs of some of the groups involved.

2.3.7 Specific Information Products

Several specific information products were included among the items for which usefulness was assessed. It is important that responses to these items not be interpreted as totally generic responses. People who gave "a bibliography of general readings on solar industrial process heat" a low rating may have done so either because of the level and content of the subject matter (i.e., general readings on solar process heat) or because of the format (i.e., bibliography). These people may or may not want bibliographies on other topics.

2.3.8 Information Sources

Another important question investigated how many respondents had used specific information sources. In using these results to plan how specific information is to be transmitted, it will be essential to specify fully both the information products or services and the groups to be reached before making the final decision of which information channels are to be used. One cannot assume, for example, that the two or three top-rated sources should be used for all, or even most, of the information transmissions to the group.

There were two other issues related to this question. The first was the decision not to ask respondents whether they had used SERI as an information source. The reasons are discussed in Appendix D.

The second issue concerned possible bias in responses to the question "have you obtained any solar information directly from the U.S. Department of Energy?" The intent of the

question was to find out if respondents had contacted DOE directly for information, rather than if they had obtained DOE-produced information from other sources [such as SERI, National Technical Information Service (NTIS), Government Printing Office (GPO), National Solar Heating and Cooling Information Center (NSHCIC), Regional Solar Energy Centers (RSECs), libraries, etc.]. There was, however, no assurance that respondents interpreted the question in this light. In cases where the response "directly from DOE" was high, there was the possibility that respondents were referring to information authored or funded by DOE but obtained from other sources.

SECTION 3.0

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT RESEARCHERS

3.1 DESCRIPTION OF RESPONDENTS

3.1.1 Description of Sample

This section describes the results of two telephone studies to determine the needs of researchers for information on solar industrial and agricultural process heat. In one study 9 solar Industrial Process Heat (IPH) Researchers were interviewed; in the other, 9 solar Agricultural Process Heat (APH) Researchers were interviewed.

The sample frame for IPH Researchers was constructed by reviewing the September 1978 U.S. Department of Energy (DOE) Solar Energy for Agricultural and Industrial Process Heat (AIPH) Program Summary [3], and by searching the Current Research Information System (CRIS) [4], the Smithsonian Science Information Exchange (SSIE) [5], and the Energy Research in Progress (RIP) [6] data bases. Only those projects in progress during some part of FY 1978 or FY 1979 were included. From the data base searches, projects were identified by the terms solar process heat or IPH. APH projects were extracted by visual inspection of search output to identify those that were farm based (see below). Entries without contact names (i.e., principal investigator) were eliminated. Duplicates between this list and any other lists of Researchers were eliminated on all other lists. No organization was sampled more than once within this group. After all adjustments were made, the 9 interview candidates were randomly selected from a sample frame of 55 names.

The sample frame for APH Researchers was constructed by reviewing the DOE AIPH Program Summary [3] and by searching CRIS [4], SSIE [5], and RIP [6] files. Only those projects in progress during some part of FY 1978 or FY 1979 were included. Selection of APH (rather than IPH) projects and duplicates were handled the same as described for the IPH Researchers. Duplicates were individuals' names rather than organizations, so that the same organization may still have been sampled more than once in this study. The same organization was sampled more than once within the APH Researcher sample frame (2 organizations occurred twice). After all adjustments were made, the 9 interview candidates were randomly selected from a sample frame of 27 names.

Respondents. In making the telephone calls to contact the randomly-selected interview candidates, it sometimes occurred that the person could not be reached. In this event another randomly selected name was substituted for the original name. When individuals were contacted it was verified that they had been involved in solar process heat research (industrial or agricultural, as appropriate for each group) and that they would be needing information on solar process heat within the next year. If they were not both involved and needing information, they were asked if they could refer the interviewer to someone else in their organization who would be an appropriate respondent. If such a referral was made, a call was then made to this new candidate; if no intraorganizational referral was made, a new candidate was randomly selected from the sample frame. The results of this process may be seen in Table 3-1.

Table 3-1. COMPLETION OF INTERVIEWS: INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (I/APH) RESEARCHERS

Event	Number of Candidates	
	IPH	APH
Interview completed with sample frame candidate	8	8
Interview completed with referral candidate	1	1
Refusal or candidate termination	0	0
Contact attempted: could not reach candidate within three attempts or before interviews were completed	3	0
Subtotal	12	9
Contact attempted: invalid candidate (e.g.; inappropriate field of interest, no telephone)	4	0
TOTAL	16	9
Sample frame error rate[a] (Percent)	25	0
Completion rate[b] (Percent)	75	100

[a]Invalid candidates divided by TOTAL
[b]Completed interviews divided by Subtotal

Comparisons. For additional insight into the information needs and information habits of these two groups of solar Process Heat Researchers, results from these groups are compared to the results from all of the researchers interviewed in this study (All Researchers). The list of all the groups contained in All Researchers can be found in Table F-2 of Appendix F. In performing any statistical comparisons, the totals for IPH Researchers and/or APH Researchers have been subtracted from the totals for All Researchers. The data for IPH Researchers, APH Researchers, and All Researchers can be found in Appendix F.

3.1.2 Current Status of Respondents

Role. Four of the IPH Researchers were employed by universities, 1 by the research center of a large manufacturer, 2 by other manufacturers, and 2 by national laboratories. Seven of the APH Researchers were employed by universities, 1 by a U.S. Department of Agriculture (USDA) research center and 1 by another agricultural research center.

Current activities of the IPH Researchers included three research projects: R&D in collector design, applications for specific collectors, and the behavior and stability of salt-gradient solar ponds used for water heating and refrigeration. Other activities included: managing solar IAPH projects, demonstration of solar industrial process steam applications, development of concentrating collector tracking controls, designing and supplying collector systems, marketing and operating a commercial dehydrator, kiln-drying malt, hospital laundry clothes drying, and "wind-collector" design.

Four of the 9 APH Researchers were currently involved with crop drying projects (corn, peanuts, fruits, and vegetables): research, exploration of concepts for solar drying, pilot tests of a variety of collectors, and testing of economic feasibility. Two were involved with agricultural space heating: animal shelters and evaluation of inexpensive collectors. Other activities mentioned included: building greenhouses to provide heat, crop drying at commodity "terminal storage systems" using solid dessicants, solar collectors for fish drying, collecting data, and writing reports.

Involvement. Seven of the 9 (78%) IPH Researchers said that they were "very involved" with solar process heat compared to 4 of the 9 (44%) APH Researchers. This compares to 107 of the 181 (59%) All Researchers who were "very involved" with their respective solar technologies.

Informedness. Five of the 9 (56%) IPH Researchers considered themselves "very informed" compared to 4 of the 9 (44%) APH Researchers and 117 of the 181 (65%) All Researchers.

Need for Information. All respondents indicated they would need information either on or off the job in the next year. Only 2 of the 9 (22%) APH Researchers indicated they would need information on solar agricultural process heat outside the job while 8 expected to need information on the job. IPH Researchers were not asked about off-the-job information needs, as it was considered unlikely that they would respond affirmatively. Only one other group of Researchers interviewed in this study was as unlikely as were the APH Researchers to need off-the-job information.

3.1.3 Background of Respondents

Four of the 9 IPH Researchers and 7 of the 9 APH Researchers held a PhD. The other 2 APH Researchers held master's degrees, while 3 of the IPH Researchers held master's degrees and 2 held bachelor's degrees. In terms of proportion of advanced degree holders (beyond bachelor's), the IPH Researchers with 78% were more similar to All Researchers (80%), than were the APH Researchers with 100%.

Only 2 of the IPH Researchers had degrees granted within the past 10 years and 7 from 10-20 years ago. Four of the APH Researchers had received their most recent degree within the last 10 years, 3 from 10-15 years ago, and 2 over 25 years ago.

Most (6) of the IPH Researchers held degrees in engineering (aeronautical, chemical, mechanical, science). The remainder (3) held degrees in physics. Two respondents were currently teaching. Other professions described were: manager of solar projects, solar manufacturer, project engineer, agricultural or mechanical engineer, process heat engineer, research administrator, and research associate. Five of the IPH Researchers had been in their current profession for 3-5 years, 1 for 6-10 years, and 3 of them for over 10 years.

Most (7) of the APH group also had their most recent degrees in engineering (agricultural, electrical). One held a degree in agronomy and 1 in food science. Five were currently educators (1 was a researcher as well). Two respondents in this group gave their present profession as engineer, 1 as an agronomist, and 1 as an expert in fruit and vegetable harvesting operations. Two had been in their current profession for 5 years or less, 3 for 6-10 years, and 4 for over 10 years.

3.2 INFORMATION NEEDS OF RESPONDENTS

3.2.1 Technical Areas

IPH Researchers were asked to choose those areas of solar industrial process heat in which they were "particularly interested in obtaining information." Eight of the 9 were interested in "hot water," 7 of the 9 in "low-temperature steam" and "refrigeration." Six were interested in "hot air" and 5 in "high-temperature steam," but only 3 were interested in "direct heat."

One IPH Researcher also volunteered an interest in electrical cogeneration.

When APH Researchers were asked to choose those areas of solar agricultural process heat in which they were "particularly interested in obtaining information," they were found to be most interested (6 of the 9) in "grain drying" and "crop drying." Five of the 9 were interested in "livestock shelter heating" and "food processing." They were least interested (2 of the 9) in "greenhouses."

Four of the APH Researchers volunteered that they were also interested in other areas: integration of solar and other renewable energy sources, water heating for farm buildings (including homes) (2), and design parameters for biomass heaters.

3.2.2 Types of Information

Both IPH and APH Researchers were asked to name the information about solar process heat that was important for them to obtain. All 9 of the IPH Researchers volunteered one or more items of information which they considered important. Three respondents considered cost information important. Other items included: operating experience from other projects (world-wide information), current reports on other projects (perhaps in newsletter form), concentrating collectors, storage and desiccant materials, amount of heat required for various applications, ways to provide lower costs with solar ponds, current opportunities for IPH, and potential industrial partners.

Eight of the 9 APH Researchers volunteered one or more items of information which they considered important. Mentioned were: basic energy data, economic analyses, detailed meteorological data, poultry house heating, drying characteristics of grain, design parameters for air collectors, new hardware innovations, solar applications in food processing, up-to-date reference lists, solar collector designs, construction details, applications for agriculture, and feasiblity of APH systems.

Information that several IPH Researchers volunteered they needed but were unable to get included: results of other projects (including government- and private-sponsored and overseas), cost and performance, and good glazing materials.

Several APH Researchers also volunteered that there was information they needed but were unable to get. Two mentioned weather and insolation data (with more frequent readings and for wider geographic areas). Also mentioned were information on materials for solar system components, and standard design products and handbooks.

Choice Between Specific Needs. A list of 11 types of solar process heat information products and 13 or 14 types of solar process heat information categories was read to each

respondent. Each respondent described the usefulness of each particular item by assigning it a value of "essential," "very useful," "somewhat useful," or "not at all useful." The results are given in Fig. 3-1 for IPH Researchers and Fig. 3-2 for APH Researchers. For the purpose of comparison, Fig. 3-3 displays the results for All Researchers and is not limited to process heat information items, but cuts across solar research technologies.

Both groups of Process Heat Researchers gave the cost information category high ratings as a class, including the following items in their five top-rated information categories/products:

- Costs of installing and operating a solar process heat system compared to a conventional system,
- Cost and performance of systems,
- Research in progress,
- Climatological data, and
- A technical description of how a particular system works.

IPH Researchers also gave high ratings to:

- System diagrams or schematics.

APH Researchers also gave high ratings to:

- Design handbooks, installation handbooks, or reference tables; and
- Manual methods for sizing and predicting performance or costs.

IPH Researchers assigned their lowest relative ratings to:

- Educational institutions and other organizations offering courses,
- A nontechnical description of how a particular system works; and
- Institutional, social, environmental, and legal aspects.

APH Researchers assigned the lowest relative ratings to:

- How to market and sell solar systems;
- A nontechnical description of how a particular system works;
- Local building codes or other regulations;
- Marketing statistics and sales projections; and
- Solar energy programs, research, industries, and markets outside the United States.

Statistical tests indicated that for IPH Researchers differences between the six highest-rated and three lowest-rated items were significant ($P < 0.05$). Similarly, differences between the seven highest-rated and five lowest-rated items for APH Researchers were statistically significant ($P < 0.05$).

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Average Usefulness*** (1.0 1.5 2.0 2.5 3.0 3.5 4.0)	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:						
Research Information Categories:						
The state of the art	8		0	6	3	0
Research in progress	1		2	5	2	0
Cost Information Categories:						
Costs of installing and operating a solar system compared to a conventional system	3		2	4	3	0
Costs and performance of systems	1		2	5	2	0
Site-Specific Information Categories:						
Local building codes or other regulations affecting siting or installation of systems	14		2	1	5	1
Climatological data such as wind, weather, or amount of sunshine	3		2	4	3	0
Marketing Information Categories:						
Marketing statistics and sales projections	17		0	4	4	1
Information on how to market and sell systems including guidelines on obtaining financial support	NA		NA	NA	NA	NA
Other Information Categories:						
Educational institutions and other organizations offering related courses on system design or application	24		0	0	5	4
Standards, specifications, or certification programs for equipment	17		1	2	5	1
Institutional, social, environmental, and legal aspects of system applications	22		0	0	9	0
Expected major developments during the next 10 years	11		0	5	4	0
Solar system programs, research, industries, and markets outside the United States	17		0	4	4	1
Tax credits, grants, or other economic incentives	8		3	0	6	0
Information Products:						
Reference Information Products:						
A bibliography of general readings	11		1	3	5	0
A calendar of conferences and programs	8		0	6	3	0
A list of sources for information	11		0	5	4	0
A list of technical experts	17		0	3	6	0
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	17		1	2	5	1
Descriptive Information Products:						
A non-technical description of how a particular system works	23		0	0	7	2
A technical description of how a particular system works	3		0	8	1	0
System diagrams or schematics	3		2	4	3	0
Design Information Products:						
System design handbooks, installation handbooks, or reference tables	14		0	4	5	0
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	7		0	7	2	0
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	14		1	2	6	0

* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

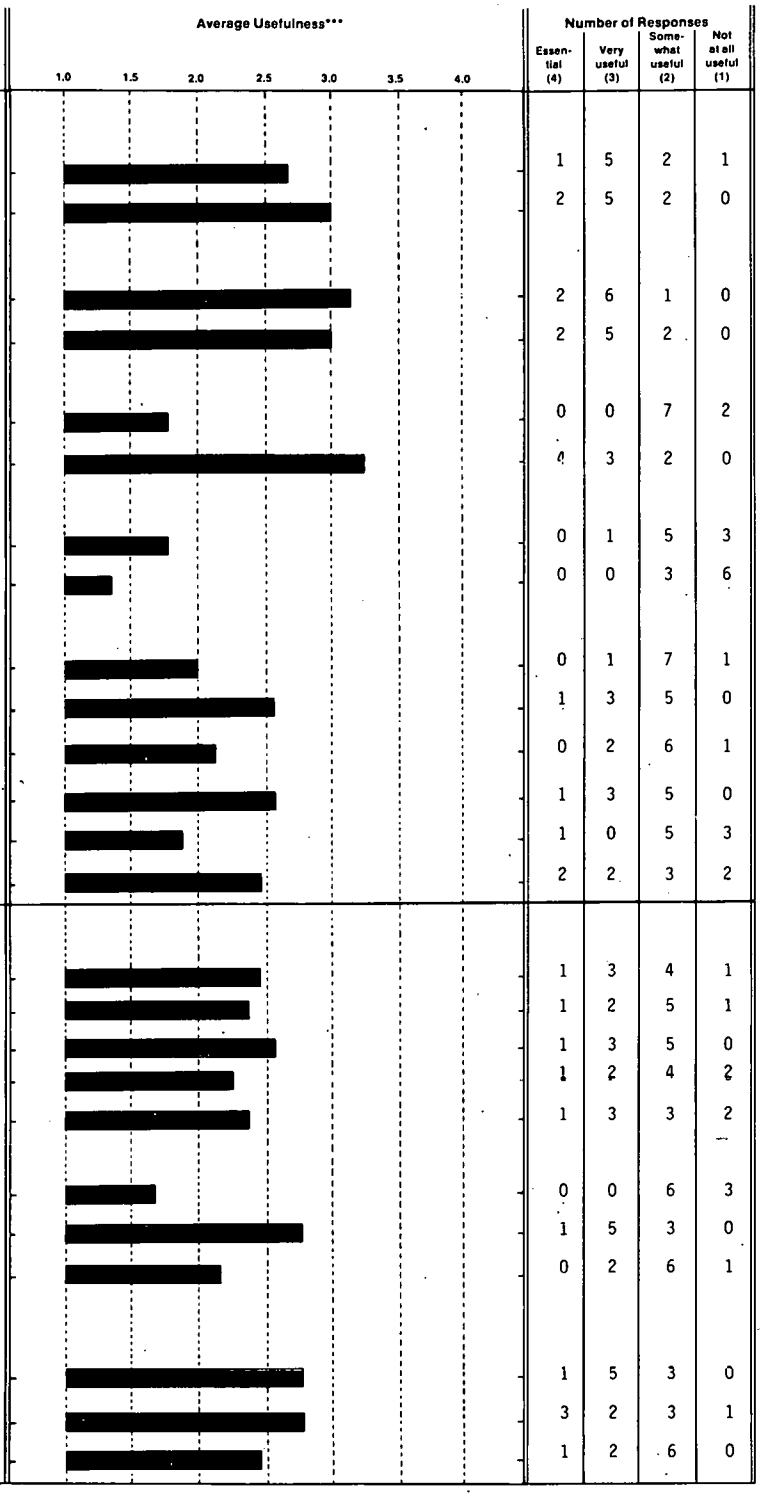
** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4".

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 3-1. Usefulness of Selected Information Items: Industrial Process Heat Researchers

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:					
Research Information Categories:					
The state of the art	8	1	5	2	1
Research in progress	3	2	5	2	0
Cost Information Categories:					
Costs of installing and operating a solar system compared to a conventional system	2	2	6	1	0
Costs and performance of systems	3	2	5	2	0
Site-Specific Information Categories:					
Local building codes or other regulations affecting siting or installation of systems	22	0	0	7	2
Climatological data such as wind, weather, or amount of sunshine	1	4	3	2	0
Marketing Information Categories:					
Marketing statistics and sales projections	22	0	1	5	3
Information on how to market and sell systems including guidelines on obtaining financial support	25	0	0	3	6
Other Information Categories:					
Educational institutions and other organizations offering related courses on system design or application	20	0	1	7	1
Standards, specifications, or certification programs for equipment	9	1	3	5	0
Institutional, social, environmental, and legal aspects of system applications	18	0	2	6	1
Expected major developments during the next 10 years	9	1	3	5	0
Solar system programs, research, industries, and markets outside the United States	21	1	0	5	3
Tax credits, grants, or other economic incentives	12	2	2	3	2
Information Products:					
Reference Information Products:					
A bibliography of general readings	12	1	3	4	1
A calendar of conferences and programs	15	1	2	5	1
A list of sources for information	9	1	3	5	0
A list of technical experts	17	1	2	4	2
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	15	1	3	3	2
Descriptive Information Products:					
A non-technical description of how a particular system works	24	0	0	6	3
A technical description of how a particular system works	5	1	5	3	0
System diagrams or schematics	18	0	2	6	1
Design Information Products:					
System design handbooks, installation handbooks, or reference tables	5	1	5	3	0
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	5	3	2	3	1
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	12	1	2	6	0



* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4".

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 3-2. Usefulness of Selected Information Items: Agricultural Process Heat Researchers

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Average Usefulness*** (1.0 1.5 2.0 2.5 3.0 3.5 4.0)	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:						
Research Information Categories:						
The state of the art	2		34	93	44	9
Research in progress	1		33	102	39	7
Cost Information Categories:						
Costs of installing and operating a solar system compared to a conventional system	4		32	70	45	16
Costs and performance of systems	3		39	70	49	14
Site-Specific Information Categories:						
Local building codes or other regulations affecting siting or installation of systems	20		19	38	58	48
Climatological data such as wind, weather, or amount of sunshine	7		34	55	46	28
Marketing Information Categories:						
Marketing statistics and sales projections	19		14	38	56	38
Information on how to market and sell systems including guidelines on obtaining financial support	23		3	0	7	8
Other Information Categories:						
Educational institutions and other organizations offering related courses on system design or application	24		1	26	99	54
Standards, specifications, or certification programs for equipment	17		18	55	53	37
Institutional, social, environmental, and legal aspects of system applications	18		13	51	73	26
Expected major developments during the next 10 years	5		24	88	51	17
Solar system programs, research, industries, and markets outside the United States	22		13	51	68	48
Tax credits, grants, or other economic incentives	15		27	44	52	40
Information Products:						
Reference Information Products:						
A bibliography of general readings	16		15	55	89	22
A calendar of conferences and programs	10		19	69	71	22
A list of sources for information	6		23	79	67	11
A list of technical experts	11		16	66	72	27
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	20		12	39	56	39
Descriptive Information Products:						
A non-technical description of how a particular system works	25		3	18	62	70
A technical description of how a particular system works	8		18	84	63	16
System diagrams or schematics	13		14	62	78	25
Design Information Products:						
System design handbooks, installation handbooks, or reference tables	12		17	67	65	31
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	9		30	65	53	33
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	13		28	51	62	40

* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4."

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 3-3. Usefulness of Selected Information Items: All Researchers

It should be noted that these lower-rated items were not necessarily of no worth to these Researchers. For example, 1 of the 9 (11%) APH Researchers thought "solar energy programs . . . outside the United States" was "essential." Thus, these information categories/products could be useful to some process heat Researchers, but were of a lower relative priority to each entire group.

Statistical tests were also used to determine whether the IPH Researchers rated any of these information items significantly higher (or lower) than they were rated by the APH Researchers or by All Researchers. Some groups, however, tended to give higher scores in general than did other groups. To compensate for this effect, these statistical tests compared the "relative rating" given by one group to the "relative rating" given by the other groups. The procedure for calculating the relative rating is described in Appendix E. The average overall rating IPH Researchers gave to all items was 2.51; for APH Researchers it was 2.40; and for All Researchers, 2.41.

In comparing the results for IPH Researchers with those for APH Researchers, IPH Researchers were found to give significantly ($P < 0.05$) higher ratings to "system diagrams or schematics" and significantly lower ($P < 0.05$) ratings to "educational institutions." It was interesting to note that IPH Researchers were less interested in "system diagrams or schematics" than APH Researchers.

IPH Researchers also gave significantly ($P < 0.05$) lower ratings than did All Researchers to "educational institutions." They gave somewhat higher ratings to "system diagrams or schematics" and "tax credits," but lower ratings to "state of the art" and "expected major developments."

APH Researchers gave significantly ($P < 0.05$) higher ratings to "climatological data" than All Researchers, and somewhat higher ratings to "standards" and "system design handbooks." APH Researchers appeared less interested, however, in "state of the art" than were All Researchers.

3.3 ACQUISITION OF INFORMATION BY RESPONDENTS

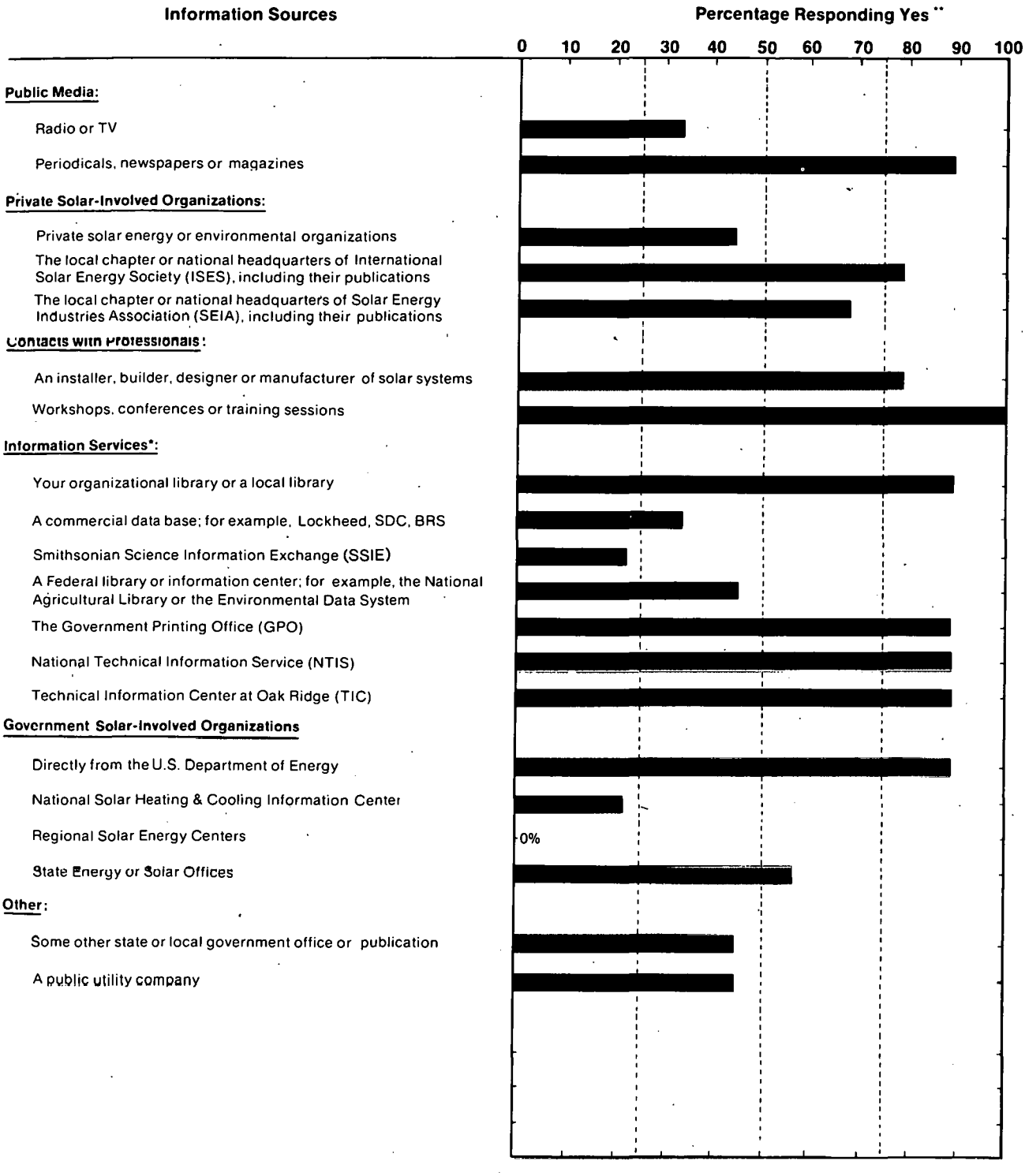
3.3.1 Use of Selected Information Sources

Process Heat Researchers were asked which of 20 different potential sources of solar information they had used in the past few years. For this question the respondents were not asked if they had obtained information on solar process heat, but instead were asked if they had obtained any solar information from each specific source. Thus, the question sought to determine which information sources were the most familiar to respondents. The results for the IPH and APH groups are shown in Figs. 3-4 and 3-5. For comparison, Fig. 3-6 shows the results for All Researchers.

The information sources mentioned most often by IPH Researchers were:

- Workshops, conferences, or training sessions;
- Periodicals, newspapers, or magazines;
- An organizational library or a local library;
- The Government Printing Office (GPO);

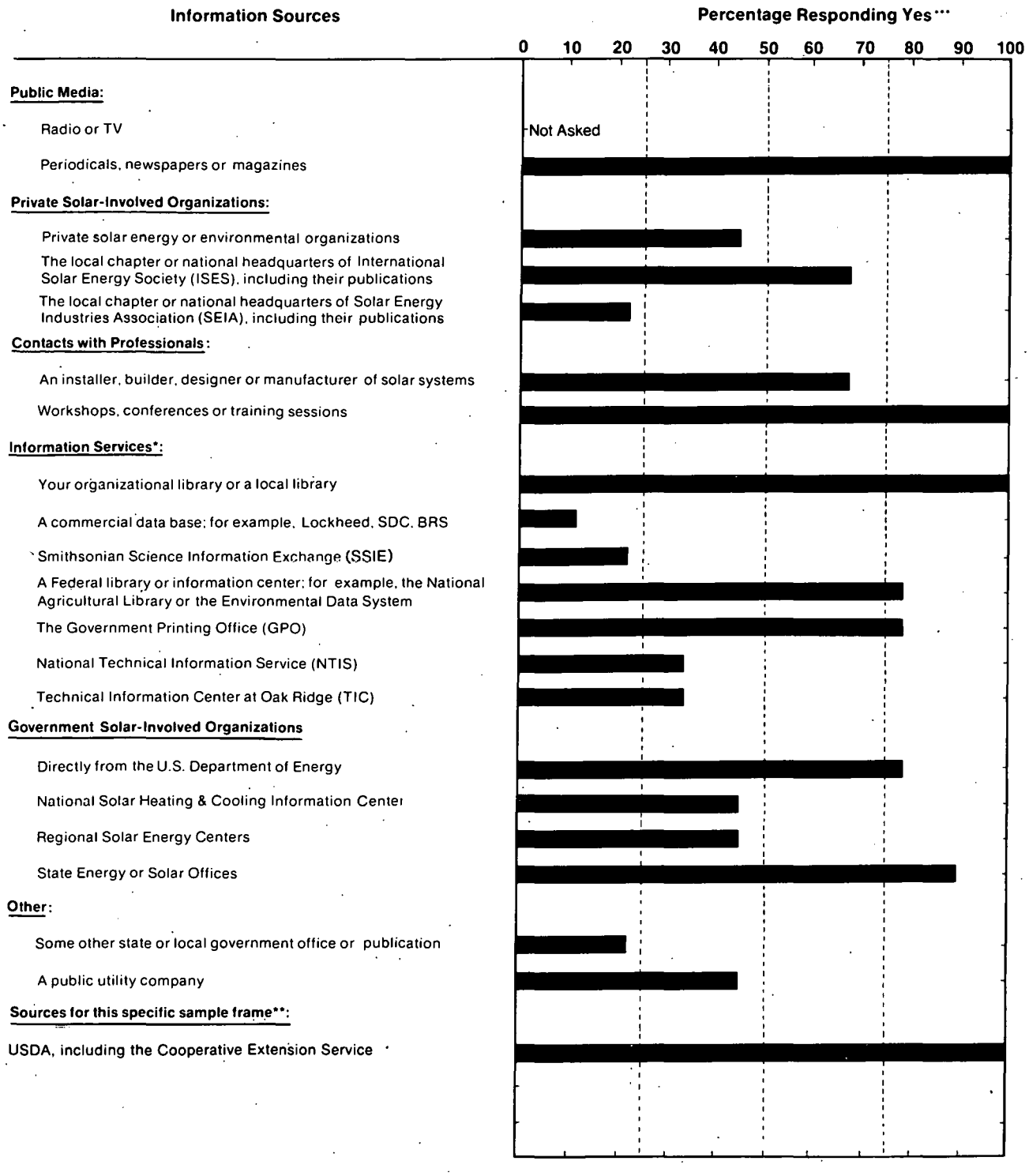
Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** These data are based upon a total of 9 respondents.

Figure 3-4. Use of Selected Information Sources: Industrial Process Heat Researchers

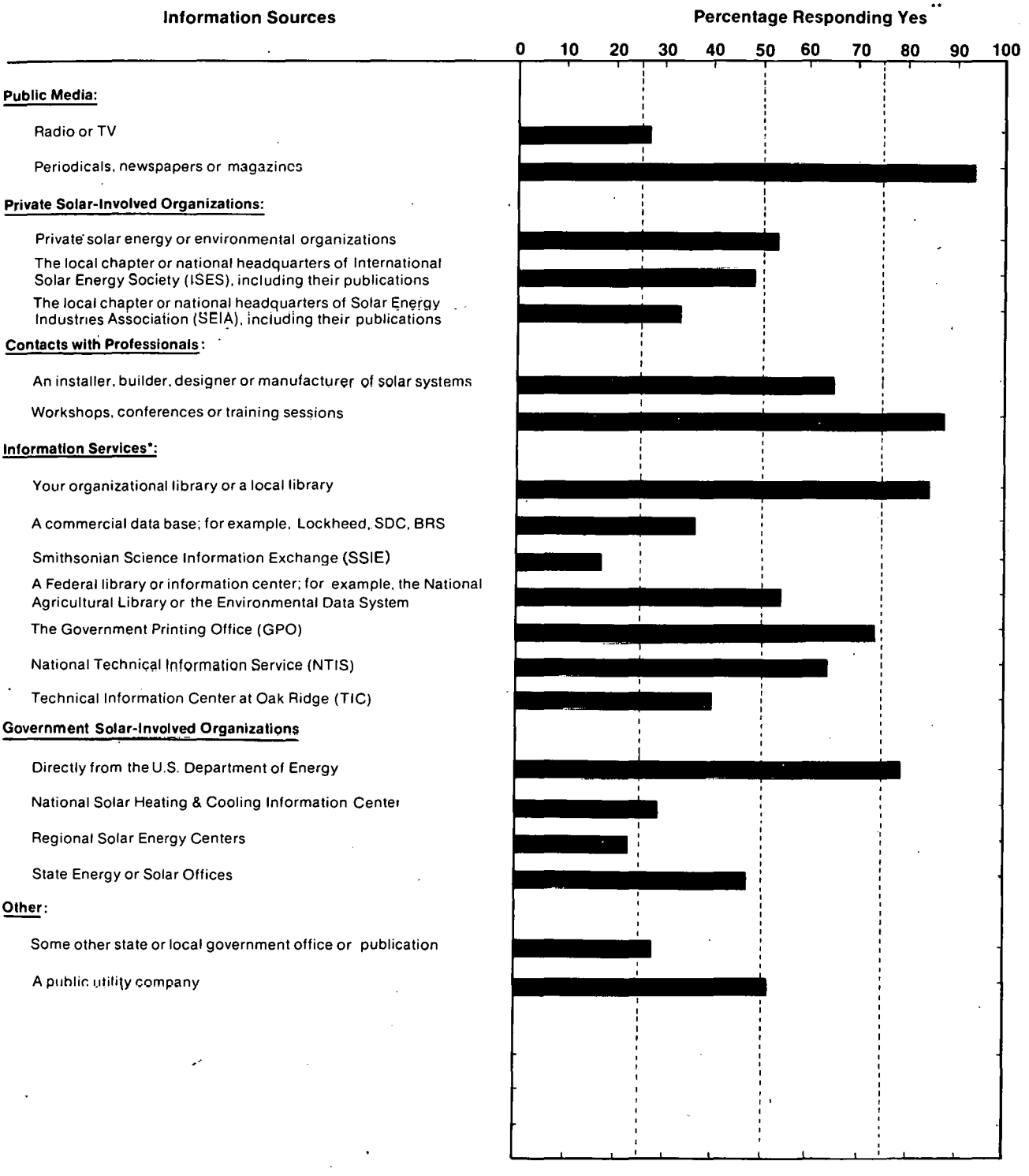
Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** Some sample frames were questioned about additional information sources which are applicable to their technology. For example, the manufacturers of biomass conversion equipment were also asked if they have obtained any type of solar information from: "the local or national office of the U.S. Department of Agriculture, including Extension and Forestry."
*** These data are based upon a total of 9 respondents.

Figure 3-5. Use of Selected Information Sources: Agricultural Process Heat Researchers

Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** These data are based upon a total of 181 respondents.

Figure 3-6. Use of Selected Information Sources: All Researchers

- National Technical Information Service (NTIS);
- Technical Information Center (TIC);
- Directly from DOE;
- The International Solar Energy Society (ISES); and
- An installer, builder, designer or manufacturer of solar systems.

Those mentioned most often by APH Researchers were:

- Periodicals, newspapers, or magazines;
- Workshops, conferences, or training sessions;
- An organizational library or a local library;
- USDA;
- State energy or solar offices;
- A federal library or information center;
- GPO; and
- DOE.

The information sources mentioned least often by IPH Researchers were:

- Regional Solar Energy Centers (RSECs),
- Smithsonian Science Information Exchange (SSIE),
- National Solar Heating and Cooling Information Center (NSHCIC),
- Radio or TV, and
- A commercial data base.

The information sources used least often by APH Researchers were:

- A commercial data base,
- Solar Energy Industries Association (SEIA),
- SSIE,
- Some other state or local government office or publication,
- NTIS, and
- TIC.

The most interesting difference was the much lower use of SEIA, NTIS, and TIC by the APH Researchers.

3.3.2 Membership in Solar-Interested Organizations

Eight of the 9 IPH Researchers studied were members of a professional, technical, or other organization with an interest in solar enegy. The organizations (and the numbers of times mentioned) were:

- American Association of Physics Teachers,
- American Institute of Chemical Engineers,
- American Physical Society (2),
- American Society of Agricultural Engineers (ASAE) (2),
- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE),
- American Society of Mechanical Engineers (3),
- California Solar Energy Association,
- Institute of Electrical and Electronics Engineers (IEEE),
- ISES (2),
- National Society of Professional Engineers (NSPE),
- Northern California Solar Energy Association,
- Optical Society of America (2), and
- SEIA.

Also mentioned was "ISE" [Institution of Structural Engineers (British) or International Society of Electrochemistry], an organization which could not be verified by the authors.

All of the 9 APH Researchers studied were members of professional, technical, or other organizations with an interest in solar energy. These organizations (and the number of times mentioned) included:

- ASAE (6),
- American Society for Engineering Education,
- ASHRAE (2),
- IEEE,
- ISES (2), and
- NSPE.

Also mentioned were "Food Technicians" and "POA," organizations which could not be verified by the authors.

3.3.3 Exposure to Publications on Solar Energy

During the past 6 months, 8 of the 9 IPH Researchers and all 9 of the APH Researchers had read publications which included information on solar process heat. The publications which the IPH Researchers identified (and the number of times mentioned) included:

- DOE reports,
- ISES publications,
- NTIS publications (including "Daily Reports") (2),
- Solar Energy Research Institute (SERI) reports,

- Solar Age (4),
- Solar Energy (3), and
- Solar Engineering.

Also mentioned were an "AICG Paper," "industrial heat publication," "Industrial Process Heat," "ISSE," and "Oakland, California paper." These publications could not be verified by the authors.

The publications which the APH Researchers could identify (and the number of times mentioned) included:

- ASAE Transactions (2),
- ASHRAE Journal,
- DOE reports,
- Energy Digest,
- ISES publications(2),
- Solar Energy(2),
- SERI publications,
- Solar Grain Drying Symposium Proceedings (USDA, DOE), and
- Symposium on Peanut Drying, Forages, and Tobacco (USDA, DOE).

Also mentioned were publications which could not be verified by the authors. These included "AES Journal," "Solar (ENIS)," and "Solar Heating of Greenhouses."

3.3.4 Use of Special Acquisition Methods

The respondents were asked whether they had obtained any information (not just process heat or solar energy) in the past year by computer terminal, by Computer Output Microform (COM), or by other microform (e.g., microfiche, microfilm sheets or rolls). Three of the 9 (33%) IPH Researchers had used computer terminals, compared to 4 of the 9 (44%) APH Researchers and 62 of the 181 (34%) All Researchers. While none of the APH group had used COM, 1 (11%) of the IPH group had, as had 16 of the 181 (9%) All Researchers. In addition, more (4 or 44%) of the IPH Researchers than APH Researchers (3 or 33%) had used other microforms, compared to 72 of the 181 (40%) All Researchers.

3.4 SUMMARY AND COMMENTS

Two types of solar process heat researchers were interviewed: solar industrial process heat researchers were asked about solar industrial process heat information, and solar agricultural process heat researchers were asked about solar agricultural process heat information. The IPH Researchers had somewhat lower levels of education than did APH Researchers, but the majority still held advanced degrees. IPH Researchers were employed by universities, manufacturers, and national laboratories; APH Researchers were employed by universities and research centers. The IPH Researchers tended to be both more involved with and more informed about solar process heat than did the APH Researchers.

Both groups of Solar Process Heat Researchers attributed the greatest utility to information on:

- Costs of installing and operating a solar process heat system compared to a conventional system,
- Costs and performance of solar process heat systems,
- Solar process heat research in progress,
- Climatological data, and
- A technical description of how a solar process heat system works.

Both groups gave low ratings to "a nontechnical description." IPH Researchers also did not find "educational institutions" or "institutional ... aspects" very useful. APH Researchers were not very interested in marketing information, "local building codes," or " programs . . . outside the United States."

IAPH researchers had recently obtained information from "periodicals, newspapers, or magazines," "workshops, conferences, or training sessions," libraries, and DOE. The IPH group also reported recent use of GPO and NTIS, while for the APH Researchers, state energy and solar offices and USDA were important sources of solar information. It was interesting to note that at least 6 of the 9 IPH Researchers had used SEIA, NTIS, and TIC, but that APH Researchers generally had not (a maximum of 3 of the 9). Most of these Researchers belonged to organizations which also acted as information sources, most importantly: ASAE, ASHRAE, ISES, and ASME. Nevertheless, there was a substantial body of information which these researchers felt they could not obtain.

SECTION 4.0

CONCENTRATING COLLECTOR MANUFACTURER REPRESENTATIVES

4.1 DESCRIPTION OF RESPONDENTS

4.1.1 Description of Sample

This section describes the results of a telephone study to determine the needs of manufacturers of concentrating collectors, solar thermal electric power equipment, reflectors, or refractors for information on solar energy. A total of 8 representatives of such manufacturers were interviewed; in this report they will be referred to as Concentrating Collector Manufacturer Representatives. Concentrating Collector Manufacturer Representatives were asked about their involvement in solar energy in general, rather than in process heat specifically. Thus, results in this section for those questions which deal with a specific technology differ somewhat in context from those in other sections of this report.

The sample frame for Concentrating Collector Manufacturer Representatives was constructed from two sources. The MITRE Solar Energy Technical Information Dissemination Program. Reference Directory: Solar Thermal Power [7] listed manufacturer/distributors (under commercializers). The second source was the Solar Energy Information Data Bank (SEIDB) Manufacturers Data Base [8] which included manufacturers of concentrating collectors, solar thermal electric power equipment, reflectors, and refractors. Products specified for these manufacturers were one or more of the following: parabolic trough collectors, focusing solar collectors, parabolic dish collectors, tracking or nontracking concentrating collectors, vacuum tube collectors, linear trough collectors, compound parabolic concentrating collectors, solar thermal systems, reflectors, refractors, or alzak reflectors. Manufacturers with no contact name and duplicates with all other manufacturer's sample frames were eliminated. After all adjustments were made, 8 interview candidates were randomly selected from a sample frame of 80 names.

Respondents. In making the telephone calls to contact the randomly selected interview candidates, it sometimes occurred that the person could not be reached. In this event another randomly selected name was substituted for the original name. When individuals were contacted, it was verified that the company they worked for really was a "Concentrating Collector Manufacturer" and that they would be needing information on solar energy within the next year. If they were not both involved and needing information, they were asked if they could refer the interviewer to someone else in their organization who would be an appropriate respondent. If such a referral was made, a call was then made to this new candidate; if no intraorganizational referral was made, a new candidate was randomly selected from the sample frame. The results of this process may be seen in Table 4-1.

Table 4-1. COMPLETION OF INTERVIEWS: CONCENTRATING COLLECTOR MANUFACTURER REPRESENTATIVES

Event	Number of Candidates
Interview completed with sample frame candidate	4
Interview completed with referral candidate	4
Refusal or candidate termination	0
Contact attempted: could not reach candidate within three attempts or before interviews were completed	1
Subtotal	9
Contact attempted: invalid candidate (e.g.; inappropriate field of interest, no telephone)	5
TOTAL	14
Sample frame error rate[a] (Percent)	36
Completion rate[b] (Percent)	89

[a]Invalid candidates divided by TOTAL
[b]Completed interviews divided by Subtotal

Comparisons. For additional insight into the information needs and the information habits of these representatives of Concentrating Collector Manufacturers, results from this group are compared to results from representatives of Total Nonconcentrating Collector Manufacturers (see Section 5.0) and representatives of All Manufacturers. In performing any statistical comparisons, the totals for Concentrating Collector Manufacturer Representatives have been subtracted from the totals for All Manufacturer Representatives. The data for Concentrating Collector Manufacturer Representatives, Total Nonconcentrating Collector Manufacturer Representatives, and All Manufacturer Representatives can be found in Appendix F.

4.1.2 Current Status of Respondents

Role. The 8 Concentrating Collector Manufacturer Representatives were involved in the production of the following types of collectors: parabolic trough (3), evacuated tube (2), semicircular trough, V-trough, and compound parabolic. Three also manufactured hot water systems, 2 manufactured space heating systems, and 1 each manufactured space cooling systems, line focus concentrators, power tower plants, and heliostats. Some Concentrating Collector Manufacturer Representatives were also involved in the manufacture of: heat pumps (2); steam supply systems; decentralized power plants; educational aids; irrigation systems; radiation measurement devices; large wind turbine generator systems; and solar cell panels, modules and array fields.

Involvement. Seven of the 8 (88%) representatives of Concentrating Collector Manufacturers felt that they were "very involved" in solar energy and 1 felt he/she was "moderately involved." In comparison with Total Nonconcentrating Collector Manufacturer Representatives [23 of the 29 or 79% "very involved" in active solar heating and cooling

(SHAC)] and All Manufacturer Representatives (77 of the 96 or 80% "very involved" in their respective technologies), the level of involvement by Concentrating Collector Manufacturer Representatives was not significantly different.

Informedness. Representatives of Concentrating Collector Manufacturers felt they were very well informed, with 7 stating that they were "very informed" and 1 "moderately informed." The level of informedness by Concentrating Collector Manufacturer Representatives did not significantly differ from that of Total Nonconcentrating Collector Manufacturer Representatives (26 of the 29 or 90% "very informed") nor All Manufacturer Representatives (72 of the 96 or 75% "very informed").

Need for Information. All respondents indicated they would need information on solar energy on the job during the next year. Three of the 8 (38%) also expected to need information on solar energy outside the job, which was slightly lower than both the Nonconcentrating Collector group (16 of the 29 or 55%) and All Manufacturer Representatives (47 of the 96 or 49%).

4.1.3 Background of Respondents

Four of the 8 (50%) representatives of Concentrating Collector Manufacturers held bachelor's degrees, three (38%) held master's degrees, and one held a doctoral degree. More Concentrating Collector Manufacturer Representatives (50%) had advanced degrees (beyond bachelor's) than Total Nonconcentrating Collector Manufacturer Representatives (20%). The degree field most common to the representatives of Concentrating Collector Manufacturers was engineering, with such degrees received by 7 of the 8 (88%) respondents. The one remaining degree was in business. Engineering degrees were also most common for Total Nonconcentrating Collector Manufacturer Representatives; however, the proportion was significantly lower at 8 of the 27 (30%). One Concentrating Collector Manufacturer Respresentative received his/her most recent degree over 60 years ago, 4 were received 20-30 years ago, and 3 were received 10-20 years ago. No degrees were received within the past 10 years, differing from Total Nonconcentrating Collector Manufacturer Representatives, where 10 of the 21 (48%) of those citing dates had received degrees within the past 10 years.

One of the representatives of Concentrating Collector Manufacturers had been in his/her current profession for 2 or fewer years, 1 for 3-5 years, 1 for 6-10 years, and 5 for over 10 years. Although the length of current professional experience was slightly longer than that of Total Nonconcentrating Collector Manufacturer Representatives and All Manufacturer Representatives, the difference was not statistically significant. When asked about their current profession, all 8 Concentrating Collector Manufacturer Representatives said they were in managerial, administrative, or executive positions. Two of the respondents specifically mentioned working in marketing, 1 in product development, and 1 in operations.

4.2 INFORMATION NEEDS OF RESPONDENTS

4.2.1 Technical Areas

Representatives of Concentrating Collector Manufacturers were asked to choose those areas in which they were "particularly interested in obtaining information" from a list of

selected technical areas of solar energy. All 8 of the respondents were interested in "energy storage" and 7 of the 8 were interested in "photovoltaics," "agricultural process heat," and "industrial process heat." Six were interested in "SHAC" and 5 in "solar thermal electric power." (See Section 4.1.1.)

4.2.2 Types of Information

Representatives of Concentrating Collector Manufacturers were asked to name the information about solar energy that was important for them to obtain. All 8 of the Concentrating Collector Manufacturer Representatives volunteered one or more items of information which they considered important. Four felt information on government progress (planning, funding, cycles, program priorities, legislation, and state and federal tax incentives) was important. Also mentioned were cost information (2), marketing information (2, including 1 mention of "where to sell"), and information on international programs (2, including 1 mention of "programs such as IEA involvement in Germany in small central receiver development"). Other topics included: new innovations, new inventions, technical information on system installations, and global insolation data on an hourly basis.

Information that the Concentrating Collector Manufacturer Representatives volunteered they needed but were unable to get included: performance data; actual savings on solar hot water, space heating and space cooling systems; and marketing information on projects and installations completed on an annual basis.

Choice Between Specific Needs. A list of 11 types of solar energy information products and 14 types of solar energy information categories was read to each respondent. Each respondent described the usefulness of each particular item by assigning it a value of "essential," "very useful," "somewhat useful," or "not at all useful." The results are given in Fig. 4-1. For the purpose of comparison, the results for All Manufacturer Representatives (Fig. 4-2) are also provided. The results for Total Nonconcentrating Collector Manufacturer Representatives are presented in Section 5.0.

Concentrating Collector Manufacturer Representatives selected economic information (including tax credits and costs) as most important. Their seven top-rated information categories/products were:

- Standards, specifications, or certification programs;
- Tax credits, grants, or other economic incentives;
- Costs and performance of systems;
- Climatological data;
- Research in progress;
- Costs of installing and operating a solar system compared to a conventional system; and
- Marketing statistics and sales projections.

Total Nonconcentrating Collector Manufacturer Representatives also rated most of these information categories/products among their most important items.

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Average Usefulness*** (1.0 1.5 2.0 2.5 3.0 3.5 4.0)	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:						
Research Information Categories:						
The state of the art	8		1	4	3	0
Research in progress	5		1	5	2	0
Cost Information Categories:						
Costs of installing and operating a solar system compared to a conventional system	5		2	4	1	1
Costs and performance of systems	3		1	6	1	0
Site-Specific Information Categories:						
Local building codes or other regulations affecting siting or installation of systems	12		2	3	1	2
Climatological data such as wind, weather, or amount of sunshine	3		3	3	1	1
Marketing Information Categories:						
Marketing statistics and sales projections	5		2	3	3	0
Information on how to market and sell systems including guidelines on obtaining financial support	12		1	3	4	0
Other Information Categories:						
Educational institutions and other organizations offering related courses on system design or application	23		0	2	3	3
Standards, specifications, or certification programs for equipment	1		5	1	1	1
Institutional, social, environmental, and legal aspects of system applications	20		0	3	4	1
Expected major developments during the next 10 years	14		0	4	4	0
Solar system programs, research, industries, and markets outside the United States	14		1	3	3	1
Tax credits, grants, or other economic incentives	1		3	4	1	0
Information Products:						
Reference Information Products:						
A bibliography of general readings	24		0	0	6	2
A calendar of conferences and programs	8		2	2	4	0
A list of sources for information	18		0	4	3	1
A list of technical experts	8		1	5	1	1
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	14		0	5	2	1
Descriptive Information Products:						
A non-technical description of how a particular system works	24		0	1	4	3
A technical description of how a particular system works	14		0	5	2	1
System diagrams or schematics	20		0	3	4	1
Design Information Products:						
System design handbooks, installation handbooks, or reference tables	20		0	4	2	2
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	8		1	5	1	1
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	18		0	5	1	2

* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4".

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 4-1. Usefulness of Selected Information Items: Concentrating Collectors Manufacturer Representatives

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Average Usefulness*** (1.0 1.5 2.0 2.5 3.0 3.5 4.0)	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:						
Research Information Categories:						
The state of the art	6		23	34	26	10
Research in progress	5		22	38	26	9
Cost Information Categories:						
Costs of installing and operating a solar system compared to a conventional system	4		19	43	23	8
Costs and performance of systems	3		19	44	26	6
Site-Specific Information Categories:						
Local building codes or other regulations affecting siting or installation of systems	13		21	32	23	19
Climatological data such as wind, weather, or amount of sunshine	8		28	28	20	19
Marketing Information Categories:						
Marketing statistics and sales projections	8		22	30	34	9
Information on how to market and sell systems including guidelines on obtaining financial support	17		22	17	33	23
Other Information Categories:						
Educational institutions and other organizations offering related courses on system design or application	23		8	15	43	30
Standards, specifications, or certification programs for equipment	2		29	28	31	8
Institutional, social, environmental, and legal aspects of system applications	22		9	24	41	21
Expected major developments during the next 10 years	7		19	36	33	8
Solar system programs, research, industries, and markets outside the United States	20		14	25	34	23
Tax credits, grants, or other economic incentives	1		30	41	15	9
Information Products:						
Reference Information Products:						
A bibliography of general readings	24		5	14	52	24
A calendar of conferences and programs	18		10	33	36	16
A list of sources for information	16		10	37	34	14
A list of technical experts	19		11	30	36	19
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	10		19	36	27	13
Descriptive Information Products:						
A non-technical description of how a particular system works	25		3	13	32	20
A technical description of how a particular system works	11		13	46	25	12
System diagrams or schematics	14		5	44	39	7
Design Information Products:						
System design handbooks, installation handbooks, or reference tables	15		9	40	33	14
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	12		19	34	26	16
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	21		8	33	29	25

* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4".

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 4-2. Usefulness of Selected Information Items: All Manufacturer Representatives

Representatives of Concentrating Collector Manufacturers assigned the lowest relative ratings to:

- A bibliography of general readings,
- A nontechnical description of how a particular system works, and
- Educational institutions and other organizations offering courses.

These three information categories/products were identical to those rated lowest by Total Nonconcentrating Collector Manufacturer Representatives.

Statistical tests indicated all seven of the top categories/products were rated significantly ($P < 0.05$) higher than were the three lowest-rated items.

It should be noted that these lower-rated items were not necessarily of no worth to the Concentrating Collector Manufacturer Representatives. For example, 3 of the 8 (38%) Concentrating Collector Manufacturer Representatives thought "institutional . . . aspects" was "very useful." Thus, these information categories/products could be useful to some Concentrating Collector Manufacturer Representatives but were of a lower relative priority to the entire group.

Statistical tests were also used to determine whether the representatives of Concentrating Collector Manufacturers rated any of these information items significantly higher (or lower) than they were rated by the representatives of Total Nonconcentrating Collector Manufacturers and representatives of All Manufacturers. Some groups, however, tended to give higher scores in general than did other groups. To compensate for this effect, these statistical tests compared the "relative rating" given by one group to the "relative rating" given by the other groups. The procedure for calculating the relative rating is described in Appendix E. The average overall rating Concentrating Collector Manufacturer Representatives gave to all items was 2.57; for Total Nonconcentrating Collector Manufacturer Representatives it was 2.42; and for All Manufacturer Representatives, 2.51.

In comparison to Total Nonconcentrating Collector Manufacturer Representatives, Concentrating Collector Manufacturer Representatives were found to rate the importance of "lists of technical experts" significantly ($P < 0.05$) higher. They also appeared to give a higher priority to "climatological data," "solar energy programs . . . outside the United States," "a calendar of conferences and programs," and "manual methods" while giving a relatively lower priority to "lists of local lenders, insurers (etc.)" and "system diagrams." In comparison to All Manufacturer Representatives, the information needs of Concentrating Collector Manufacturer Representatives did not significantly differ. However, the Concentrating Collector Manufacturer Representatives did appear to value more highly "lists of technical experts" and "calendars."

4.3 ACQUISITION OF INFORMATION BY RESPONDENTS

4.3.1 Use of Selected Information Sources

Representatives of Concentrating Collector Manufacturers were asked which of 20 different potential sources of solar information they had used in the past few years. For this question the respondents were asked if they had obtained any solar information from

each specific source. Thus, the question sought to determine which information sources were the most familiar to the respondents. The results are shown in Fig. 4-3. For the purpose of comparison, the results for All Manufacturer Representatives (Fig. 4-4) are also provided. The results for Total Nonconcentrating Collector Manufacturers are presented in Section 5.0.

The information sources mentioned most often (at least 6 of the 8) by representatives of Concentrating Collector Manufacturers were:

- An installer, builder, designer, or manufacturer;
- A federal library or information center;
- Periodicals, newspapers, or magazines;
- International Solar Energy Society (ISES);
- Solar Energy Industries Association (SEIA);
- Workshops, conferences, or training sessions;
- The Government Printing Office (GPO);
- Directly from the U.S. Department of Energy (DOE);
- State energy or solar offices; and
- An organizational or local library.

Similarly, with the exception of ISES, Total Nonconcentrating Collector Manufacturer Representatives also listed the same information sources most often.

The information sources mentioned least often by representatives of Concentrating Collector Manufacturers were:

- Smithsonian Science Information Exchange (SSIE),
- Radio or TV,
- A commercial data base,
- National Solar Heating and Cooling Information Center (NSHCIC), and
- Regional Solar Energy Centers (RSECs).

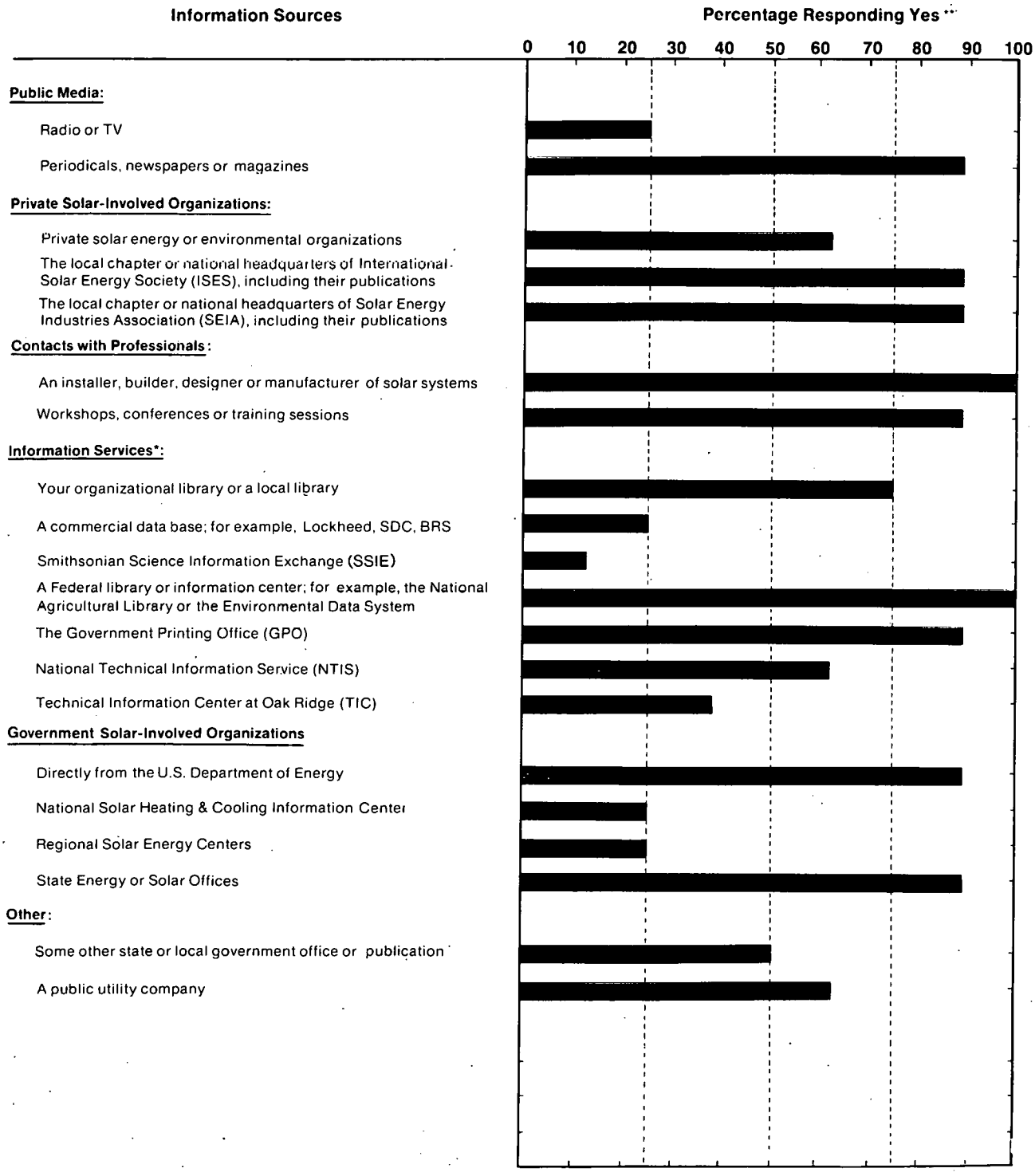
Total Nonconcentrating Collector Manufacturer Representatives also did not make much use of SSIE nor "a commercial data base." In comparison to Total Nonconcentrating Collector Manufacturer Representatives, significantly ($P < 0.05$) more Concentrating Collector Manufacturer Representatives had used "a federal library or information center" and significantly fewer had used NSHCIC.

4.3.2 Membership in Solar-Interested Organizations

Six of the 8 representatives of Concentrating Collector Manufacturers studied were members of a professional, technical, or other organization with an interest in solar energy. These organizations (and the number of times mentioned) included:

- American Institute of Aeronautics and Astronautics (AIAA) (2);
- National Security Industrial Association, Energy panel;

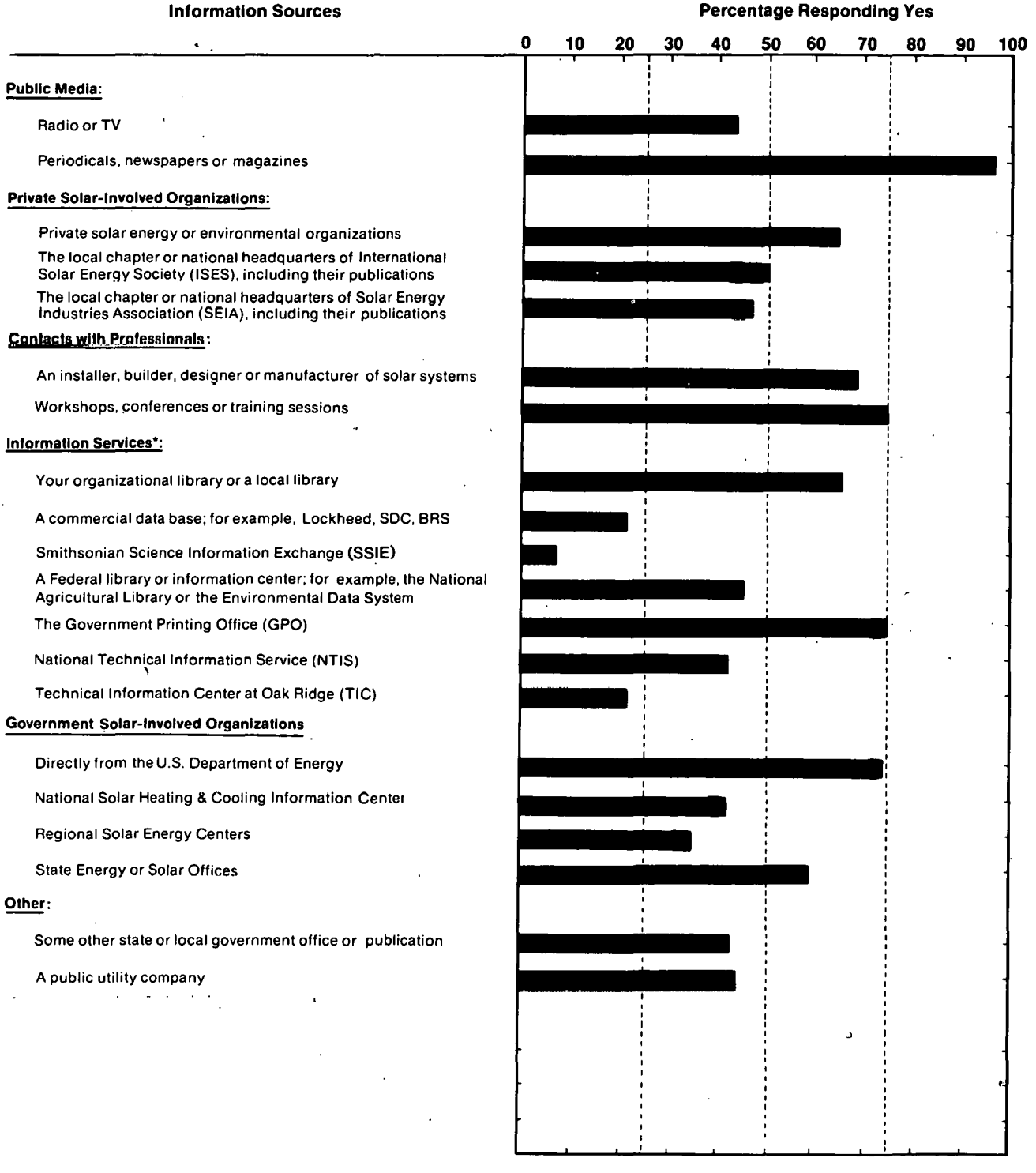
Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** These data are based upon a total of 8 respondents.

Figure 4-3. Use of Selected Information Sources: Concentrating Collectors Manufacturer Representatives

Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** These data are based upon a total of 96 respondents.

Figure 4-4. Use of Selected Information Sources: All Manufacturer Representatives

- Northern California Solar Energy Association; and
- SEIA (5).

Some organizations which the authors could not verify were also mentioned. These were "Energy Engineering Society," "Society of Energy Engineers," and "Solar Energy Research Association."

4.3.3 Exposure to Publications on Solar Energy

During the past 6 months, all 8 of the representatives of Concentrating Collector Manufacturers had read publications which included information on solar energy. The publications they could specify (and the number of times mentioned) included:

- AIAA Journal,
- Energy Daily,
- Energy User News,
- In Review,
- Mother Earth News,
- Optical Spectra,
- Plant Engineering,
- Solar Age (3),
- Solar Energy (2),
- Solar Energy Intelligence Report (3),
- Solar Engineering (7),
- Solar Heating and Cooling, and
- Sun Up.

Some publications which the authors could not verify were also mentioned. These were "Solar Information" and "Southern California Solar Energy publications."

4.3.4 Use of Special Acquisition Methods

The respondents were asked whether they had obtained any information (not just solar energy) in the past year by computer terminal, by Computer Output Microform (COM), or by other microform (e.g., microfiche, microfilm sheets or rolls). Few representatives of Concentrating Collector Manufacturers appeared accustomed to using these special acquisition methods, a trait common to representatives of manufacturers in all technologies studied. In the past year, only 2 of the 8 (25%) Concentrating Collector Manufacturer Representatives had used a computer terminal, 1 (13%) had used COM, and 3 (38%) had used other microform.

4.4 SUMMARY AND COMMENTS

Most representatives of Concentrating Collector Manufacturers (7 of the 8, or 88%) were very involved and very informed in solar energy; most had engineering degrees. Compared to representatives of Total Nonconcentrating Collector Manufacturers, Concentrating Collector Manufacturer Representatives appeared to be slightly better educated and had more years of experience in their current profession.

All 8 Concentrating Collector Manufacturer Representatives expressed an interest in energy storage and 7 of the 8 (88%) were interested in industrial process heat, agricultural process heat, and photovoltaics. Six were interested in SHAC and 5 in solar thermal electric power. (See Section 4.1.1.)

Representatives of Concentrating Collector Manufacturers gave the highest priority to:

- Standards, specifications, or certification programs;
- Tax credits, grants, or other economic incentives;
- Costs and performance of systems;
- Climatological data;
- Research in progress;
- Costs of installing and operating a solar system compared to a conventional system; and
- Marketing statistics and sales projections.

They gave low ratings to "a bibliography," "a nontechnical description," "educational institutions," and "institutional, social . . . aspects."

Concentrating Collector Manufacturer Representatives frequently relied on contacts with professionals ("an installer, builder (etc.)" and "workshops (etc.)") for information on solar energy. They also relied on private solar involved organizations and federal services including "a federal library," ISES, SEIA, GPO, DOE, and state energy or solar offices. The publication Solar Engineering also served as an important information source. Their use of NSHCIC was significantly lower (only 2 of 8) than that of Total Nonconcentrating Collector Manufacturer Representatives (24 of 34).

SECTION 5.0

TOTAL NONCONCENTRATING COLLECTOR MANUFACTURER REPRESENTATIVES

5.1 DESCRIPTION OF RESPONDENTS

5.1.1 Description of Sample

This section describes the combined results of three telephone studies to determine the needs of representatives of manufacturers of nonconcentrating collectors for information on solar energy. A total of 29 representatives of Total Nonconcentrating Collector Manufacturers were interviewed. Data from the three studies are also included in the Active Solar Heating and Cooling (SHAC) Information User Study [9]. Although most of these respondents were asked principally about information on SHAC, and the others were asked about information on solar energy in general, the results are also presented in this document because of the applicability to low temperature industrial and agricultural process heat.

The sample frame for Total Nonconcentrating Collector Manufacturer Representatives was constructed from the Solar Energy Information Data Bank (SEIDB) Manufacturers Database [8]. Manufacturers who produced one or more of the following were chosen: flat plate collectors (liquid or air), liquid type collectors, freon charged collectors, or special liquid collectors. Manufacturers of concentrating collectors were eliminated. Manufacturers without a contact name were eliminated. After all adjustments were made, 29 interview candidates were randomly selected from a sample frame of 177 manufacturers.

Respondents. In making the telephone calls to contact the randomly selected interview candidates, it sometimes occurred that the person could not be reached. In this event another randomly selected name was substituted for the original name. When individuals were contacted, it was verified that the company they worked for was really a Nonconcentrating Collector Manufacturer and that they would be needing information on solar energy within the next year. If they were not both involved and needing information, they were asked if they could refer the interviewer to someone else in their organization who would be an appropriate respondent. If such a referral was made, a call was then made to this new candidate; if no intraorganizational referral was made, a new candidate was randomly selected from the sample frame. The results of this process may be seen in Table 5-1.

Comparisons. For additional insight into the information needs and the information habits of these representatives of Total Nonconcentrating Collector Manufacturers, the results are compared to those of representatives of All Manufacturers. Comparisons of Total Nonconcentrating Collector Manufacturers to Concentrating Collector Manufacturers may be found in the previous section (Section 4.0). The Concentrating Collector Manufacturers group consisted of representatives of manufacturers of concentrating collectors, reflectors, and refractors. In performing any statistical comparisons, the totals for Total Nonconcentrating Collector Manufacturers have been subtracted from the totals for All Manufacturers. The list of groups contained in All Manufacturers can be found in Table F-2 of Appendix F. The data for these groups can be found in Appendix F.

Table 5-1. COMPLETION OF INTERVIEWS: TOTAL NONCONCENTRATING COLLECTOR MANUFACTURER REPRESENTATIVES

Event	Number of Candidates
Interview completed with sample frame candidate	17
Interview completed with referral candidate	12
Refusal or candidate termination	1
Contact attempted: could not reach candidate within three attempts or before interviews were completed	4
Subtotal	34
Contact attempted: invalid candidate (e.g.; not a collector manufacturer, no telephone)	11
TOTAL	45
Sample frame error rate[a] (Percent)	24
Completion rate[b] (Percent)	85

[a]Invalid candidates divided by TOTAL
[b]Completed interviews divided by Subtotal

5.1.2 Current Status of Respondents

Role. Twenty-six of the 29 Total Nonconcentrating Collector Manufacturers manufactured collectors for liquid systems and 10 of the 29 manufactured collectors for air systems. Eight of the 29 also manufactured swimming pool heating systems and 14 of the 29 manufactured other components.

Involvement. Twenty-three of the 29 (79%) Total Nonconcentrating Collector Manufacturer Representatives felt that they were "very involved" in solar energy and 3 of the 29 (10%) felt they were "moderately involved." The level of involvement by Total Nonconcentrating Collector Manufacturers did not significantly differ from that of All Manufacturer Representatives, in which 77 of the 96 (80%) were "very involved" and 10 of the 96 (10%) "moderately involved."

Informedness. Of the Total Nonconcentrating Collector Manufacturer Representatives, 26 of the 29 (90%) representatives felt they were "very informed" and 2 of the 29 (7%) felt "moderately informed." This level of informedness was significantly ($P < 0.05$) higher than All Manufacturer Representatives, in which 75 of the 96 (75%) were "very informed" and 21 of the 96 (22%) "moderately involved."

Need for Information. All respondents indicated they would need information on solar energy either on the job and/or outside the job. On the job, 28 of the 29 (97%) Total Nonconcentrating Collector Manufacturers expected to need information. Sixteen of the 29 (55%) Total Nonconcentrating Collector Manufacturers also expected to need information on solar energy outside the job.

5.1.3 Background of Respondents

Sixteen (55%) of the representatives of Total Nonconcentrating Collector Manufacturers held bachelor's degrees, 4 (14%) held master's degrees, 1 held a doctoral degree, and 1 a law certificate. The educational level of Total Nonconcentrating Collector Manufacturers was similar to that of All Manufacturers. The degree field most common to Total Nonconcentrating Collector Manufacturers was engineering, received by 7 of the 22 (32%) respondents with degrees. The remaining 15 respondents had received degrees in various fields including: architecture (3), business (2), chemistry, management, banking, law, education, marine transportation, marine science, aeronautics, geology, and history. One received his/her most recent degree over 30 years ago, 7 from 20-30 years ago, 4 from 10-20 years ago, and 10 within the past 10 years. The educational level and the year of most recent degree for Total Nonconcentrating Collector Manufacturers were similar to those of representatives of All Manufacturers.

The number of years of professional experience was dispersed among the group, with 1 in his/her current profession for 2 or fewer years, 11 for 3-5 years, 9 for 6-10 years, and 8 for over 10 years. Similarly, the professional experience of All Manufacturers also varied widely. As their current profession, 9 of the 29 representatives of Total Nonconcentrating Collector Manufacturers mentioned they were in management, 10 were engineers, and the other 10 mentioned manufacturer (4), solar energy specialist (2), marketing (2), architect (1), and salesman (1).

5.2 INFORMATION NEEDS OF RESPONDENTS

Representatives of Total Nonconcentrating Collector Manufacturers were asked to name the information about solar energy that was important for them to obtain. Twenty-seven of the 29 (93%) volunteered one or more items of information which they considered important. Seven felt marketing information was important (including sales trends, market analysis, pricing, and how to sell). This seemed to be a typical response for manufacturers; for example, Passive Manufacturers also mentioned marketing information as a high-priority need. Other topics cited as important by Total Nonconcentrating Collector Manufacturers included: new products/new development and design breakthroughs (4), government and financial incentives (3), nontechnical descriptions (3), standards (2), cost information (cost versus efficiency of systems and comparative costs of collectors) (2), insolation data (2), and a single mention each for test results, research on cooling, product availability, "storage capacity of solar ovens," low temperature collectors, solar demonstration projects, industrial and commercial applications data, information on hybrid systems of solar-assisted heat pumps, conference papers from ISES, information on "how to get government out of the business," and performance test data on the longevity of various solar systems on the market.

Eleven representatives of Total Nonconcentrating Collector Manufacturers stated that there was information that they needed but were unable to get. This included climatological data (3), performance/reliability information (including verification of heat pump loadings for homes) (2), marketing information (2), computer and manual methods for computation of passive applications, information on retrofits, transport components, piping, control equipment, government projects on solar energy, data on installations by geographical area, building codes, air collectors, and data on etched glass for reduction of reflection.

Choice Between Specific Needs. A list of 11 types of solar energy information products and 14 types of solar energy information categories was read to each respondent. Each respondent described the usefulness of each particular item by assigning it a value of "essential," "very useful," "somewhat useful," or "not at all useful." The results for Total Nonconcentrating Collector Manufacturer Representatives are shown in Fig. 5-1. For the purpose of comparison, the results for All Manufacturer Representatives are shown in Fig. 5-2.

The type of information on which Total Nonconcentrating Collector Manufacturers placed the highest priority was "tax credits, grants, or other economic incentives." This item received a significantly ($P < 0.05$) higher rating than any of the other items. This information category was also rated number one by All Manufacturers. The six information categories/products rated highest by Total Nonconcentrating Collector Manufacturer Representatives were:

- Tax credits, grants, or other economic incentives;
- Costs and performance of systems;
- Standards, specifications, or certification programs;
- Costs of installing and operating a solar heating and cooling system compared to a conventional system;
- Marketing statistics and sales projections; and
- Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors.

Total Nonconcentrating Collector Manufacturer Representatives assigned the lowest ratings to:

- A bibliography of general readings;
- Educational institutions and other organizations offering courses;
- A nontechnical description of how a particular system works;
- Solar energy programs, research, industries, and markets outside the United States; and
- Lists of technical experts.

Statistical tests indicated all six of the top categories/products were rated significantly ($P < 0.05$) higher than were the ten lowest-rated items.

It should be noted that these lower-rated items were not necessarily of no worth to Total Nonconcentrating Collector Manufacturers. For example, 7 of the 29 (24%) representatives of Total Nonconcentrating Collector Manufacturers thought "lists of technical experts" was "very useful." Thus, these information categories/products could be useful to some Nonconcentrating Collector Manufacturers, but were of a lower relative priority to the entire group.

Statistical tests were also used to determine whether the representatives of Total Nonconcentrating Collector Manufacturers rated any of these information items significantly higher (or lower) than they were rated by the representatives of All Manufacturers. Some groups, however, tended to give higher scores in general than did other groups. To

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Average Usefulness*** (1.0 1.5 2.0 2.5 3.0 3.5 4.0)	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:						
Research Information Categories:						
The state of the art	7		6	11	6	4
Research in progress	10		4	12	8	4
Cost Information Categories:						
Costs of installing and operating a solar system compared to a conventional system	4		5	15	5	3
Costs and performance of systems	2		5	16	5	2
Site-Specific Information Categories:						
Local building codes or other regulations affecting siting or installation of systems	8		7	11	6	5
Climatological data such as wind, weather, or amount of sunshine	11		4	11	9	4
Marketing Information Categories:						
Marketing statistics and sales projections	5		7	8	12	1
Information on how to market and sell systems including guidelines on obtaining financial support	11		6	7	11	4
Other Information Categories:						
Educational institutions and other organizations offering related courses on system design or application	24		0	4	16	9
Standards, specifications, or certification programs for equipment	3		9	8	10	2
Institutional, social, environmental, and legal aspects of system applications	18		2	8	11	7
Expected major developments during the next 10 years	13		3	11	10	5
Solar system programs, research, industries, and markets outside the United States	22		0	7	12	10
Tax credits, grants, or other economic incentives	1		10	16	1	1
Information Products:						
Reference Information Products:						
A bibliography of general readings	25		1	2	15	11
A calendar of conferences and programs	14		1	12	12	3
A list of sources for information	18		3	6	12	7
A list of technical experts	21		0	7	14	8
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	6		6	14	4	5
Descriptive Information Products:						
A non-technical description of how a particular system works	23		1	5	11	11
A technical description of how a particular system works	9		3	13	10	2
System diagrams or schematics	14		1	12	12	3
Design Information Products:						
System design handbooks, installation handbooks, or reference tables	17		1	13	9	6
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	16		2	11	9	6
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	18		2	8	11	7

* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4."

*** Average usefulness was calculated by assigning the responses on a 1–4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 5-1. Usefulness of Selected Information Items: Total Nonconcentrating Collectors Manufacturer Representatives

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Average Usefulness*** (1.0 1.5 2.0 2.5 3.0 3.5 4.0)	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:						
Research Information Categories:						
The state of the art	6		23	34	26	10
Research in progress	5		22	38	26	9
Cost Information Categories:						
Costs of installing and operating a solar system compared to a conventional system	4		19	43	23	8
Costs and performance of systems	3		19	44	26	6
Site-Specific Information Categories:						
Local building codes or other regulations affecting siting or installation of systems	13		21	32	20	19
Climatological data such as wind, weather, or amount of sunshine	8		28	28	20	19
Marketing Information Categories:						
Marketing statistics and sales projections	8		22	30	34	9
Information on how to market and sell systems including guidelines on obtaining financial support	17		22	17	33	23
Other Information Categories:						
Educational institutions and other organizations offering related courses on system design or application	23		8	15	43	30
Standards, specifications, or certification programs for equipment	2		29	28	31	8
Institutional, social, environmental, and legal aspects of system applications	22		9	24	41	21
Expected major developments during the next 10 years	7		19	36	33	8
Solar system programs, research, industries, and markets outside the United States	20		14	25	34	23
Tax credits, grants, or other economic incentives	1		30	41	15	9
Information Products:						
Reference Information Products:						
A bibliography of general readings	24		5	14	52	24
A calendar of conferences and programs	18		10	33	36	16
A list of sources for information	16		10	37	34	14
A list of technical experts	19		11	30	36	19
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	10		19	36	27	18
Descriptive Information Products:						
A non-technical description of how a particular system works	25		3	13	32	20
A technical description of how a particular system works	11		13	45	25	12
System diagrams or schematics	14		5	44	39	7
Design Information Products:						
System design handbooks, installation handbooks, or reference tables	15		9	40	33	14
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	12		19	34	26	16
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	21		8	33	29	25

* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4".

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 5-2. Usefulness of Selected Information Items: All Manufacturer Representatives

compensate for this effect, these statistical tests compared the "relative rating" given by one group to the "relative rating" given by the other groups. The procedure for calculating the relative rating is described in Appendix E. The average overall rating for Total Nonconcentrating Collector Manufacturer Representatives was 2.42, for All Manufacturer Representatives it was 2.51.

Comparisons between Total Nonconcentrating Collector Manufacturer Representatives and All Manufacturers showed that both groups wanted cost-related information, but neither wanted design information products. Representatives of Total Nonconcentrating Collector Manufacturers were significantly ($P < 0.05$) more interested in "tax credits (etc.)," but less interested in "lists of technical experts" and "programs, research . . . outside the United States." All Manufacturers appeared to be oriented more towards monitoring research and technological progress ("expected major developments") of their respective solar technologies. One explanation for these variations may be the differences in levels of commercial readiness of the products manufactured. With the exception of Passive Manufacturers, the majority of products produced by the other solar manufacturers have not progressed to the same commercial level as nonconcentrating collectors.

5.3 ACQUISITION OF INFORMATION BY RESPONDENTS

5.3.1 Use of Selected Information Sources

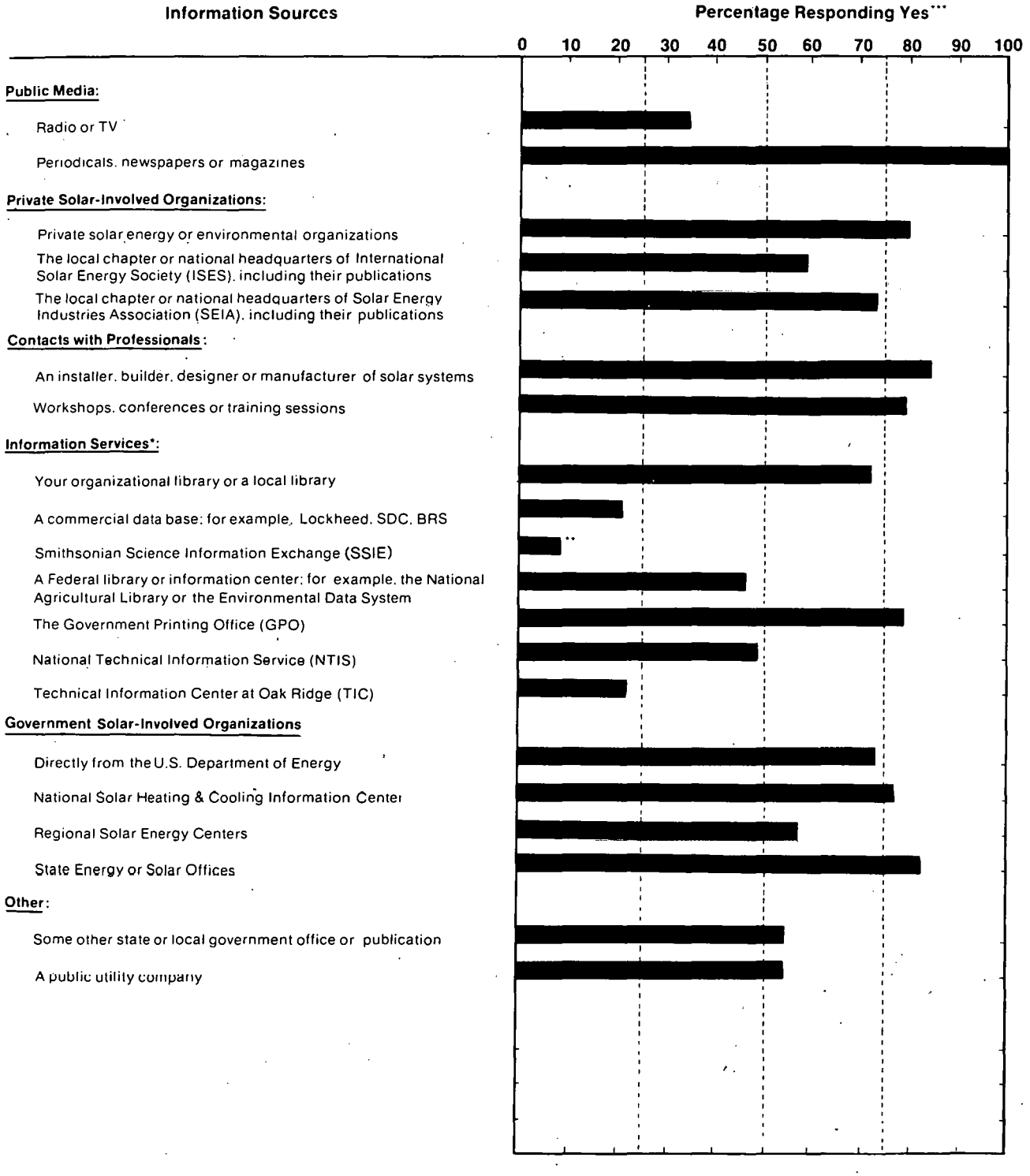
Representatives of Total Nonconcentrating Collector Manufacturers were asked which of 18-20 different potential sources of solar information they had used in the past few years. The question sought to determine which information sources were the most familiar to the respondents. The results are shown in Fig. 5-3. For the purpose of comparison, those for All Manufacturers are shown in Fig. 5-4.

The information sources mentioned most often by representatives of Total Nonconcentrating Collector Manufacturers were:

- Periodicals, newspapers, or magazines;
- An installer, builder, designer, or manufacturer (outside your own organization);
- State energy or solar offices;
- Private solar energy or environmental organizations;
- Workshops, conferences, or training sessions;
- The Government Printing Office (GPO);
- National Solar Heating and Cooling Information Center (NSHCIC);
- Solar Energy Industries Association (SEIA);
- An organizational library or a local library; and
- Directly from the U.S. Department of Energy (DOE).

Each of these sources was mentioned by at least 60% of all respondents.

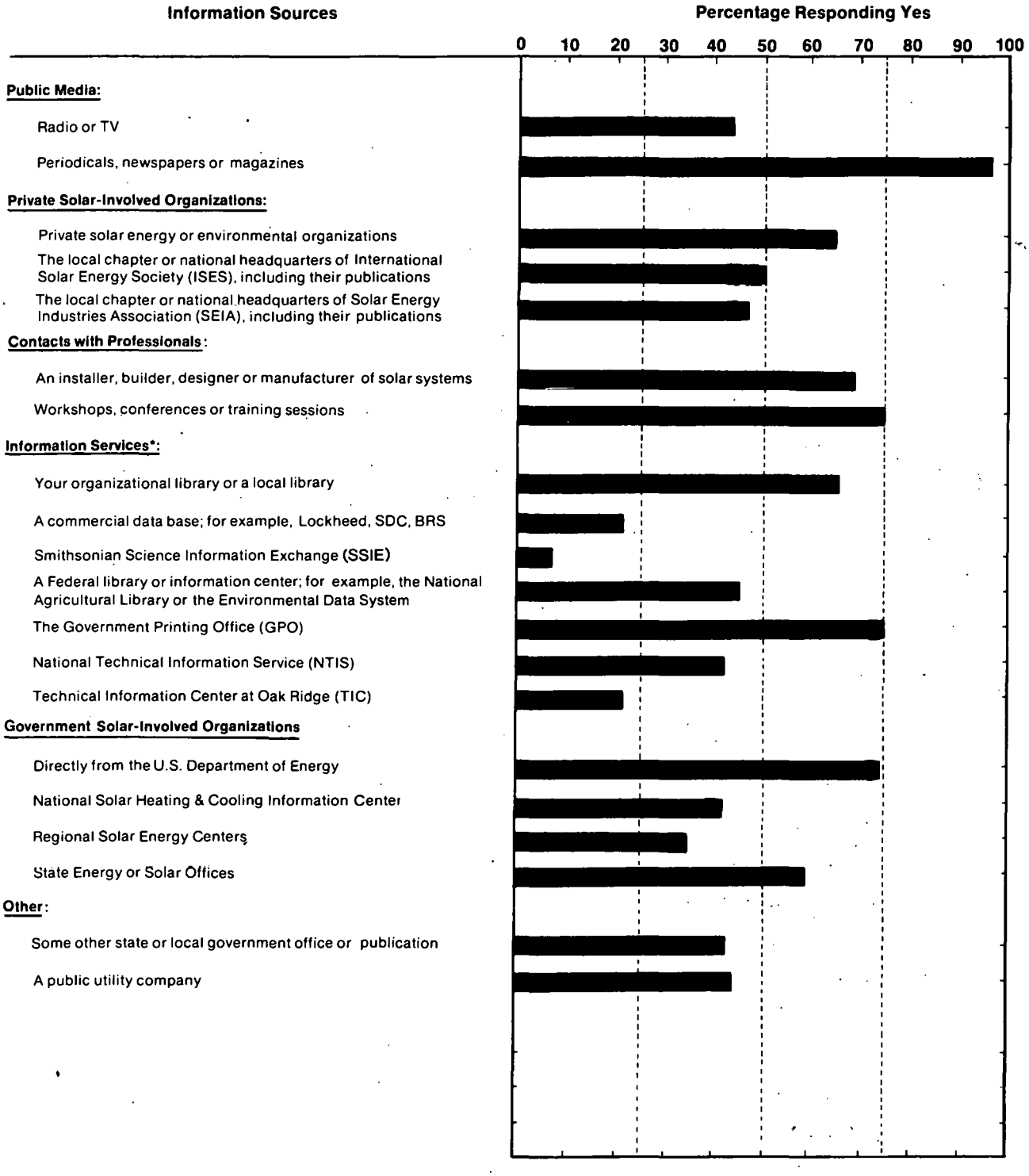
Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** Only asked of Nonconcentrating Collectors Manufacturer Representatives.
*** These data are based upon a total of 29 respondents.

Figure 5-3. Use of Selected Information Sources: Total Nonconcentrating Collectors Manufacturer Representatives

Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** These data are based upon a total of 96 respondents.

Figure 5-4. Use of Selected Information Sources: All Manufacturer Representatives

The information sources mentioned least often by Nonconcentrating Collector Manufacturer Representatives were:

- Smithsonian Science Information Exchange (SSIE),
- A commercial data base,
- Technical Information Center (TIC), and
- Radio or TV.

In comparison to All Manufacturer Representatives, Total Nonconcentrating Collector Manufacturers mentioned Regional Solar Energy Centers (RSECs) and state energy or solar offices significantly ($P < 0.05$) more often.

5.3.2 Membership in Solar-Interested Organizations

Representatives of 20 of the 29 Nonconcentrating Manufacturers studied were members of a professional, technical, or other organization with an interest in solar energy. These organizations (and the number of times mentioned) included:

- Air Conditioning and Refrigeration Institute (ARI);
- American Chemical Society;
- American Physical Society;
- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE);
- American Society for Testing Materials (ASTM);
- Arizona Solar Energy Society;
- Association of Energy Engineers (AEE);
- Florida Solar Energy Center;
- Home Builders Association;
- International Solar Energy Society (ISES) (9);
- Maine Solar Energy Association;
- National Solar Energy Society;
- North Carolina Solar Energy Association (SEA) (2);
- Northern California Solar Society;
- Ohio Solar Association;
- SEIA (19 total);

  Arizona SEIA,

  California SEIA (2),

  Colorado SEIA,

  Florida SEIA,

  Michigan SEIA,

Mid Atlantic SEIA,

Pennsylvania SEIA;

- Solar Energy Research and Education Foundation;
- Southern California SEA (2); and
- World Trade Council.

Some organizations were also mentioned which the authors could not verify. These were "Solar Equipment Manufacturers Association" and "National Swimming Pool Institute."

5.3.3 Exposure to Publications on Solar Energy

During the past 6 months, 28 of the 29 representatives of Total Nonconcentrating Collector Manufacturers had read publications which included information on solar energy. The publications they could specify (and the number of times mentioned) included:

- Air Conditioning and Refrigeration Business;
- American Society of Mechanical Engineers papers;
- Builder (American Housing Industry organ);
- Contractor;
- DOE publications, newsletters, and reports (e.g., on solar water heating) (2);
- Edmund Scientific Co. Catalog;
- Fuel Oil News (2);
- Heating, Piping and Air Conditioning (2);
- Department of Housing and Urban Department (HUD) solar demonstration project in east;
- National Aeronautics and Space Administration (NASA) reports;
- New England Solar Energy Association Newsletter;
- NESEC Update;
- News Roots;
- Passive Solar Energy Book, Mazria;
- Popular Mechanics;
- Popular Science;
- R.S.I. (Roofing, Siding, Insulation);
- San Diego publication on solar cooling;
- Solar Age (14);
- Solar Energy (3);
- Solar energy conference proceedings (in Colorado);
- SEIA News;
- SEIA publications;

- Solar Energy Intelligence Report (4);
- Solar Engineering (19);
- Solar Heating and Cooling (6);
- Sun Times; and
- Sun Up (2).

Also mentioned were "Leonard Eiserer's publication (Silver Springs, Florida)," "Eric Farber's publication," "Heating and Cooling," "International Solar Engineer," "Passive Systems by Bruce Anderson," "Solar Energy Newsletter," "Solar Primer by David Wright," "Sun Digest," "newspapers," "technical journals," "swimming pool trade journals," "Pool and Spa News," "Solar Heating and Air Conditioning," "Solar Engineer and Cooling," and "trade magazines."

5.3.4 Use of Special Acquisition Methods

The respondents were asked whether they had obtained any information (not just solar energy) in the past year by computer terminal, by Computer Output Microform (COM), or by other microform (e.g., microfiche, microfilm sheets or rolls). Few Total Nonconcentrating Collector Manufacturer Representatives appeared accustomed to using these special acquisition methods, a trait common to Manufacturers in all technologies studied. In the past year, only 7 of the 29 (24%) Total Nonconcentrating Collector Manufacturer Representatives had used a computer terminal, 2 of the 29 (7%) had used COM, and only 3 of the 29 (10%) had used other microform.

5.4 SUMMARY AND COMMENTS

Total Nonconcentrating Collector Manufacturers included representatives from 29 manufacturers of Nonconcentrating Collectors. The degree of involvement and the educational level of representatives of Total Nonconcentrating Collector Manufacturers were similar to those of All Manufacturer Representatives. The level of informedness, however, was significantly higher ($P<0.05$) for Total Nonconcentrating Collector Manufacturer Representatives.

Representatives of Total Nonconcentrating Collector Manufacturers gave significantly high ($P<0.05$) priority to receiving information on:

- Tax credits, grants, or other economic incentives for solar systems.

They also gave high ratings to:

- Costs and performance of solar systems;
- Standards, specifications, or certification programs for solar systems;
- Costs of installing and operating a solar system compared to a conventional system;
- Marketing statistics and sales projections for solar equipment; and
- Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors for solar systems.

Total Nonconcentrating Collector Manufacturers gave low ratings to "a bibliography," "educational institutions," "a nontechnical description," "solar energy programs, research . . . outside the United States," and "lists of technical experts."

Representatives of Total Nonconcentrating Collector Manufacturers were similar to All Manufacturer Representatives in their need for information on costs. Beyond this point, however, Total Nonconcentrating Collector Manufacturers differed in that they were significantly ($P < 0.05$) more interested in "tax credits (etc.)" and appeared to be more marketing oriented. In contrast, manufacturers in other technologies appeared to be more oriented towards monitoring research and technological progress. This was most likely a result of the more advanced stage of commercialization of nonconcentrating collectors compared to products produced by manufacturers in other solar technologies.

Representatives of Total Nonconcentrating Collector Manufacturers most often received solar information through "periodicals (etc.)," contacts with professionals including "an installer (etc.)," and "workshops (etc.)," "state energy or solar offices," "private solar energy or environmental organizations," and GPO. Compared to All Manufacturers, Total Nonconcentrating Collector Manufacturers were more frequent users of the "Regional Solar Energy Centers" and "state energy or solar offices." At least 20 of the 29 (69%) representatives of Total Nonconcentrating Collector Manufacturers were members of a local or national solar energy association. Solar Age, Solar Engineering, and Solar Heating and Cooling served as important information disseminators.

SECTION 6.0

INDUSTRIAL PROCESS HEAT ENGINEERS

6.1 DESCRIPTION OF RESPONDENTS

6.1.1 Description of Sample

This section describes the results of three telephone studies to determine the needs of plant engineers, industrial engineers, and agricultural engineers for information on solar industrial process heat (IPH). A total of 9 IPH Plant Engineers, 9 IPH Industrial Engineers, and 9 IPH Agricultural Engineers were interviewed.

The sample frame for IPH Plant Engineers was constructed from two sources. Five percent of the engineers listed in the category of Plant and Facilities Engineering in Who's Who In Engineering [10] were selected. Names were also taken from The Association of Energy Engineers (AEE) Directory of Energy Professionals [11] if their title specified plant engineer and their area of expertise specified "plant." Engineers used were not necessarily solar or IPH related. Duplicate names with Engineer sample frames for other technologies, with related researcher sample frames, and with other IPH sample frames were eliminated. After all adjustments were made, 9 interview candidates were selected from a sample frame of 111 names.

The sample frame for IPH Industrial Engineers was taken from the AEE Directory [11]. Names were picked if their area of expertise included: solar energy, industrial process heat, process heat, heat recovery, energy recovery, waste heat recovery, gasification of organic material, use of industrial or wood waste, industrial furnaces, cogeneration, or refinery operation; or if the industrial engineer worked for a manufacturer or (food) processor. Duplicate names with Engineer sample frames for other technologies, with related researcher sample frames, and with other IPH sample frames were eliminated. After all adjustments were made, 9 interview candidates were selected from a sample frame of 42 names.

The sample frame for IPH Agricultural Engineers was taken from the 1979 Directory of the American Section of the International Solar Energy Society [12]; names from the agricultural division with professional codes of "engineer" were used. Subsampling was used to allow no more than 3 names per state. Duplicate names with Engineer sample frames for other technologies, with related researcher sample frames, and with other IPH sample frames were eliminated. After all adjustments were made, 9 interview candidates were selected from a sample frame of 139 names.

Respondents. In making the telephone calls to contact the randomly selected interview candidates, it sometimes occurred that the person could not be reached. In this event, another randomly selected name was substituted for the original name. When individuals were contacted, it was verified that they really were plant engineers, industrial engineers, or agricultural engineers, and that they would be needing information on solar industrial process heat within the next year. If they were not both involved and needing information, they were asked if they could refer the interviewer to someone else in their organization who would be an appropriate respondent. If such a referral was made, a call was then made to this new candidate; if no intraorganizational referral was made, a new candidate was randomly selected from the sample frame. The results of this process may be seen in Table 6-1.

Table 6-1. COMPLETION OF INTERVIEWS: INDUSTRIAL PROCESS HEAT (IPH) ENGINEERS

Event	Number of Candidates		
	IPH Plant Engineers	IPH Industrial Engineers	IPH Agricultural Engineers
Interview completed with sample frame candidate	6	7	8
Interview completed with referral candidate	3	2	1
Refusal or candidate termination	0	0	1
Contact attempted: could not reach candidate within three attempts or before interviews were completed	3	4	1
Subtotal	12	13	11
Contact attempted: invalid candidate (e.g.; inappropriate field of interest, no telephone)	2	5	3
TOTAL	14	19	14
Sample frame error rate[a] (Percent)	14	32	21
Completion rate[b] (Percent)	75	69	82

[a]Invalid candidates divided by TOTAL
[b]Completed interviews divided by Subtotal

Comparisons. For additional insight into the information needs and the information habits of these IPH Plant Engineers, IPH Industrial Engineers, and IPH Agricultural Engineers, results from these groups are compared to each other and to All Engineers. In addition, IPH Industrial Engineers are compared to Active Solar Heating and Cooling (SHAC) Engineers. In performing any statistical comparisons, totals for each IPH Engineer group have been subtracted from the totals for All Engineers. The data for IPH Plant Engineers, IPH Industrial Engineers, IPH Agricultural Engineers, SHAC Industrial Engineers, and All Engineers can be found in Appendix F.

6.1.2 Current Status of Respondents

Role. All 9 IPH Plant Engineers were working for industries; none were consultants. None were directly involved with an existing application of industrial process heat. One respondent was heating his/her facilities with solar energy and 1 was in the planning stage of constructing a solar energy office building. Feasibility studies on IPH were being conducted by 1 respondent and had been completed by another ("an analysis of four different applications which resulted in deferring the project because the payback period was determined to be in 11 to 15 years"). Of the remaining 5 IPH Plant Engineers interviewed, 3 were keeping up-to-date and gathering data on industrial process heat, while 2 stated no current involvement in the technology.

Two of the 9 IPH Industrial Engineers were consulting engineers, the remaining 7 worked for industries. Similar to IPH Plant Engineers, none of the 9 IPH Industrial Engineers were found to be directly involved with an existing application of industrial process heat. Four of the respondents were evaluating the process and economics of IPH, 1 was an advisor on the use of solar panels on roofs and factory buildings, 1 was using a form of passive solar heating, and 4 stated no current involvement in the technology.

Three of the 9 IPH Agricultural Engineers were working for universities, 2 for national laboratories, 2 for manufacturers, 1 for an engineering firm, and 1 for a U.S. Department of Agriculture (USDA) research center. IPH related activities mentioned by the IPH Agricultural Engineers group included installing a system (1) and involvement in system design through an engineering service (1). Five respondents were involved with IPH research activities including: research on drying crops (3); research on evaluating methods for fabricating copper panels (1); research on collection and storage in applications such as heating greenhouses, rural houses and for distilling alcohol (1); and research in agricultural applications (1). Of the remaining 2 IPH Agricultural Engineers interviewed, 1 was not currently involved, but needed information for future use; the other one was only involved in other solar technologies, including installing a limited number of solar collectors and considering photovoltaics energy.

Involvement. Of the three IPH engineer groups studied (plant, industrial, and agricultural), the IPH Agricultural Engineers appeared to be most involved in industrial process heat. Compared to SHAC Industrial Engineers and All Engineers, the IPH Industrial Engineers were significantly ($P < 0.05$) less involved. IPH Plant Engineers were also significantly ($P < 0.05$) less involved than All Engineers. Table 6-2 compares the levels of involvement by the three IPH engineer groups, SHAC Industrial Engineers, and All Engineers.

Table 6-2. LEVELS OF INVOLVEMENT: INDUSTRIAL PROCESS HEAT (IPH), ACTIVE SOLAR HEATING AND COOLING (SHAC) INDUSTRIAL, AND ALL ENGINEERS

Engineer Group	Very Involved		Moderately Involved		Slightly Involved		Not at All Involved	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
IPH Plant Engineers	0	0	1	11	5	56	3	33
IPH Industrial Engineers	0	0	1	11	7	78	1	11
IPH Agricultural Engineers	3	33	1	11	4	44	1	11
SHAC Industrial Engineers	3	33	3	33	2	22	1	11
All Engineers	25	26	21	22	43	45	7	7

Informedness. The IPH Agricultural Engineers were significantly ($P < 0.05$) more informed than the IPH Plant Engineers and slightly more informed than the IPH Industrial Engineers. SHAC Industrial Engineers also appeared to be slightly more informed than the IPH Industrial Engineers. Overall, IPH Engineers stated that they were more informed than they were involved. Table 6-3 compares the levels of informedness of the three IPH engineer groups, SHAC Industrial Engineers, and All Engineers.

Table 6-3. LEVELS OF INFORMEDNESS: INDUSTRIAL PROCESS HEAT (IPH), ACTIVE SOLAR HEATING AND COOLING (SHAC) INDUSTRIAL, AND ALL ENGINEERS

Engineer Group	Very Informed		Moderately Informed		Slightly Informed		Not at All Informed	
	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent
IPH Plant Engineers	2	22	2	22	5	56	0	0
IPH Industrial Engineers	1	11	5	56	3	33	0	0
IPH Agricultural Engineers	3	33	6	67	0	0	0	0
SHAC Industrial Engineers	5	56	4	44	0	0	0	0
All Engineers	35	36	44	46	17	18	0	0

6.1.3 Background of Respondents

Of the three IPH engineer groups studied, the IPH Agricultural Engineer respondents appeared to be slightly more educated. All respondents in all three groups held a minimum of a bachelor's degree. Advanced degrees, however, were held by 5 of the 9 (56%) IPH Agricultural Engineers (1 master's and 4 doctoral degrees) compared to 1 of the 9 (11%) IPH Plant Engineers (a master's degree) and 3 of the 9 (33%) IPH Industrial Engineers (2 master's and 1 professional engineering degree). The educational level of Total IPH Engineers did not differ significantly from SHAC Industrial Engineers or from All Engineers.

Engineering degrees were held by 8 of the 9 (89%) IPH Plant Engineers, 5 of the 9 (56%) IPH Industrial Engineers and all 9 of the IPH Agricultural Engineers. The types of engineering degrees held by the 8 IPH Plant Engineers included: electrical (3), mechanical (2), chemical (1), ceramic (1), and not specified (1). The 1 other respondent in the IPH Plant Engineer group held a degree in industrial management. The types of engineering degrees held by the 5 IPH Industrial Engineers included: industrial (2), electrical (2), and chemical (1). The other 4 degrees included industrial technology, industrial management, physics, and pre-med. The types of engineering degrees held by the 9 IPH Agricultural Engineers included: electrical (5), agricultural (2), metallurgical (1), and not specified (1). The years in which the IPH Engineers received their most recent degree are summarized in Table 6-4.

Table 6-4. YEARS SINCE MOST RECENT DEGREE AWARDED: INDUSTRIAL PROCESS HEAT (IPH) ENGINEERS

Engineer Group	Less Than 10 Years Ago	10 - 20 Years Ago	20 - 30 Years Ago	Over 30 Years Ago
IPH Plant Engineers	4	3	1	1
IPH Industrial Engineers	2	5	1	1
IPH Agricultural Engineers	3	4	2	0

As their current profession, the IPH Plant Engineers stated their roles as: plant engineer (4), chief environmental manager/pollution control/energy conservationist (1), energy conservation manager (1), corporate energy manager (1), professional engineer (1), and not specified (1). Current professions mentioned by the 9 IPH Industrial Engineers interviewed included: industrial engineer (4), engineer (1), consulting engineer (1), energy conservation engineer (1), senior project engineer (1), and energy manager (1). Of the 9 respondents in the IPH Agricultural Engineer group, 5 stated their current profession as engineers [electrical (2), agricultural (1), professional engineer (1), and engineering manager (1)] and the other 4 as a researcher/teacher, college professor (2), and a research scientist.

The combinations in levels of professional experience were similar for all three IPH engineer groups. The number of years in which each IPH Engineer group had been in their current profession is summarized in Table 6-5.

Table 6-5. YEARS IN CURRENT PROFESSION: INDUSTRIAL PROCESS HEAT (IPH) ENGINEERS

Engineer Group	0 - 2 Years	3 - 5 Years	6 - 10 Years	Over 10 Years
IPH Plant Engineers	0	1	3	5
IPH Industrial Engineers	0	3	2	4
IPH Agricultural Engineers	1	1	3	4

6.2 INFORMATION NEEDS OF RESPONDENTS

6.2.1 Technical Areas

The three groups of IPH Engineers were asked to choose those areas in which they were "particularly interested in obtaining information" from a list of selected technical areas of solar industrial process heat (see Table 6-6). All three groups expressed the highest interest in "hot water" (8 of the 9 in each group) and significantly ($P < 0.05$) less interest in "high-temperature steam." Differences between the groups were not statistically significant.

Table 6-6. AREAS OF INTEREST: INDUSTRIAL PROCESS HEAT (IPH) ENGINEERS

Technical Areas of Interest	IPH Plant Engineers		IPH Industrial Engineers		IPH Agricultural Engineers	
	No.	Percent	No.	Percent	No.	Percent
Hot Water	8	89	8	89	8	89
Hot Air	5	56	8	89	7	78
Refrigeration	6	67	7	78	7	78
Low-Temperature Steam	5	56	7	78	6	67
Direct Heat	3	33	2	22	3	33
High-Temperature Steam	1	11	2	22	2	22

Two IPH Plant Engineers volunteered that they were also interested in information on heat pumps (1) and the feasibility of converting from oil heating systems to solar hot water systems (1). Three IPH Agricultural Engineers volunteered interest in passive heating (1), agricultural applications for crop drying (1), and the use of dessicants for crop drying (1).

6.2.2 Types of Information

Respondents were asked to name the information about industrial process heat that was important for them to obtain. Two IPH Plant Engineers wanted information on the cost of systems (cost and payback) and 2 on technical breakthroughs in (economical) applications. Other topics mentioned included: the availability of systems, the availability of equipment, documentation on the performance of existing installations, state-of-the-art information, applications data, the amount of heat recoverable by area, methods to determine equipment requirements (the square footage in collectors required), and data on collectors for hot water heating.

IPH Industrial Engineers felt information on the cost of systems was important (3) including cost, cost justification, and the method to calculate return on investment. Other topics mentioned included: new industrial applications of solar energy, new developments in IPH, performance data, design applications, the benefits of different applications, availability of products, marketing information, data on using solar heat for drying textiles, and information on precombustion air heating and heat sources (hot water or steam) sufficient to preheat heat process tanks to 180° F.

Three of the 9 IPH Agricultural Engineers felt economics information was important including mentions of design information and procedures for economical systems (1), economical energy storage systems (2), types of economical collectors (1), and cost study information (1). Two of the 9 IPH Agricultural Engineers mentioned case studies on operating experience of IPH systems and new developments as important, and 2 mentioned applications information. Other topics mentioned included: state-of-the-art information, performance data, engineering specifications for IPH systems, procedures for designing systems, a list of IPH systems currently in use and their locations, general information on water heating, and the availability of photovoltaics cells and equipment. Other technical information also considered important included information on: highly efficient electric motors, corrosion control and control strategies, and collector design to get a particular quality of heat exchange.

Some of the respondents volunteered that there was information they needed but were unable to get. Two IPH Industrial Engineer respondents were in need of data on the legality of building codes (1) and the cost of industrial process heat compared to conventional systems (1). Information needed by IPH Agricultural Engineers included data on the type of equipment necessary to get a good payback (1), government sponsored programs on agricultural process heat (1), and research/developments in the field of industrial process heat (1).

Choice Between Specific Needs. A list of 11 types of solar process heat information products and 13 solar process heat information categories was read to each respondent. Each respondent described the usefulness of each particular item by assigning it a value of "essential," "very useful," "somewhat useful," or "not at all useful." The results are given in Figs. 6-1, 6-2, and 6-3. For the purpose of comparison, the results for SHAC Industrial Engineers (Fig. 6-4) and for All Engineers (Fig. 6-5) are also included.

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Average Usefulness*** (1.0 1.5 2.0 2.5 3.0 3.5 4.0)	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:						
Research Information Categories:						
The state of the art	5		1	3	5	0
Research in progress	14		0	2	6	1
Cost Information Categories:						
Costs of installing and operating a solar system compared to a conventional system	5		1	3	5	0
Costs and performance of systems	4		2	2	5	0
Site-Specific Information Categories:						
Local building codes or other regulations affecting siting or installation of systems	15		1	1	4	3
Climatological data such as wind, weather, or amount of sunshine	2		2	4	2	1
Marketing Information Categories:						
Marketing statistics and sales projections	22		0	0	5	4
Information on how to market and sell systems including guidelines on obtaining financial support	NA		NA	NA	NA	NA
Other Information Categories:						
Educational institutions and other organizations offering related courses on system design or application	15		0	3	3	3
Standards, specifications, or certification programs for equipment	11		1	1	7	0
Institutional, social, environmental, and legal aspects of system applications	15		0	1	7	1
Expected major developments during the next 10 years	5		0	6	2	1
Solar system programs, research, industries, and markets outside the United States	24		0	0	4	5
Tax credits, grants, or other economic incentives	8		1	3	4	1
Information Products:						
Reference Information Products:						
A bibliography of general readings	15		0	3	3	3
A calendar of conferences and programs	19		0	2	4	3
A list of sources for information	12		1	3	2	3
A list of technical experts	21		0	1	5	3
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	22		0	0	5	4
Descriptive Information Products:						
A non-technical description of how a particular system works	12		1	3	2	3
A technical description of how a particular system works	1		3	4	1	1
System diagrams or schematics	8		0	4	5	0
Design Information Products:						
System design handbooks, installation handbooks, or reference tables	2		0	7	2	0
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	8		0	4	5	0
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	19		0	3	2	4

* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4."

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 6-1. Usefulness of Selected Information Items: Industrial Process Heat Plant Engineers

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Average Usefulness*** (1.0 1.5 2.0 2.5 3.0 3.5 4.0)	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:						
Research Information Categories:						
The state of the art	9		1	3	4	1
Research in progress	17		0	2	5	2
Cost Information Categories:						
Costs of installing and operating a solar system compared to a conventional system	1		3	5	0	1
Costs and performance of systems	1		3	5	0	1
Site-Specific Information Categories:						
Local building codes or other regulations affecting siting or installation of systems	17		0	3	3	3
Climatological data such as wind, weather, or amount of sunshine	10		0	5	2	2
Marketing Information Categories:						
Marketing statistics and sales projections	23		0	0	4	5
Information on how to market and sell systems including guidelines on obtaining financial support	NA		NA	NA	NA	NA
Other Information Categories:						
Educational institutions and other organizations offering related courses on system design or application	21		0	1	6	2
Standards, specifications, or certification programs for equipment	14		0	3	4	2
Institutional, social, environmental, and legal aspects of system applications	21		0	2	4	3
Expected major developments during the next 10 years	14		0	3	4	2
Solar system programs, research, industries, and markets outside the United States	23		0	1	2	6
Tax credits, grants, or other economic incentives	5		1	6	1	1
Information Products:						
Reference Information Products:						
A bibliography of general readings	10		0	5	2	2
A calendar of conferences and programs	17		0	2	5	2
A list of sources for information	5		3	3	1	2
A list of technical experts	12		1	1	6	1
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	17		1	2	2	4
Descriptive Information Products:						
A non-technical description of how a particular system works	14		0	4	2	3
A technical description of how a particular system works	3		2	4	3	0
System diagrams or schematics	8		1	4	2	1
Design Information Products:						
System design handbooks, installation handbooks, or reference tables	3		3	3	2	1
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	7		1	6	0	2
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	12		0	4	3	2

* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

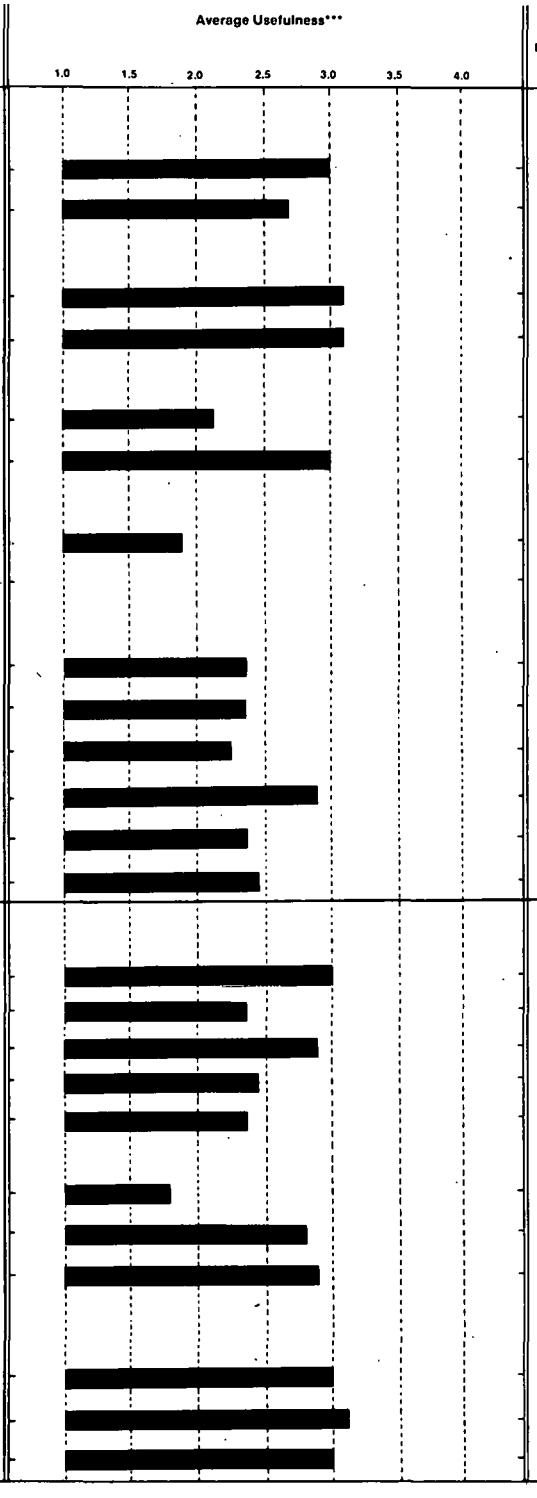
** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4."

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 6-2. Usefulness of Selected Information Items: Industrial Process Heat Industrial Engineers

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:					
Research Information Categories:					
The state of the art	4	4	1	2	1
Research in progress	13	2	3	3	1
Cost Information Categories:					
Costs of installing and operating a solar system compared to a conventional system	1	3	4	2	0
Costs and performance of systems	1	3	4	2	0
Site-Specific Information Categories:					
Local building codes or other regulations affecting siting or installation of systems	22	1	0	7	1
Climatological data such as wind, weather, or amount of sunshine	4	3	4	1	1
Marketing Information Categories:					
Marketing statistics and sales projections	23	0	2	4	3
Information on how to market and sell systems including guidelines on obtaining financial support	NA	NA	NA	NA	NA
Other Information Categories:					
Educational institutions and other organizations offering related courses on system design or application	16	1	3	3	2
Standards, specifications, or certification programs for equipment	16	0	4	4	1
Institutional, social, environmental, and legal aspects of system applications	21	1	3	2	3
Expected major developments during the next 10 years	9	3	2	4	0
Solar system programs, research, industries, and markets outside the United States	16	2	1	4	2
Tax credits, grants, or other economic incentives	14	1	2	6	0
Information Products:					
Reference Information Products:					
A bibliography of general readings	4	3	4	1	1
A calendar of conferences and programs	16	1	2	5	1
A list of sources for information	9	1	6	2	0
A list of technical experts	14	1	2	6	0
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	16	2	2	2	3
Descriptive Information Products:					
A non-technical description of how a particular system works	24	0	1	5	3
A technical description of how a particular system works	12	2	3	4	0
System diagrams or schematics	9	3	3	2	1
Design Information Products:					
System design handbooks, installation handbooks, or reference tables	4	3	3	3	0
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	1	3	4	2	0
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	4	2	5	2	0



* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4."

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful"

Figure 6-3. Usefulness of Selected Information Items: Industrial Process Heat Agricultural Engineers

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Average Usefulness*** (1.0 1.5 2.0 2.5 3.0 3.5 4.0)	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:						
Research Information Categories:						
The state of the art	12		1	3	4	1
Research in progress	11		1	4	3	1
Cost Information Categories:						
Costs of installing and operating a solar system compared to a conventional system	5		0	7	2	0
Costs and performance of systems	5		1	5	3	0
Site-Specific Information Categories:						
Local building codes or other regulations affecting siting or installation of systems	5		4	1	2	2
Climatological data such as wind, weather, or amount of sunshine	4		2	5	1	1
Marketing Information Categories:						
Marketing statistics and sales projections	23		0	0	4	5
Information on how to market and sell systems including guidelines on obtaining financial support	NA		NA	NA	NA	NA
Other Information Categories:						
Educational institutions and other organizations offering related courses on system design or application	19		0	1	6	2
Standards, specifications, or certification programs for equipment	10		1	4	4	0
Institutional, social, environmental, and legal aspects of system applications	22		1	0	4	4
Expected major developments during the next 10 years	12		1	3	4	1
Solar system programs, research, industries, and markets outside the United States	24		0	0	2	7
Tax credits, grants, or other economic incentives	5		1	6	1	1
Information Products:						
Reference Information Products:						
A bibliography of general readings	19		0	0	8	1
A calendar of conferences and programs	17		1	1	4	3
A list of sources for information	16		0	2	6	1
A list of technical experts	17		0	2	5	2
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	15		0	5	1	3
Descriptive Information Products:						
A non-technical description of how a particular system works	19		0	2	4	3
A technical description of how a particular system works	5		1	6	1	1
System diagrams or schematics	1		3	5	0	1
Design Information Products:						
System design handbooks, installation handbooks, or reference tables	3		2	6	0	1
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	1		3	4	2	0
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	12		2	3	1	3

* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

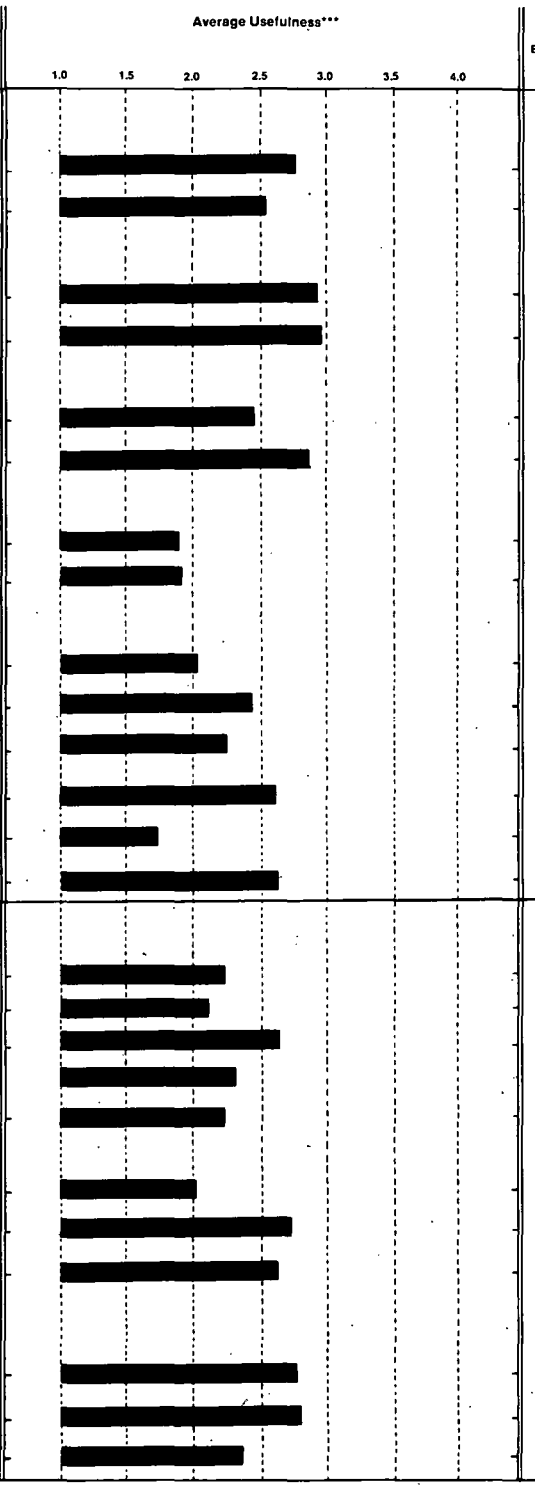
** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4."

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 6-4. Usefulness of Selected Information Items: Active Solar Heating and Cooling Industrial Engineers

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	** Rank	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:					
Research Information Categories:					
The state of the art	6	19	38	34	4
Research in progress	12	11	35	42	8
Cost Information Categories:					
Costs of installing and operating a solar system compared to a conventional system	2	22	47	21	6
Costs and performance of systems	1	24	47	21	4
Site-Specific Information Categories:					
Local building codes or other regulations affecting siting or installation of systems	13	18	24	38	16
Climatological data such as wind, weather, or amount of sunshine	3	29	38	16	13
Marketing Information Categories:					
Marketing statistics and sales projections	24	3	13	34	28
Information on how to market and sell systems including guidelines on obtaining financial support	23	2	7	11	15
Other Information Categories:					
Educational institutions and other organizations offering related courses on system design or application	21	4	19	49	24
Standards, specifications, or certification programs for equipment	14	13	29	42	12
Institutional, social, environmental, and legal aspects of system applications	17	11	26	33	25
Expected major developments during the next 10 years	11	13	39	34	10
Solar system programs, research, industries, and markets outside the United States	25	5	13	30	48
Tax credits, grants, or other economic incentives	8	16	41	28	11
Information Products:					
Reference Information Products:					
A bibliography of general readings	17	6	25	51	14
A calendar of conferences and programs	20	5	23	45	23
A list of sources for information	9	14	41	32	9
A list of technical experts	16	9	27	44	16
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	19	11	26	33	26
Descriptive Information Products:					
A non-technical description of how a particular system works	22	3	16	22	21
A technical description of how a particular system works	6	20	44	21	11
System diagrams or schematics	10	20	30	32	13
Design Information Products:					
System design handbooks, installation handbooks, or reference tables	5	17	45	28	5
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	4	19	45	27	5
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	15	11	35	28	22



* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4".

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 6-5. Usefulness of Selected Information Items: All Engineers

The information categories/products which were rated the highest by IPH Plant Engineers were:

- A technical description of how a particular systems works;
- Climatological data;
- Design handbooks, installation handbooks, or reference tables;
- Costs and performance of systems;
- The state of the art;
- Costs of installing and operating a solar IPH system compared to a conventional system; and
- Expected major developments during the next 10 years.

The information categories/products which were rated the highest by IPH Industrial Engineers were:

- Costs of installing and operating a solar IPH system compared to a conventional system;
- Costs and performance of systems;
- A technical description of how a particular system works;
- Design handbooks, installation handbooks, or reference tables;
- Tax credits, grants, or other economic incentives; and
- Lists of sources for information.

The information categories/products which were rated the highest by IPH Agricultural Engineers were:

- Costs of installing and operating a solar IPH system compared to a conventional system;
- Cost and performance of systems;
- Manual methods for sizing and predicting performance or costs;
- The state of the art;
- Climatological data;
- A bibliography of general readings;
- Design handbooks, installation handbooks, or reference tables; and
- Computer models for sizing and predicting performance or costs.

IPH Plant Engineers assigned the lowest ratings to:

- Solar energy programs, research, industries, and markets outside the United States;
- Marketing statistics and sales projections;
- Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors;

- Lists of technical experts;
- Calendars of conferences and programs; and
- Computer models for sizing and predicting performance or costs.

IPH Industrial Engineers assigned the lowest ratings to:

- Marketing statistics and sales projections;
- Solar energy programs, research, industries, and markets outside the United States;
- Educational institutions and other organizations offering courses;
- Institutional, social, environmental, and legal aspects;
- Research in progress;
- Local building codes or other regulations;
- Calendars of conferences and programs; and
- Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors.

IPH Agricultural Engineers assigned the lowest ratings to:

- A nontechnical description of how a particular system works;
- Marketing statistics and sales projections;
- Local building codes or other regulations; and
- Institutional, social, environmental, and legal aspects.

For each of these IPH Engineer groups statistical tests indicated that the ratings for these highest-rated information items were significantly ($P < 0.05$) greater than the ratings for these lowest-rated items.

It should be noted that these lower-rated items were not necessarily of no worth to the IPH Plant, Industrial, or Agricultural Engineers. For example, 4 of the 9 (44%) IPH Agricultural Engineers thought "institutional, social, environmental . . . aspects" were either "essential" or "very useful." Thus, these information categories/products could be useful to some IPH Engineers, but were of a lower relative priority to the entire group.

Statistical tests were also used to determine whether any of the three IPH Engineer groups rated any of these information items significantly higher (or lower) than they were rated by either of the other IPH Engineer groups or by All Engineers (IPH Industrial Engineers were also compared to SHAC Industrial Engineers). Some groups, however, tended to give higher scores in general than did other groups. To compensate for this effect, these statistical tests compared the "relative rating" given by one group to the "relative rating" given by the other groups. The procedure for calculating the relative rating is described in Appendix E. The average overall rating for IPH Plant Engineers was 2.22; for IPH Agricultural Engineers it was 2.62; for IPH Industrial Engineers it was 2.31; for SHAC Industrial Engineers it was 2.38; and for All Engineers, 2.45.

A comparison of the ratings given by the three IPH Engineer groups showed no statistically significant differences between IPH Plant Engineers and IPH Industrial Engineers.

There were indications, however, that the IPH Industrial Engineers were more interested in "sources of information" and "technical experts," but less interested in "expected major developments" and "climatological data."

Compared to SHAC Industrial Engineers, the ratings assigned by IPH Industrial Engineers did not differ significantly.

Compared to IPH Agricultural Engineers, IPH Plant Engineers rated "a nontechnical description" significantly ($P < 0.05$) higher and "computer models" significantly ($P < 0.05$) lower. There also were indications that the IPH Plant Engineers gave higher ratings to descriptive information, but lower ratings to reference information and design information.

Compared to IPH Agricultural Engineers, IPH Industrial Engineers assigned significantly ($P < 0.05$) higher ratings to "tax credits." Additionally, IPH Plant Engineers were more interested in descriptive information, while Agricultural Engineers were more interested in "climatological data," "a bibliography," and "computer models for sizing."

6.3 ACQUISITION OF INFORMATION BY RESPONDENTS

6.3.1 Use of Selected Information Sources

IPH Engineers were asked which of 20 different potential sources of solar information they had used in the past few years. For this question the respondents were not asked if they had obtained information on industrial process heat, but instead were asked if they had obtained any solar information from each specific source. Thus, the question sought to determine which information sources were the most familiar to the respondents. The results are shown in Figs. 6-6, 6-7, and 6-8. For the purpose of comparison, the results for SHAC Industrial Engineers (Fig. 6-9) and for All Engineers (Fig. 6-10) are also included.

The information sources mentioned most often by IPH Plant Engineers were:

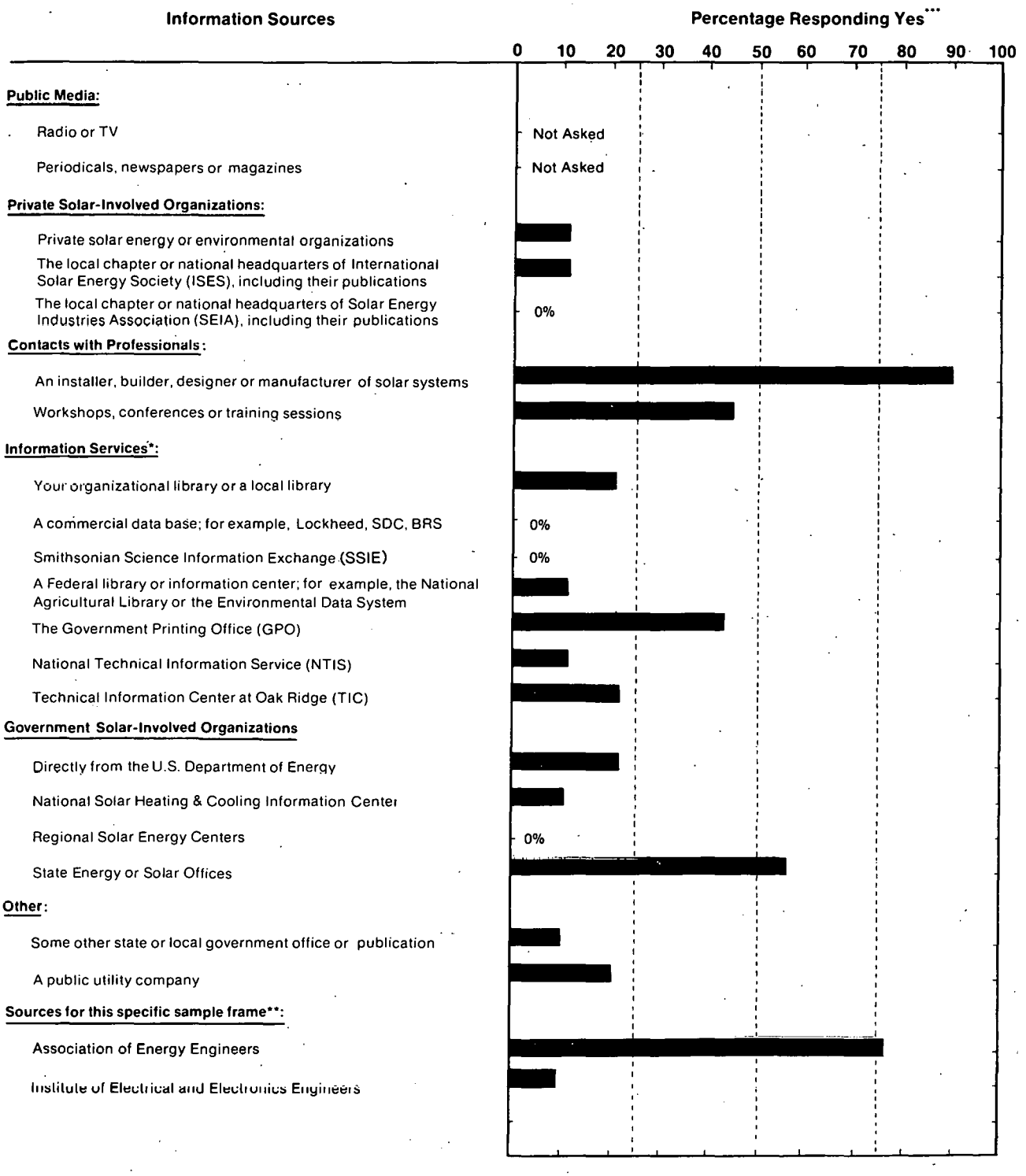
- An installer, builder, designer, or manufacturer; and
- AEE.

Few IPH Plant Engineers mentioned using any of the 20 information sources. Only 3 of the 20 sources were mentioned by more than half of the engineers in this group. Of the 86 groups included in the study, only one had less familiarity with these information resources than the IPH Plant Engineers. The information sources which received zero mentions included:

- Solar Energy Industries Association (SEIA),
- A commercial data base,
- Smithsonian Science Information Exchange (SSIE), and
- Regional Solar Energy Centers (RSECs).

The information sources mentioned most often by IPH Industrial Engineers were:

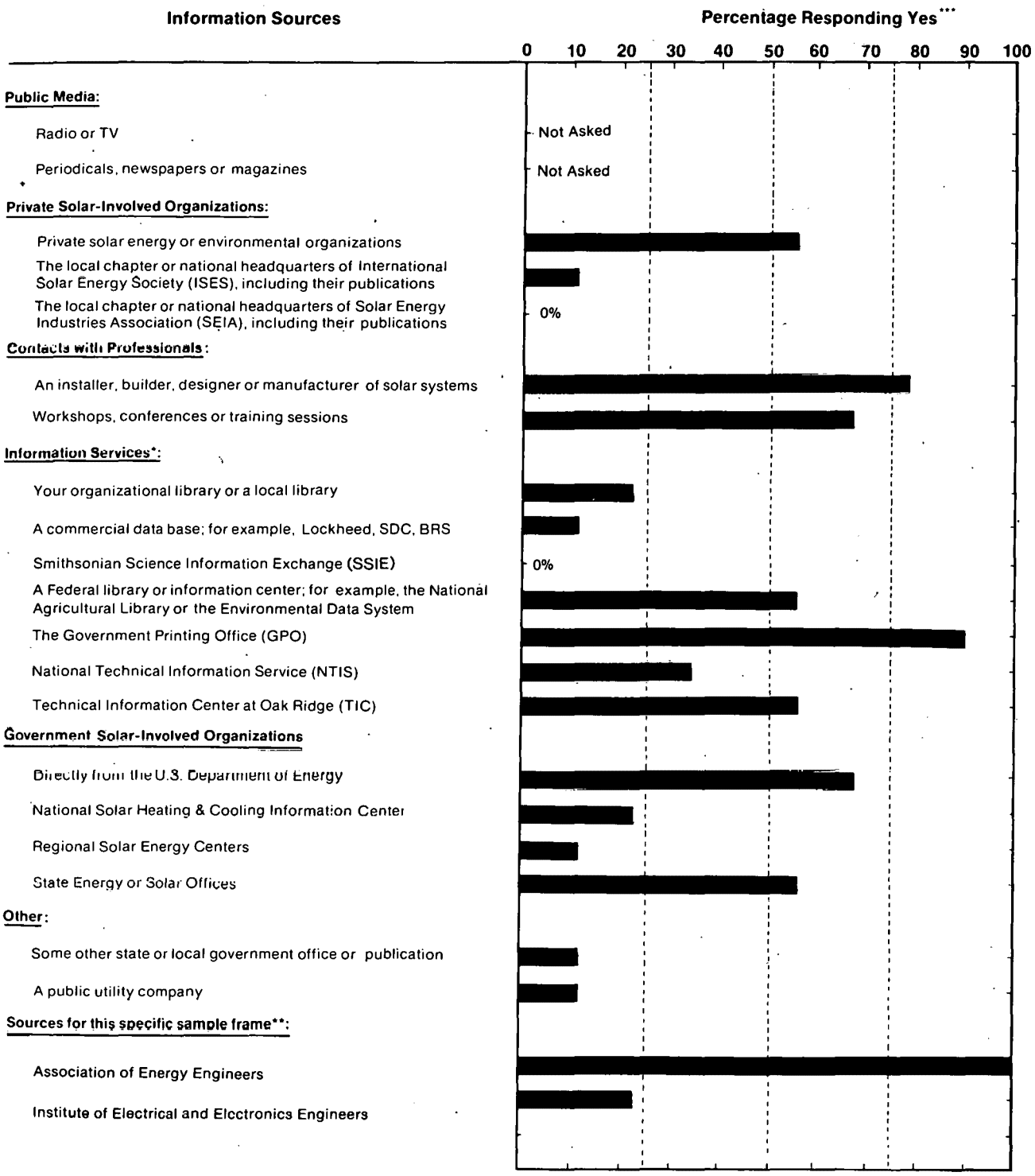
Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** Some sample frames were questioned about additional information sources which are applicable to their technology. For example, the manufacturers of biomass conversion equipment were also asked if they have obtained any type of solar information from: "the local or national office of the U.S. Department of Agriculture, including Extension and Forestry."
*** These data are based upon a total of 9 respondents.

Figure 6-6. Use of Selected Information Sources: Industrial Process Heat Plant Engineers

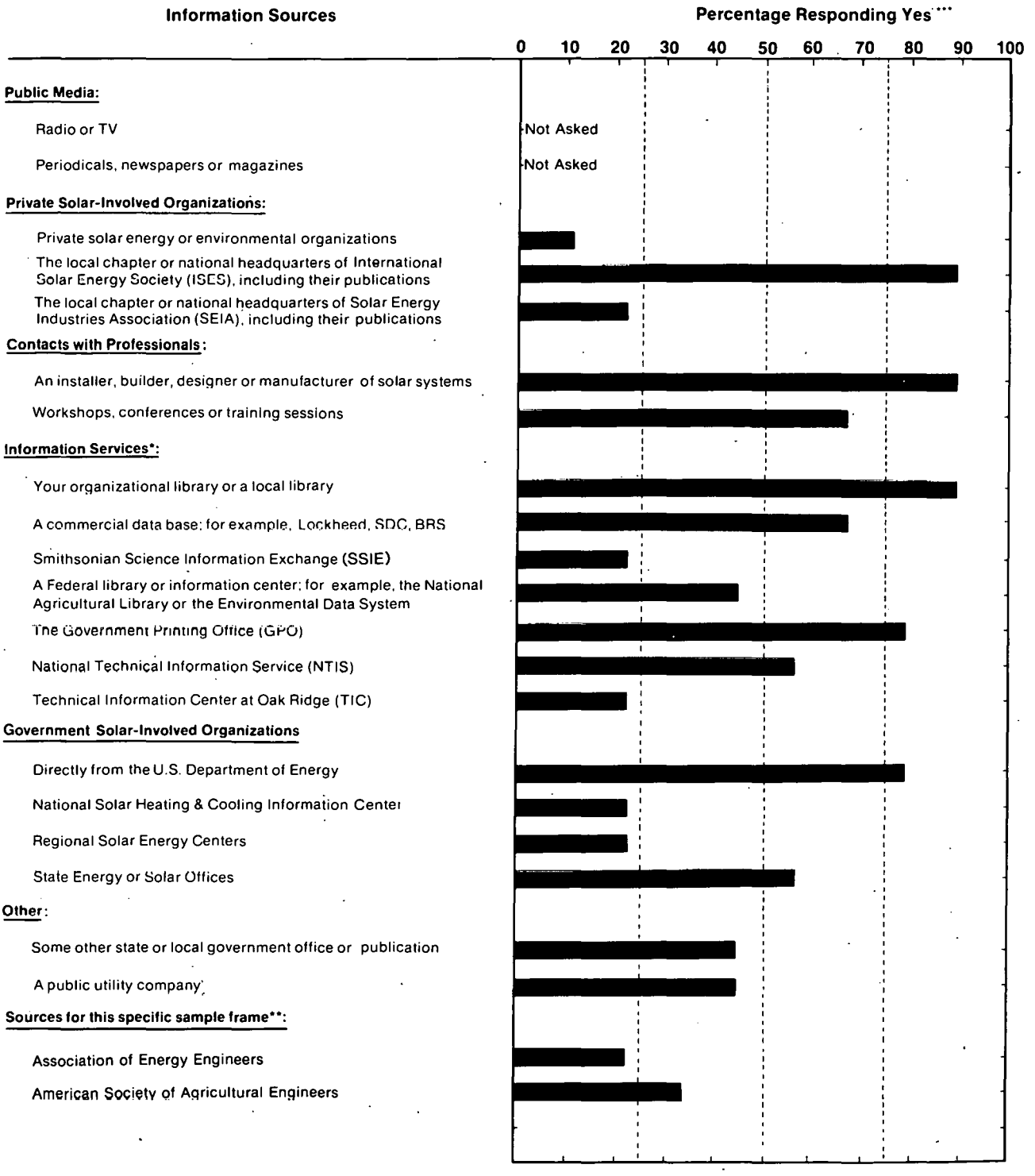
Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** Some sample frames were questioned about additional information sources which are applicable to their technology. For example, the manufacturers of biomass conversion equipment were also asked if they have obtained any type of solar information from: "the local or national office of the U.S. Department of Agriculture, including Extension and Forestry."
*** These data are based upon a total of 9 respondents.

Figure 6-7. Use of Selected Information Sources: Industrial Process Heat Industrial Engineers

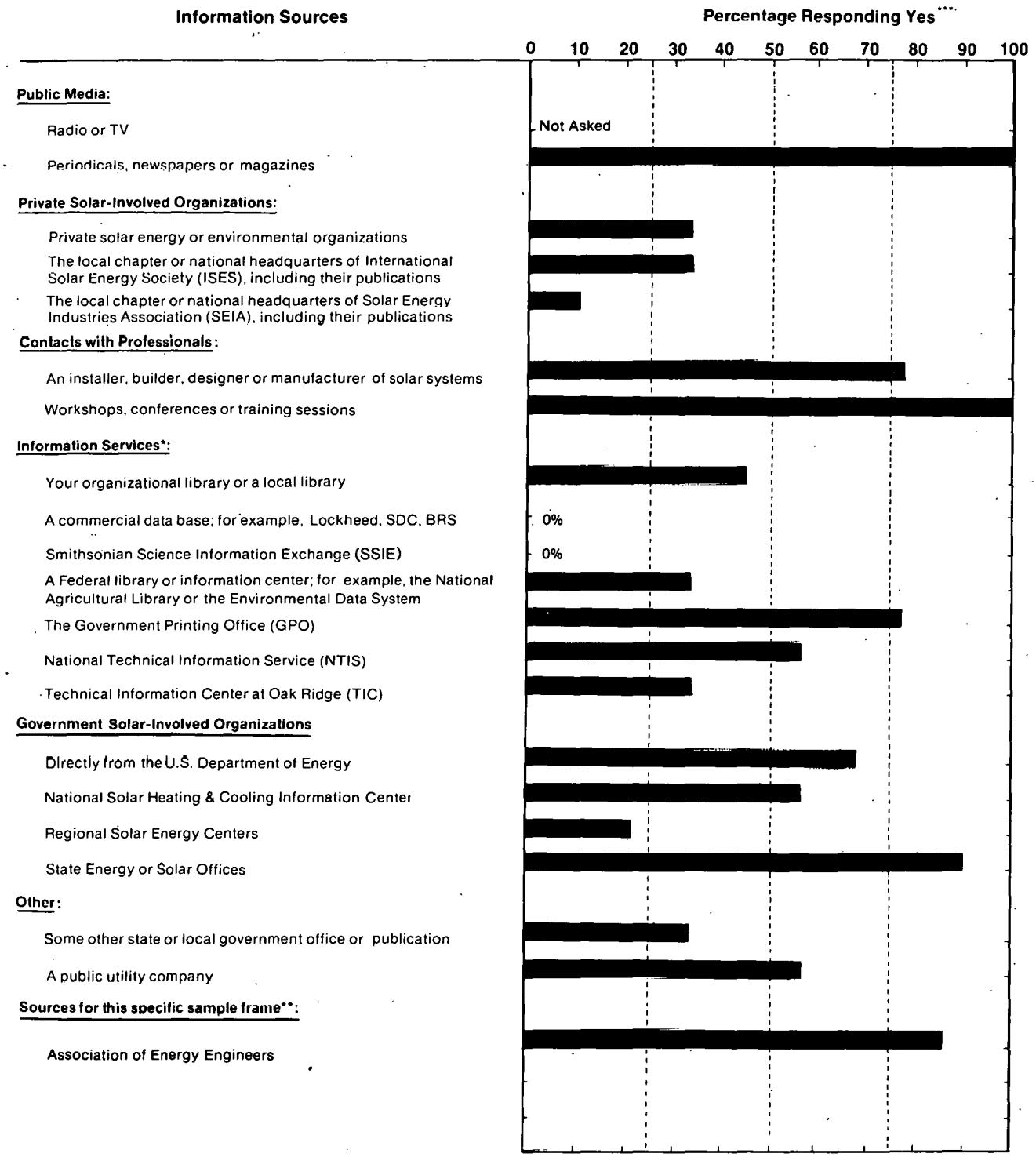
Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** Some sample frames were questioned about additional information sources which are applicable to their technology. For example, the manufacturers of biomass conversion equipment were also asked if they have obtained any type of solar information from: "the local or national office of the U.S. Department of Agriculture, including Extension and Forestry."
*** These data are based upon a total of 9 respondents.

Figure 6-8. Use of Selected Information Sources: Industrial Process Heat Agricultural Engineers

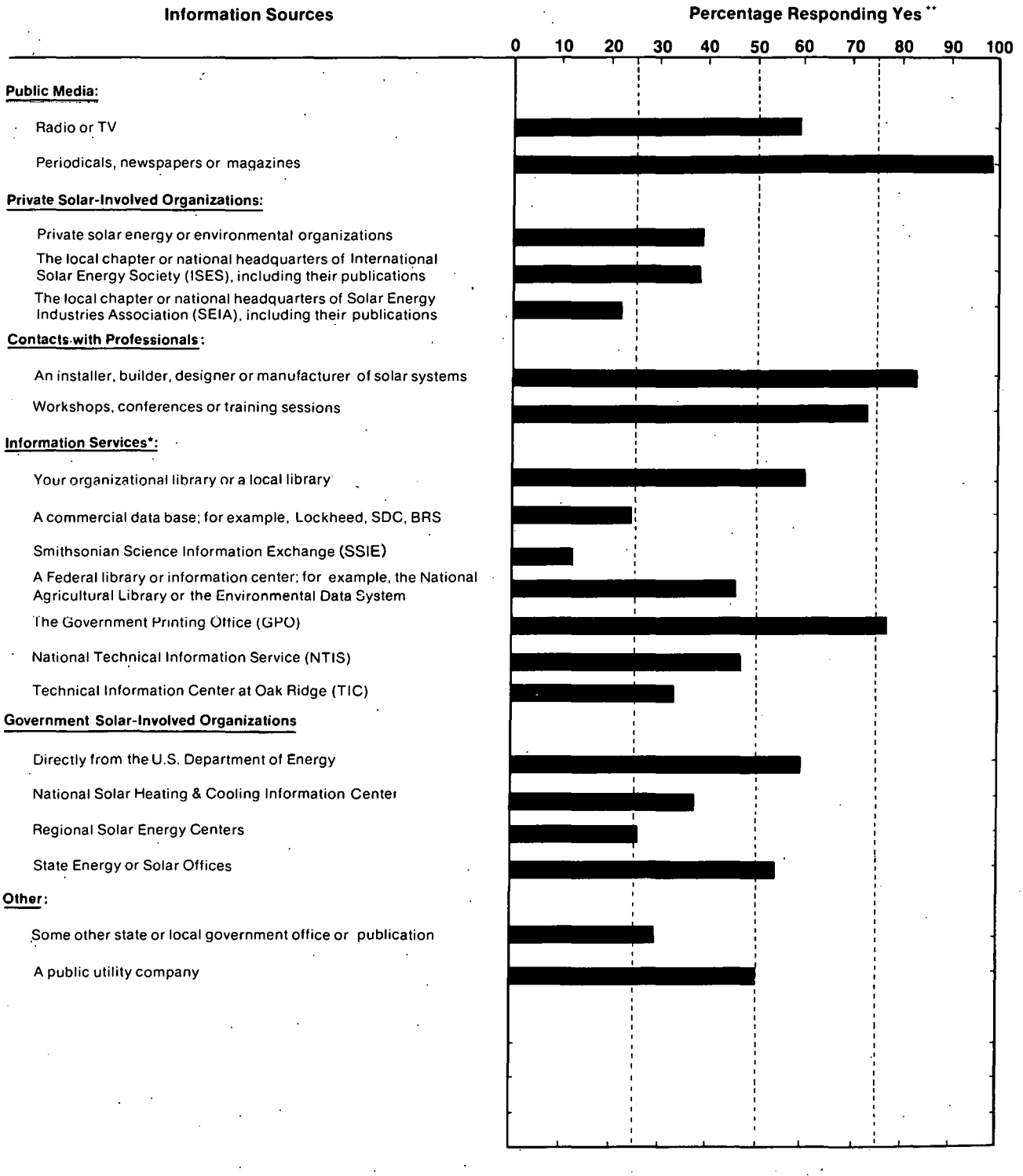
Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** Some sample frames were questioned about additional information sources which are applicable to their technology. For example, the manufacturers of biomass conversion equipment were also asked if they have obtained any type of solar information from: "the local or national office of the U.S. Department of Agriculture, including Extension and Forestry."
*** These data are based upon a total of 9 respondents.

Figure 6-9. Use of Selected Information Sources: Active Solar Heating and Cooling Industrial Engineers

Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** These data are based upon a total of 96 respondents.

Figure 6-10. Use of Selected Information Sources: All Engineers

- AEE;
- The Government Printing Office (GPO);
- An installer, builder, designer, or manufacturer;
- Workshops, conferences, or training sessions; and
- Directly from the U.S. Department of Energy (DOE).

The information sources mentioned least often by IPH Industrial Engineers were:

- SEIA,
- SSIE,
- International Solar Energy Society (ISES),
- A commercial data base,
- RSECs,
- Some other state or local government office or publication, and
- A public utility company.

The information sources mentioned most often by IPH Agricultural Engineers were:

- ISES;
- An installer, builder, designer, or manufacturer;
- An organizational library or a local library;
- GPO;
- DOE;
- Workshops, conferences, or training sessions; and
- A commercial data base.

The information sources mentioned least often by IPH Agricultural Engineers were:

- Private solar energy or environmental organizations,
- SEIA,
- SSIE,
- Technical Information Center (TIC),
- National Solar Heating and Cooling Information Center (NSHCIC),
- RSECs, and
- AEE.

The one information source mentioned most often which was common to all three groups of IPH Engineers was "an installer, builder (etc.)." Both IPH Plant and IPH Industrial Engineers mentioned AEE significantly ($P < 0.05$) more often than the IPH Agricultural Engineers, but mentioned ISES, "an organizational library or a local library," and "a commercial data base" significantly ($P < 0.05$) less often. The differences in preferences for AEE and ISES probably are a direct reflection of the method of defining the sample

(see Section 5.1.1). Although there were no statistically significant differences between IPH Plant Engineers and IPH Industrial Engineers, there were several sources with which the IPH Industrial Engineers appeared to be more familiar. Overall, IPH Plant and IPH Industrial Engineers appeared to mention fewer sources than the IPH Agricultural Engineers.

In contrast to All Engineers, significantly ($P < 0.05$) fewer IPH Plant Engineers use federal sources including "a federal library or information center," GPO, National Technical Information Service, and DOE. Other comparisons to All Engineers showed IPH Industrial Engineers mentioning ISES significantly ($P < 0.05$) more often and "a public utility company" significantly ($P < 0.05$) less often.

The sources used by IPH Industrial Engineers did not differ significantly from those used by SHAC Industrial Engineers.

6.3.2 Membership in Solar-Interested Oganizations

Seven of the 9 IPH Plant Engineers were members of a professional, technical, or some other organization which has an interest in solar energy. These organizations (and the number of times mentioned) included:

- American Institute of Plant Engineers (AIPE) (4),
- American Socicty of Mechanical Engineers (2), and
- AEE (5).

Seven of the 9 IPH Industrial Engineers were members of an organization with an interest in solar energy. These organizations (and the number of times mentioned) included:

- Air Pollution Control Association,
- American Institute of Chemical Engineers,
- American Institute of Industrial Engineers,
- AIPE,
- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE),
- AEE (6),
- National Society of Professional Engineers (NSPE) (2),
- Virginia Society of Professional Engineers, and
- Water Pollution Control Federation.

All 9 IPH Agricultural Engineers were members of an organization with an interest in solar energy. These organizations (and the number of times mentioned) included:

- AIPE,
- American Society of Agricultural Engineers (2),
- ASHRAE (2),

- American Society for Metals,
- American Welding Society,
- Arizona Solar Energy Association,
- Arkansas Professional Engineers,
- AEE,
- Institute of Electrical and Electronics Engineers,
- ISES (6),
- NSPE (2),
- New Mexico Solar Energy Association,
- Oklahoma Professional Engineers, and
- SEIA.

Also mentioned by one IPH Agricultural Engineer was "ISEE," an organization which could not be verified by the authors.

The two organizations mentioned by one or more respondents in all three groups of IPH Engineers were AEE and the American Institute of Plant Engineers. This strong representation for AEE, however, most probably reflected the method of sample frame development (see Section 5.1.1). Similarly, the high percentage of IPH Agricultural Engineers in ISES also could be explained by sample frame development.

6.3.3 Exposure to Publications on Solar Energy

During the past 6 months, 8 of the 9 (89%) IPH Plant Engineers, all 9 IPH Industrial Engineers, and all IPH Agricultural Engineers had read publications which included information on solar industrial process heat. The publications they could specify (and the number of times mentioned) are displayed in Table 6-7.

Also mentioned by IPH Plant Engineers was "AEE Bulletin (about a midwestern plant using total solar power for electricity)," "Facilities Planner," "Heating, Ventilation, and Air Conditioning," and "Presidential report on Plant Energy Management, IPC publisher." These publications could not be verified by the authors.

Also mentioned by IPH Industrial Engineers were additional publications which could not be verified by the authors. These included "Advertisers Data Sheet," "American Society of Energy Conservation" publications, "Flat Plate Collector Technology Materials," "Modern Industrial Energy," "Journal of the Association of Solar Energy Engineers," "Solar Gradient Ponds Material," and "textbooks."

Also mentioned by 1 IPH Agricultural Engineer was "Proceedings of Second Conference of SHAC Demonstration Program Contractors Review, Volume II and III," a publication which could not be verified by the authors.

Table 6-7. PUBLICATIONS READ WHICH INCLUDED INFORMATION ON SOLAR ENERGY: INDUSTRIAL PROCESS HEAT (IPH) ENGINEERS

Publication	IPH Engineer Group			Total
	Plant	Industrial	Agricultural	IPH
Air Conditioning and Refrigeration Business	1	-	-	1
Agricultural Engineering	-	-	1	1
Alternative Sources of Energy	-	1	-	1
American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) publications	-	-	1	1
ASHRAE Journal	-	1	-	1
American Society of Mechanical Engineers journals	1	-	-	1
Association of Energy Engineers publications (including 1 mention for Energy Engineer Magazine)	-	2	-	2
Bornquist literature (Solaron distributor)	-	-	1	1
Building Systems Design	-	1	-	1
Chemical and Engineering News	1	-	-	1
Chemical Engineering	-	2	-	2
Chemical Engineering Progress	-	1	-	1
Encyclopedia of Energy by McGraw Hill	-	-	1	1
Energy Management and Federal Energy Guidelines	1	-	-	1
Energy User News	2	2	1	5
Factory	1	-	-	1
Heating, Piping and Air Conditioning	-	2	1	3
Industry Week	1	-	-	1
Instruments and Control Systems	1	-	-	1
International Solar Energy Society publications (including 1 mention for "proceedings on agricultural uses")	-	-	2	2
Machine Design	1	-	-	1
Manufacturer's bulletins	-	-	1	1
Mechanical Engineering	1	-	-	1
New Mexico Solar Energy publications	-	-	1	1
Plant Energy Management	3	1	1	5
Plant Engineering	7	1	-	8
Power	1	1	1	3
Production Engineering	-	1	-	1
Solar Age	-	1	4	5
Solar Energy	-	-	4	4
Technology for Energy Conservation	-	-	1	1

6.3.4 Use of Special Acquisition Methods

The respondents were asked whether they had obtained any information (not just industrial process heat or solar energy) in the past year by computer terminal, by Computer Output Microform (COM), or by other microform (e.g., microfiche, microfilm sheets or rolls).

During the past year, the IPH Industrial Engineers appeared slightly more accustomed to using these special acquisition methods than the other two IPH Engineer groups studied. In the past year, 5 of the 9 Industrial, 4 of the 9 Agricultural, and 2 of the 9 Plant Engineers had used a computer terminal; only 1 of the 9 Industrial, 1 of the 9 Agricultural, and none of the Plant Engineers had used COM; however, 2 of the 9 Industrial, 4 of the 9 Agricultural, and 1 of the 9 Plant Engineers had used other microform. A comparison of the three groups of IPH Engineers to each other or to SHAC Industrial Engineers showed no statistically significant differences in the proportion using computer terminals, COM, or other microform.

6.4 SUMMARY AND COMMENTS

A total of 9 plant engineers, 9 industrial engineers, and 9 agricultural engineers were interviewed on industrial process heat. IPH Agricultural Engineers was the only group having direct involvement in industrial process heat. Their involvement level was similar to that of SHAC Industrial Engineers.

The technical area of industrial process heat generating the highest interest in all three IPH Engineer groups was "hot water," with the least interest shown in "high-temperature steam." Other areas of interest were "hot air," "refrigeration," and "low-temperature steam."

The IPH Plant Engineers gave the highest priority to receiving information on:

- A technical description of how a particular solar IPH system works;
- Climatological data;
- Solar IPH system design handbooks, installation handbooks, or reference tables;
- Costs and performance of solar IPH systems;
- The state of the art in solar IPH;
- Costs of installing and operating a solar IPH system compared to a conventional system; and
- Expected major developments in solar IPH during the next 10 years.

IPH Industrial Engineers gave the highest priority to receiving information on:

- Costs of installing and operating a solar IPH system compared to a conventional system;
- Costs and performance of solar IPH systems;
- A technical description of how a particular solar IPH system works;
- Solar IPH system design handbooks, installation handbooks, or reference tables;

- Tax credits, grants, or other economic incentives for solar IPH; and
- Lists of sources for information on solar IPH.

Information assigned the highest priority by IPH Agricultural Engineers included:

- Costs and performance of solar IPH systems;
- Costs of installing and operating a solar IPH system compared to a conventional system;
- Manual methods for sizing and predicting performance or cost of solar IPH systems;
- The state of the art in solar IPH;
- Climatological data;
- A bibliography of general readings on solar IPH;
- Solar IPH system design handbooks, installation handbooks, or reference tables; and
- Computer models for sizing and predicting performance or cost of solar IPH systems.

IPH Plant Engineers assigned the lowest ratings to "solar energy programs, research . . . outside the United States," "marketing statistics," "lists of local lenders (etc.)," "lists of technical experts," "calendars of conferences," and "computer models."

IPH Industrial Engineers gave low ratings to "marketing statistics," "solar energy programs . . . outside the United States," "educational institutions," "institutional, social . . . aspects," "research in progress," "local building codes," "calendars of conferences," and "lists of local lenders (etc.)."

IPH Agricultural Engineers gave low ratings to "a nontechnical description," "marketing statistics," "local building codes," and "institutional, social . . . aspects."

The resulting picture showed that cost information was valued highly by all three groups of IPH Engineers. Ratings given by IPH Plant Engineers and IPH Industrial Engineers were similar, with no significant differences found. However, a comparison of these two groups to IPH Agricultural Engineers identified the agricultural group as somewhat less interested in descriptive information (technical and nontechnical) and more interested in methods for sizing and predicting performance (both manual methods and computer models). The lower levels of involvement by both IPH Plant and IPH Industrial Engineers may have been a factor in their greater need for descriptive information than the IPH Agricultural Engineers, whose level of involvement in solar industrial process heat was higher.

IPH Plant Engineers appeared to rely on a limited number of sources, principally "an installer, builder (etc.)," and AEE. IPH Industrial Engineers also rely on these two sources plus GPO. IPH Agricultural Engineers used many more sources, most often mentioning ISES, "an installer, builder (etc.)," "an organization . . . library," GPO, and DOE.

Both IPH Plant Engineers and IPH Industrial Engineers appeared to rely more on publications specifically on engineering, while IPH Agricultural Engineers frequently used solar publications. These preferences may have been biased by the sample selection procedure: both IPH Plant and Industrial Engineers were selected from AEE sources, and IPH Agricultural Engineers were selected from ISES sources (see Section 6.1.1).

SECTION 7.0

SOLAR INDUSTRIAL PROCESS HEAT EDUCATORS

7.1 DESCRIPTION OF RESPONDENTS

7.1.1 Description of Sample

This section describes the results of a telephone study to determine the needs of post-secondary educators for information on industrial process heat. Nine Industrial Process Heat (IPH) Educators were interviewed.

The sample frame for IPH Educators was constructed by searching the Solar Energy Information Data Bank (SEIDB) Education Data Base [13]. Thirty-eight colleges listed courses which included industrial process heat information and identified instructors for each course. Both introductory and advanced level course instructors were included. Instructors who also appeared in Educator sample frames for other technologies were eliminated. Related Researcher and Engineer sample frames were checked for duplication of contact names, and duplicates were eliminated from the larger sample frame. After all adjustments were made, the 9 interview candidates were randomly selected from the sample frame of 33 names.

Respondents. In making the telephone calls to contact the randomly selected interview candidates, it sometimes occurred that the person could not be reached. In this event another randomly selected name was substituted for the original name. When individuals were contacted it was verified that they really had been teaching courses on industrial process heat, and that they would be needing information on industrial process heat within the next year. If they were not both involved and needing information, they were asked if they could refer the interviewer to someone else in their organization who would be an appropriate respondent. If such a referral was made, a call was then made to this new candidate; if no intraorganizational referral was made, a new candidate was randomly selected from the sample frame. The results of this process may be seen in Table 7-1.

Comparisons. For additional insight into the information needs and the information habits of these IPH Educators, results from this group are compared to the results from all of the educators interviewed in this study (All Educators). In addition to industrial process heat, the technologies included in All Educators were wind energy conversion, active solar heating and cooling, passive solar heating and cooling, photovoltaics, biomass, and solar thermal electric power. In performing any statistical comparisons, the totals for IPH Educators have been subtracted from the totals for All Educators. The data for Wind Educators and for All Educators can be found in Appendix F.

7.1.2 Current Status of Respondents

Role. Six of the 9 IPH Educators were on the faculties of four-year colleges or universities, the other 3 taught at two-year colleges. Seven of them taught courses in engineering departments (mechanical, environmental, industrial and management, technology, industrial/mechanical technology, and thermal/environmental). The other 2 educators were in an applied science department and a public affairs department. All 9

Table 7-1. COMPLETION OF INTERVIEWS: INDUSTRIAL PROCESS HEAT EDUCATORS

Event	Number of Candidates
Interview completed with sample frame candidate	8
Interview completed with referral candidate	1
Refusal or candidate termination	1
Contact attempted: could not reach candidate within three attempts or before interviews were completed	11
Subtotal	21
Contact attempted: invalid candidate (e.g.; inappropriate field of interest, no telephone)	8
TOTAL	29
Sample frame error rate[a] (Percent)	28
Completion rate[b] (Percent)	43

[a]Invalid candidates divided by TOTAL
[b]Completed interviews divided by Subtotal

taught courses which covered many energy topics; at least one course included solar IPH. In describing what they were presently doing in IPH, only 3 specifically mentioned teaching (1 teaching conferences, 2 teaching courses). Four mentioned working on solar projects (1 on process heat pumping projects, 1 as a designer for a DOE-funded project and other projects, 1 on a solar heating and cooling system demonstration project, and 1 in use and development of solar hot water heat). Three mentioned looking into proposals and possibilities for use of solar process heat.

Involvement. Two of the 9 (22%) IPH Educators said that they were "very involved" in industrial process heat. Another 3 of the IPH Educators said that they were "moderately involved" in industrial process heat, thus making 5 of the 9 (56%) of these educators either "very involved" or "moderately involved." This was lower than the 78% (49 of the 63) of All Educators who were either "very involved" or "moderately involved." The IPH Educators were the least involved group in comparison with all the Educator groups interviewed in this study.

Informedness. Four of the 9 (44%) IPH Educators considered themselves "very informed," compared to 31 of the 63 (49%) All Educators. Another 3 IPH Educators said that they were "moderately informed," thus making 7 of the 9 (78%) of these educators either "very informed" or "moderately informed." This was lower than for All Educators, where 58 of the 63 (92%) considered themselves at least "moderately informed."

One possible explanation of the lower levels of involvement and informedness than observed in All Educators is that for other technologies the teachers were generally instructors for advanced-level courses only.

7.1.3 Background of Respondents

Five of the 9 (56%) IPH Educators held doctoral degrees, 3 (33%) held master's degrees and 1 (11%) held a bachelor's degree. In comparison, 44 of the 63 (70%) All Educators had doctoral degrees, 12 of the 63 (19%) had master's degrees and 5 of the 63 (8%) had bachelor's degrees. Six of the IPH Educators had degrees in engineering (2 mechanical, 1 solar, 1 industrial, 2 general), 2 had degrees in education (1 industrial), and 1 a degree in political science. Seven of the 9 IPH Educators had received their most recent degree within the past 15 years: 2 of these within the past 5 years, 3 from 5-10 years ago, and 2 from 10-15 years ago. Two IPH Educators received their degree 15-25 years ago.

Most (6 of the 9 or 67%) of the IPH Educators had been in their present profession (not necessarily teaching) for over 10 years. Two were in their present profession for 3-5 years and 1 for less than 2 years. In comparison, 41 of the 63 (65%) All Educators had been in their present profession for over 10 years. All 9 gave their present profession as educator, professor, or instructor. Other professional descriptions were: department chairman (2), manager (1), solar consultant (1), solar design engineer (1), and solar installation engineer (1). Two respondents included reference to solar energy in their descriptions of profession.

7.2 INFORMATION NEEDS OF RESPONDENTS

7.2.1 Technical Areas

IPH Educators were asked to choose those areas in which they were "particularly interested in obtaining information" from a list of selected technical areas of solar industrial process heat. They seemed to be more interested in "hot water" (8 of the 9), "low-temperature steam" (8 of the 9), and "hot air" (8 of the 9) than in "direct heat" (4 of the 9). Information on "high-temperature steam" (6 of the 9) and "refrigeration" (7 of the 9) were also of interest.

One IPH Educator volunteered that he/she was also interested in solar electrical generation.

7.2.2 Types of Information

IPH Educators were asked to name the information about industrial process heat that was important for them to obtain. All 9 volunteered one or more items of information which they considered important. Included in the items they mentioned were: information on current applications (3 - 1 results of demonstrations, 1 case studies, and 1 educational information on installations); performance data (3 - 1 industrial heat system performance information, 1 data on actual operation of a large-scale solar heating system, and 1 "good performance data"); schematics and diagrams of particular systems; methods of analysis; life of collectors; "contact knowledge related to current trends"; new techniques; and potential applications.

Information that IPH Educators volunteered they needed but were unable to get included: climatological data (2) and information on existing IPH systems. One Educator said all information was inconvenient to obtain: it took too long to obtain and the procedures were too drawn out.

Choice Between Specific Needs. A list of 11 types of solar industrial process heat information products and 14 types of solar industrial process heat information categories was read to each respondent. Each respondent described the usefulness of each particular item by assigning it a value of "essential," "very useful," "somewhat useful," or "not at all useful." The results are given in Fig. 7-1. For the purpose of comparison, results for All Educators are in Fig. 7-2.

IPH Educators gave the two items in the cost information category high ratings as a class. Their four top-rated information categories/products were:

- Expected major developments during the next 10 years;
- Costs of installing and operating a solar IPH system compared to a conventional system;
- Costs and performance of systems; and
- A technical description of how a particular system works.

IPH Educators gave the two items in the marketing information category low ratings as a class. The five lowest-rated information categories/products were:

- Educational institutions and other organizations offering courses;
- Marketing statistics and sales projections;
- How to market and sell solar systems;
- Standards, specifications, or certification programs; and
- Solar energy programs, research, industries, and markets outside the U.S.

Statistical tests indicated that significant ($P < 0.05$) differences existed between the ratings for the four highest-rated information items and the five lowest-rated information items for IPH Educators.

It should be noted that these lower-rated items were not necessarily of no worth to the IPH Educators. For example, 2 of the 9 (22%) thought "marketing statistics" was either "essential" or "very useful." Thus, these information categories/products could be useful to some IPH Educators, but were of a lower relative priority to the entire group.

Statistical tests were also used to determine whether the IPH Educators rated any of these information items significantly higher (or lower) than they were rated by All Educators. Some groups, however, tended to give higher scores in general than did other groups. To compensate for this effect, these statistical tests compared the "relative rating" given by one group to the "relative rating" given by the other groups. The procedure for calculating the relative rating is described in Appendix E. The average overall rating IPH Educators gave to all items was 2.49, for All Educators, 2.64.

In comparing the results for IPH Educators to the results for All Educators, there were marked similarities. The two cost information items and "expected major developments" were also among the top-rated items for All Educators, where each of the seven groups of educators were asked about the same items, but for different technologies. All Educators concurred with lowest ratings for three of the five categories/products, i.e., the two marketing information items and "solar system programs . . . outside the U.S." were also rated lowest by All Educators. Statistical tests indicated that, compared to All

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Average Usefulness*** (1.0 1.5 2.0 2.5 3.0 3.5 4.0)	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:						
Research Information Categories:						
The state of the art	8		1	4	4	0
Research in progress	8		1	4	4	0
Cost Information Categories:						
Costs of installing and operating a solar system compared to a conventional system	2		3	4	1	1
Costs and performance of systems	2		2	5	2	0
Site-Specific Information Categories:						
Local building codes or other regulations affecting siting or installation of systems	17		1	3	3	2
Climatological data such as wind, weather, or amount of sunshine	5		3	2	3	1
Marketing Information Categories:						
Marketing statistics and sales projections	24		0	2	3	4
Information on how to market and sell systems including guidelines on obtaining financial support	21		0	1	6	2
Other Information Categories:						
Educational institutions and other organizations offering related courses on system design or application	24		1	0	4	4
Standards, specifications, or certification programs for equipment	21		1	1	3	4
Institutional, social, environmental, and legal aspects of system applications	14		1	3	4	1
Expected major developments during the next 10 years	1		4	4	1	0
Solar system programs, research, industries, and markets outside the United States	21		0	2	4	3
Tax credits, grants, or other economic incentives	8		2	2	5	0
Information Products:						
Reference Information Products:						
A bibliography of general readings	14		1	2	6	0
A calendar of conferences and programs	17		1	3	3	2
A list of sources for information	8		0	6	3	0
A list of technical experts	17		1	2	5	1
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	12		3	0	5	1
Descriptive Information Products:						
A non-technical description of how a particular system works	14		2	2	3	2
A technical description of how a particular system works	2		2	5	2	0
System diagrams or schematics	12		1	4	3	1
Design Information Products:						
System design handbooks, installation handbooks, or reference tables	17		0	3	6	0
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	5		2	4	2	1
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	5		3	2	3	1

* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

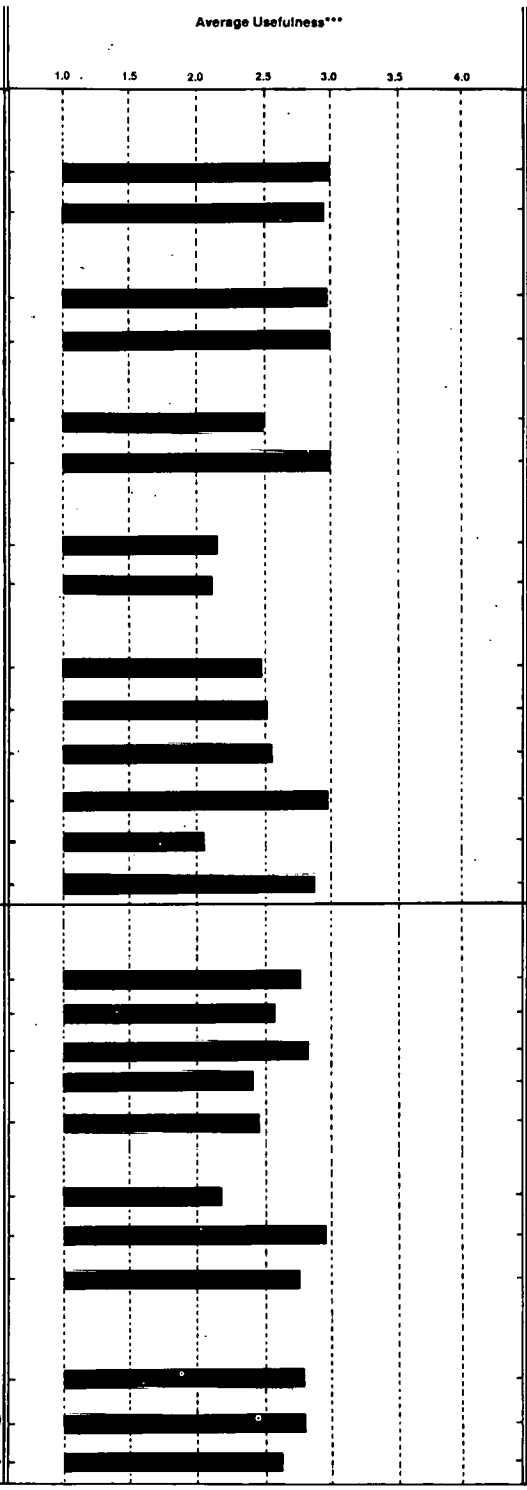
** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4".

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 7-1. Usefulness of Selected Information Items: Industrial Process Heat Educators

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:					
Research Information Categories:					
The state of the art	1	15	35	11	2
Research in progress	7	14	33	14	2
Cost Information Categories:					
Costs of installing and operating a solar system compared to a conventional system	4	19	29	10	5
Costs and performance of systems	1	20	23	20	0
Site-Specific Information Categories:					
Local building codes or other regulations affecting siting or installation of systems	18	10	22	20	11
Climatological data such as wind, weather, or amount of sunshine	1	21	24	15	3
Marketing Information Categories:					
Marketing statistics and sales projections	23	5	15	26	17
Information on how to market and sell systems including guidelines on obtaining financial support	24	5	17	21	20
Other Information Categories:					
Educational institutions and other organizations offering related courses on system design or application	19	8	26	17	12
Standards, specifications, or certification programs for equipment	17	11	18	26	8
Institutional, social, environmental, and legal aspects of system applications	16	6	30	19	8
Expected major developments during the next 10 years	4	17	31	10	4
Solar system programs, research, industries, and markets outside the United States	25	5	14	23	21
Tax credits, grants, or other economic incentives	8	19	19	22	3
Information Products:					
Reference Information Products:					
A bibliography of general readings	12	12	27	21	3
A calendar of conferences and programs	15	6	30	21	6
A list of sources for information	9	11	32	17	3
A list of technical experts	21	7	19	30	7
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	20	9	22	20	12
Descriptive Information Products:					
A non-technical description of how a particular system works	22	9	11	25	18
A technical description of how a particular system works	6	12	37	11	2
System diagrams or schematics	13	12	28	18	5
Design Information Products:					
System design handbooks, installation handbooks, or reference tables	11	14	25	20	4
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	10	15	25	16	6
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	14	11	23	23	6



* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4."

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 7-2. Usefulness of Selected Information Items: All Educators

Educators, the IPH Educators rated "expected major developments" significantly ($P < 0.05$) higher and "standards" and "educational institutions" significantly ($P < 0.05$) lower.

7.3 ACQUISITION OF INFORMATION BY RESPONDENTS

7.3.1 Use of Selected Information Sources

IPH Educators were asked which of 20 different potential sources of solar information they had used in the past few years. For this question the respondents were not asked if they had obtained information about solar industrial process heat, but instead were asked if they had obtained any solar information from each specific source. Thus, the question sought to determine which information sources were the most familiar to the respondents. The results for IPH Educators are shown in Fig. 7-3. For comparison, those for All Educators are shown in Fig. 7-4.

The information sources mentioned most often by IPH Educators (at least 7 of the 9 had used them) were:

- Periodicals, newspapers, or magazines;
- An organizational library or a local library;
- Workshops, conferences, or training sessions;
- Directly from the U.S. Department of Energy (DOE);
- An installer, builder, designer, or manufacturer of solar systems;
- National Technical Information Service (NTIS); and
- A public utility company.

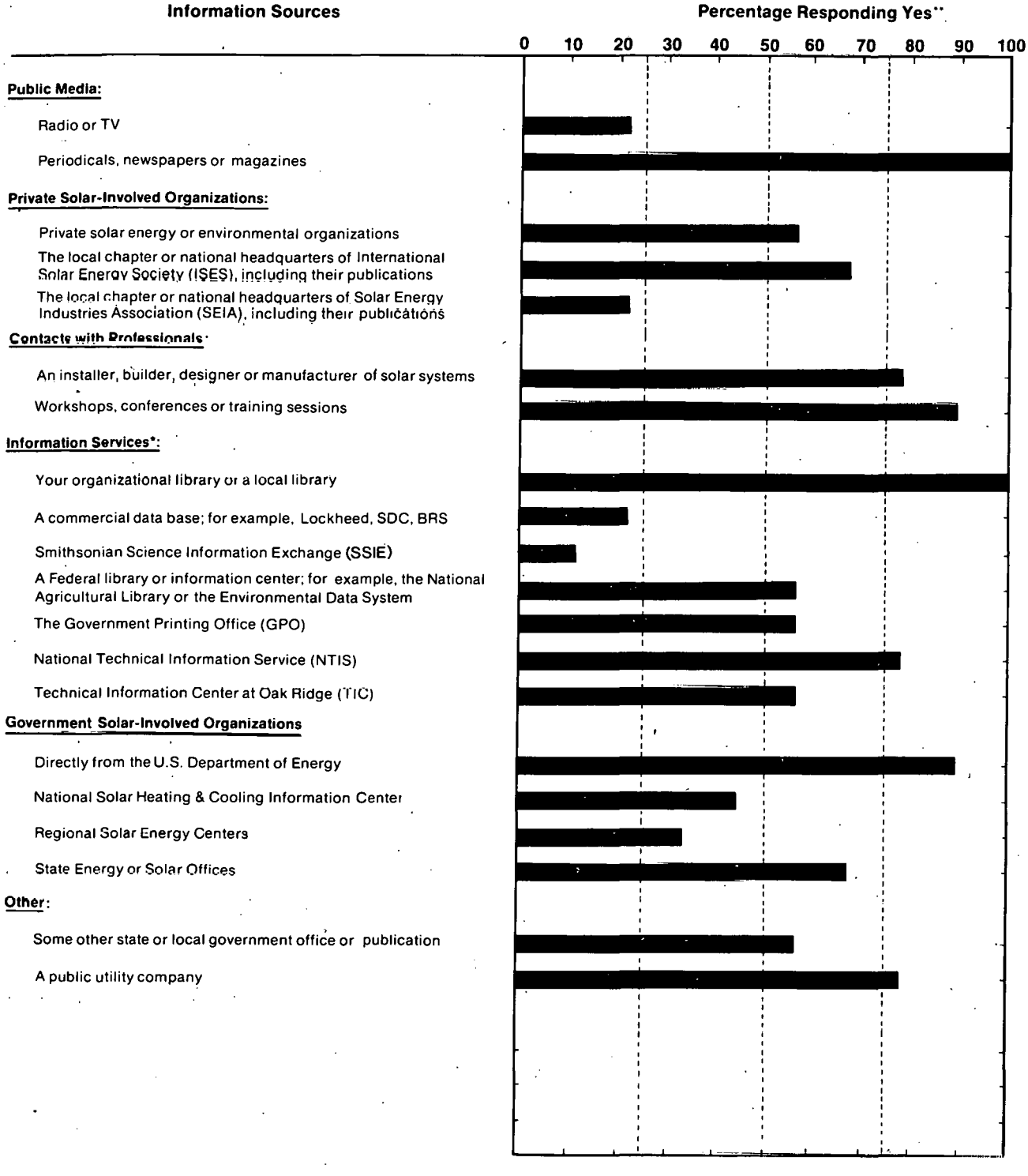
In comparing these results to those for All Educators, it was found that all of the top-mentioned sources except "public utility company" and NTIS were among the five top-mentioned sources for All Educators.

The information sources mentioned least often by IPH Educators were:

- Smithsonian Science Information Exchange,
- A commercial data base,
- Radio or TV,
- Solar Energy Industries Association, and
- Regional Solar Energy Centers.

Once again the results for All Educators were virtually identical. Four of these sources were also among the five lowest-rated items for All Educators (only "Radio or TV" was not).

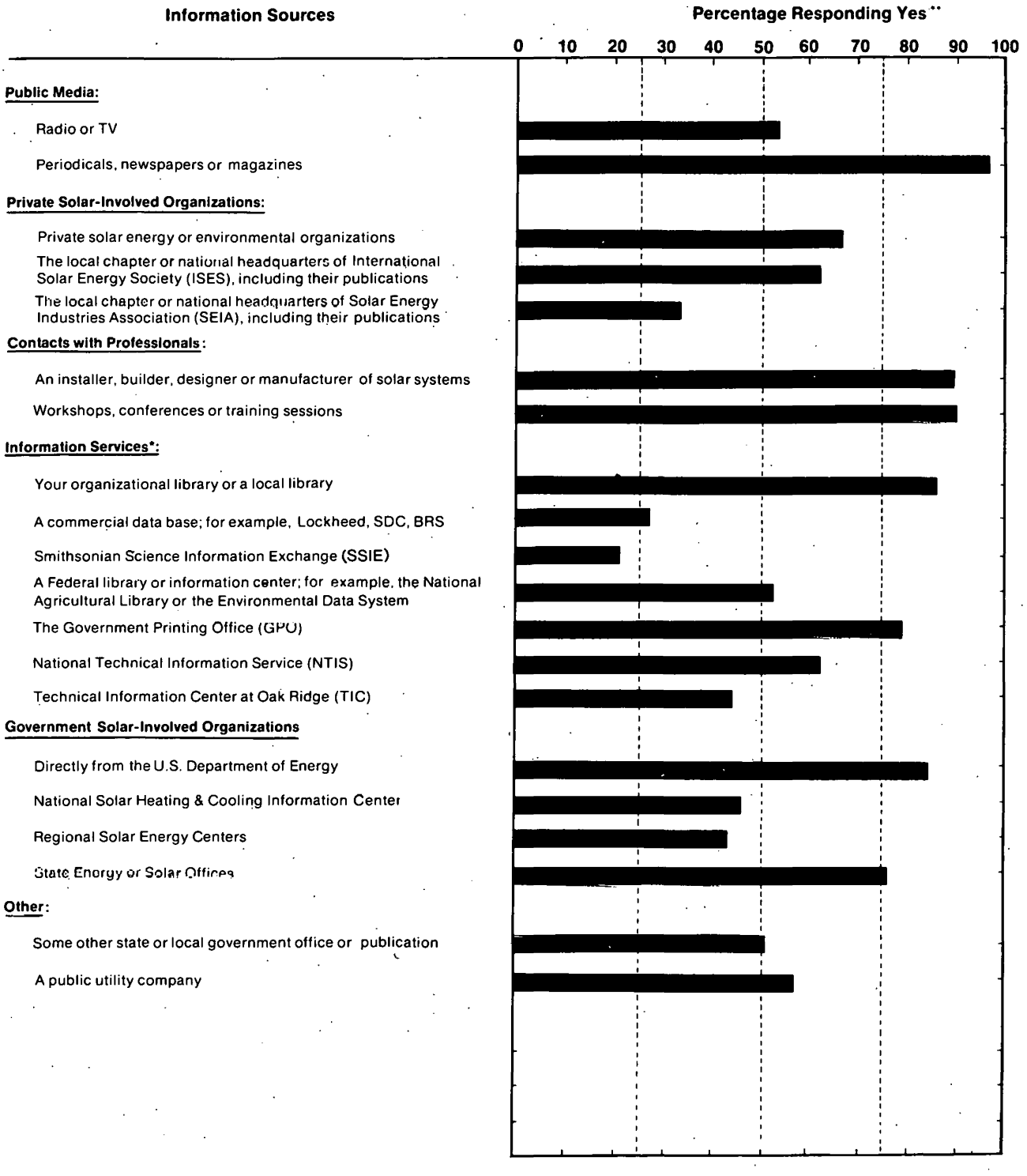
Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** These data are based upon a total of 9 respondents.

Figure 7-3. Use of Selected Information Sources: Industrial Process Heat Educators

Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** These data are based upon a total of 63 respondents.

Figure 7-4. Use of Selected Information Sources: All Educators

7.3.2 Membership in Solar-Interested Organizations

Eight of the 9 IPH Educators were members of a professional, technical, or other organization with an interest in solar energy. These organizations (and the number of times mentioned) included:

- American Association for the Advancement of Science;
- American Institute of Industrial Engineers;
- American Physical Society;
- American Society of Heating, Refrigerating and Air Conditioning Engineers;
- American Society of Mechanical Engineers (2);
- American Vocational Association;
- International Solar Energy Society (ISES) (4);
- Louisiana Solar Energy Council (New Orleans Chapter);
- Michigan Society of Professional Engineers;
- National Society of Professional Engineers; and
- Oregon Vocational Association.

Engineering and solar energy associations (particularly ISES) were the most popular organizations with the IPH Educators.

7.3.3 Exposure to Publications on Solar Energy

During the past 6 months, 8 of the 9 IPH Educators had read publications which included information on industrial process heat. The publications they could specify (and the number of times mentioned) included:

- Civil Engineering journals,
- Conference proceedings,
- DOE reports,
- Heat Transfer journals,
- Plant Energy Management,
- Plant Engineering,
- Sandia National Lab reports,
- Solar Age (3),
- Solar Energy journals, and
- Solar Engineering.

Solar energy publications (specifically Solar Age) were the most popular readings among this group of respondents.

7.3.4 Use of Special Aquisition Methods

The respondents were asked whether they had obtained any information (not just industrial process heat or solar energy) in the past year by computer terminal, by Computer Output Microform (COM), or by other microform (e.g., microfiche, microfilm sheets or rolls). Few of the IPH Educators appeared accustomed to using these special acquisition methods. Three (33%) had used a computer terminal in the past year, none had used COM, and 3 (33%) had used other microforms. By comparison, All Educators had 22%, 6%, and 33% using computer terminals, COM, and other microforms, respectively.

7.4 SUMMARY AND COMMENTS

Nine postsecondary educators teaching courses including solar industrial process heat topics were interviewed. In addition to teaching, four were working on solar IPH projects and three were looking into possibilities for use of process heat. Despite this, the IPH Educators considered themselves the least involved in their technology of any of the groups of Educators studied. IPH Educators also considered themselves less informed than did All Educators. Some of the differences between IPH Educators and All Educators may be because the IPH Educators included instructors of basic level courses, while for most other groups of Educators only instructors of advanced level courses were interviewed.

The level of education of IPH Educators was similar to that for All Educators. Most IPH Educators had degrees in engineering and were teaching in engineering departments.

The technical areas of solar industrial process heat which most interested these educators were "hot water," "low-temperature steam," "hot air," "refrigeration," and "high temperature steam."

IPH Educators gave the highest priority to receiving information on:

- Expected major developments in solar IPH during the next 10 years,
- Costs of installing and operating a solar IPH system compared to a conventional system,
- Costs and performance of solar IPH systems, and
- A technical description of how a particular solar IPH system works.

They gave low ratings to "educational institutions," "marketing statistics and sales projections," "how to market and sell solar industrial process heat systems," "solar energy programs, research, industries, and markets outside the U.S.," and "standards, specifications, or certification programs."

In addition to the high ratings given to "a technical description" and "costs and performance," information on current applications was mentioned as important for these respondents to obtain.

IPH Educators most often received solar information from "periodicals, newspapers, or magazines," "an organizational library or a local library," "workshops, conferences, or training sessions," DOE, "an installer, builder, designer, or manufacturer," and NTIS. Many were members of engineering or solar energy associations. Publications such as Solar Age were the most popular publications from which these respondents received solar information.

SECTION 8.0

STATE AGRICULTURAL OFFICE REPRESENTATIVES

8.1 DESCRIPTION OF RESPONDENTS

8.1.1 Description of Sample

This section describes the results of a telephone study to determine the needs of representatives of State Departments of Agriculture for information on solar agricultural process heat (APH). Eight State Agricultural Office Representatives were interviewed.

The sample frame for State Agricultural Office Representatives was selected from a list provided by the Colorado Department of Agriculture [14]. The list contained contact names, phone numbers, and addresses for all 50 states. Contact names were director, chairman, or commissioner. Alaska and Hawaii were not used. The 8 interview candidates were randomly selected from a sample frame of 48 names.

Respondents. In making the telephone calls to contact the randomly selected interview candidates, it sometimes occurred that the person could not be reached. In this event another randomly selected name was substituted for the original name. When individuals were contacted, it was verified that they really had some interest in solar agricultural process heat (APH), and that they would be needing information on APH within the next year. If they were not both involved and needing information, they were asked if they could refer the interviewer to someone else in their organization who would be an appropriate respondent. If such a referral was made, a call was then made to this new candidate; if no intraorganizational referral was made, a new candidate was randomly selected from the sample frame. The results of this process may be seen in Table 8-1. In one case, the interviewer inadvertently completed an interview with a referral candidate who was not employed by a State Department of Agriculture, and therefore could not be included in this sample.

Table 8-1. COMPLETION OF INTERVIEWS: STATE AGRICULTURAL OFFICE REPRESENTATIVES

Event	Number of Candidates
Interview completed with sample frame candidate	2
Interview completed with referral candidate	6
Refusal or candidate termination	0
Contact attempted: could not reach candidate within three attempts or before interviews were completed	8
Subtotal	16
Contact attempted: invalid candidate (e.g.; inappropriate field of interest, no telephone)	4
TOTAL	20
Sample frame error rate[a] (Percent)	20
Completion rate[b] (Percent)	50

[a]Invalid candidates divided by TOTAL
[b]Completed interviews divided by Subtotal

Comparisons. For additional insight into the information needs and information habits of these State Agricultural Office Representatives, results from this group are compared to the results from state level Cooperative Extension Service (CES) specialists in agriculture and information (All State Specialists) and from CES County Agricultural Agents (APH County Agents) interviewed in this study about solar agricultural process heat (see Section 8.0). The data for State Agricultural Office Representatives, All CES State Specialists, and APH County Agents can be found in Appendix F.

8.1.2 Current Status of Respondents

Respondents represented the following eight states:

- California,
- Iowa,
- Kansas,
- Maryland,
- Montana,
- Oregon,
- South Carolina, and
- Vermont.

Thus, these respondents were fairly well scattered across the country. In comparison, APH County Agents represented mostly the central United States, while All State Specialists (13 states) had no representation from states in New England nor the far West.

Role. Solar activities in which State Agricultural Office Representatives were currently engaged included not only APH, but active solar heating and cooling and the use of biomass energy. Three respondents were involved in providing information on APH: 1 of these was preparing a publication for farmers and setting up a demonstration project; another was operating an APH information clearing house. Two were involved with gasohol: the production of ethanol (not APH), and the use of gasohol for grain drying. Two other respondents were reviewing APH literature, and 1 was associated with farm demonstrations for heating water (APH).

Involvement. Two of the 8 (25%) State Agricultural Office Representatives said that they were "very involved" in solar agricultural process heat, 1 was "moderately involved," and the other 5 were "slightly involved."

Informedness. Three of the 8 (38%) State Agricultural Office Representatives stated that they were either "very informed" or "moderately informed." Five were only "slightly informed." APH County Agents were similarly not very well informed about APH, while All State Specialists were more informed about solar energy generally.

Need for Information. All respondents indicated they would need information on solar APH on the job during the next year. Five of the 8 (62%) State Agricultural Office Representatives expected to need information on solar APH outside the job as well as on the job. This was about the same level of expected off-the-job information need that was found for APH County Agents (5 of the 9, 56%). All State Specialists (7 of the 18, 39%) were less likely to need solar information outside of their jobs.

8.1.3 Background of Respondents

Three of the State Agricultural Office Representatives held master's degrees, 1 held a PhD., and 3 held bachelor's degrees (1 held no degree). The proportion of advanced degree holders (beyond bachelor's) was about the same for these respondents as for APH County Agents (50% and 56%, respectively), but much lower than for All State Specialists (83%). Only 3 of the State Agricultural Office Representatives had received their most recent degree in agricultural fields: agricultural education, animal nutrition, and agricultural engineering. Other degree fields were: chemistry, biochemistry, and political science (2). Five of the 7 degree-holders had received their most recent degree within the past 10 years, and 2 more than 35 years ago.

Two of the State Agricultural Office Representatives had been in their current profession for less than 2 years, 3 for 3-5 years, and 4 for over 6 years. In addition to stating their present professions as commissioner, administrator, or director of the State Department of Agriculture, respondents also described themselves as researcher, marketing specialist, and director of a long-range planning program.

8.2 INFORMATION NEEDS OF RESPONDENTS

8.2.1 Technical Areas

State Agricultural Office Representatives were asked to choose those areas in which they were "particularly interested in obtaining information" from a list of selected technical areas of solar agricultural process heat. Interest levels were high for all areas. Six expressed interest in all five areas about which they were asked. APH County Agents showed similarly high levels of interest (see Table 8-2).

Table 8-2. AREAS OF INTEREST: STATE AGRICULTURAL OFFICE REPRESENTATIVES AND AGRICULTURAL PROCESS HEAT (APH) COUNTY AGENTS

Technical Area of Interest	State Agricultural Office Reps		APH County Agents	
	No.	Percent	No.	Percent
Total Respondents	8	100	9	100
Livestock shelter heating	7	88	7	78
Crop drying	7	88	7	78
Greenhouses	7	88	7	78
Food processing	7	88	6	67
Grain drying	6	75	8	89

Some State Agricultural Office Representatives volunteered that they were also interested in: irrigation and pumping power, alcohol distillation (gasohol), water heating, solar storage, farm home heating, and photovoltaics.

8.2.2 Types of Information

State Agricultural Office Representatives were asked to name the information about solar APH that was important for them to obtain. Seven of the 8 volunteered one or more items of information which they considered important. Topics mentioned included: fruit and vegetable dehydration, economics and cost effectiveness, solar heating of stock watering tanks in winter, solar alcohol production, uses of solar energy for reducing moisture in corn mash, practical developments in farm solar collector design and installation, types of materials that produce best results, and insolation for specific areas. Three respondents expressed the importance of any and all information that relates specifically to farm applications.

Information that State Agricultural Office Representatives volunteered they needed but were unable to get included: a list of sources of information and nontechnical information on system effectiveness and "re-usability."

Choice Between Specific Needs. A list of 11 types of solar APH information products and 14 types of solar APH information categories was read to each respondent. Each respondent described the usefulness of each particular item by assigning it a value of "essential," "very useful," "somewhat useful," or "not at all useful." The results are displayed in Fig. 8-1. For the purpose of comparison, results for APH County Agents are shown in Fig. 9-1, those for All State Specialists in Fig. 9-3 (Section 9.0).

The five top-rated information categories/products selected by the State Agricultural Office Representatives were:

- Lists of sources for information;
- Tax credits, grants, or other economic incentives;
- Costs and performance of systems;
- A nontechnical description of how a particular system works; and
- System diagrams or schematics.

State Agricultural Office Representatives assigned the lowest relative ratings to:

- Solar energy programs, research, industries, and markets outside the United States;
- How to market and sell solar systems;
- Marketing statistics and sales projections; and
- Institutional, social, environmental, and legal aspects.

Statistical tests indicated that all five of the top categories/products were rated significantly ($P < 0.05$) higher than were the four lowest-rated items.

It should be noted that these lower-rated items were not necessarily of no worth to the State Agricultural Office Representatives. For example, 4 of the 8 (50%) thought "local building codes" were "very useful." Thus, these information categories/products could be useful to some State Agricultural Office Representatives, but were of a lower relative priority to the entire group.

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Average Usefulness*** (1.0 1.5 2.0 2.5 3.0 3.5 4.0)	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:						
Research Information Categories:						
The state of the art	14		0	4	3	1
Research in progress	9		0	5	2	1
Cost Information Categories:						
Costs of installing and operating a solar system compared to a conventional system	6		0	6	1	1
Costs and performance of systems	3		0	6	2	0
Site-Specific Information Categories:						
Local building codes or other regulations affecting siting or installation of systems	21		0	4	1	3
Climatological data such as wind, weather, or amount of sunshine	9		1	3	3	1
Marketing Information Categories:						
Marketing statistics and sales projections	22		0	3	1	4
Information on how to market and sell systems including guidelines on obtaining financial support	24		0	1	3	4
Other Information Categories:						
Educational institutions and other organizations offering related courses on system design or application	16		0	3	3	1
Standards, specifications, or certification programs for equipment	17		0	3	4	1
Institutional, social, environmental, and legal aspects of system applications	22		0	1	5	2
Expected major developments during the next 10 years	9		0	4	4	0
Solar system programs, research, industries, and markets outside the United States	25		0	1	2	5
Tax credits, grants, or other economic incentives	2		0	6	1	0
Information Products:						
Reference Information Products:						
A bibliography of general readings	9		1	3	3	1
A calendar of conferences and programs	17		0	3	4	1
A list of sources for information	1		2	4	2	0
A list of technical experts	6		1	3	4	0
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	9		0	4	4	0
Descriptive Information Products:						
A non-technical description of how a particular system works	3		0	7	0	1
A technical description of how a particular system works	14		0	4	3	1
System diagrams or schematics	3		0	6	2	0
Design Information Products:						
System design handbooks, installation handbooks, or reference tables	6		0	5	3	0
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	17		0	3	4	1
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	17		1	2	3	2

* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4".

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 8-1. Usefulness of Selected Information Items: State Agricultural Office Representatives

Statistical tests were also used to determine whether the State Agricultural Office Representatives rated any of these information items significantly higher (or lower) than they were rated by the APH County Agents or by All State Specialists. Some groups, however, tended to give higher scores in general than did other groups. To compensate for this effect, these statistical tests compared the "relative rating" given by one group to the "relative rating" given by the other groups. The procedure for calculating the relative rating is described in Appendix E. The average overall rating for State Agricultural Office Representatives was 2.38, slightly higher than the 2.27 average of All State Specialists, but lower than the 2.66 average for APH County Agents.

In comparing the results for State Agricultural Office Representatives to the results for All State Specialists and APH County Agents, all three groups gave high ratings to "costs and performance of systems" and "economic incentives," and low ratings to "institutional, social, environmental, and legal aspects." Statistical tests showed that the State Agricultural Office Representatives rated "educational institutions" significantly ($P < 0.05$) higher than did All State Specialists and rated "computer models" significantly ($P < 0.05$) higher than they were rated by APH County Agents. There seemed to be evidence that State Agricultural Office Representatives were more interested in reference products and descriptive costs than All State Specialists were.

8.3 ACQUISITION OF INFORMATION BY RESPONDENTS

8.3.1 Use of Selected Information Sources

State Agricultural Office Representatives were asked which of 21 different potential sources of solar information they had used in the past few years. For this question the respondents were not asked if they had obtained information on solar APH, but instead were asked if they had obtained any solar information from each specific source. Thus, the question sought to determine which information sources were the most familiar to the respondents. The results are shown in Fig. 8-2. For comparison, results for APH County Agents and All State Specialists are in Figs. 9-4 and 9-6 (Section 9.0).

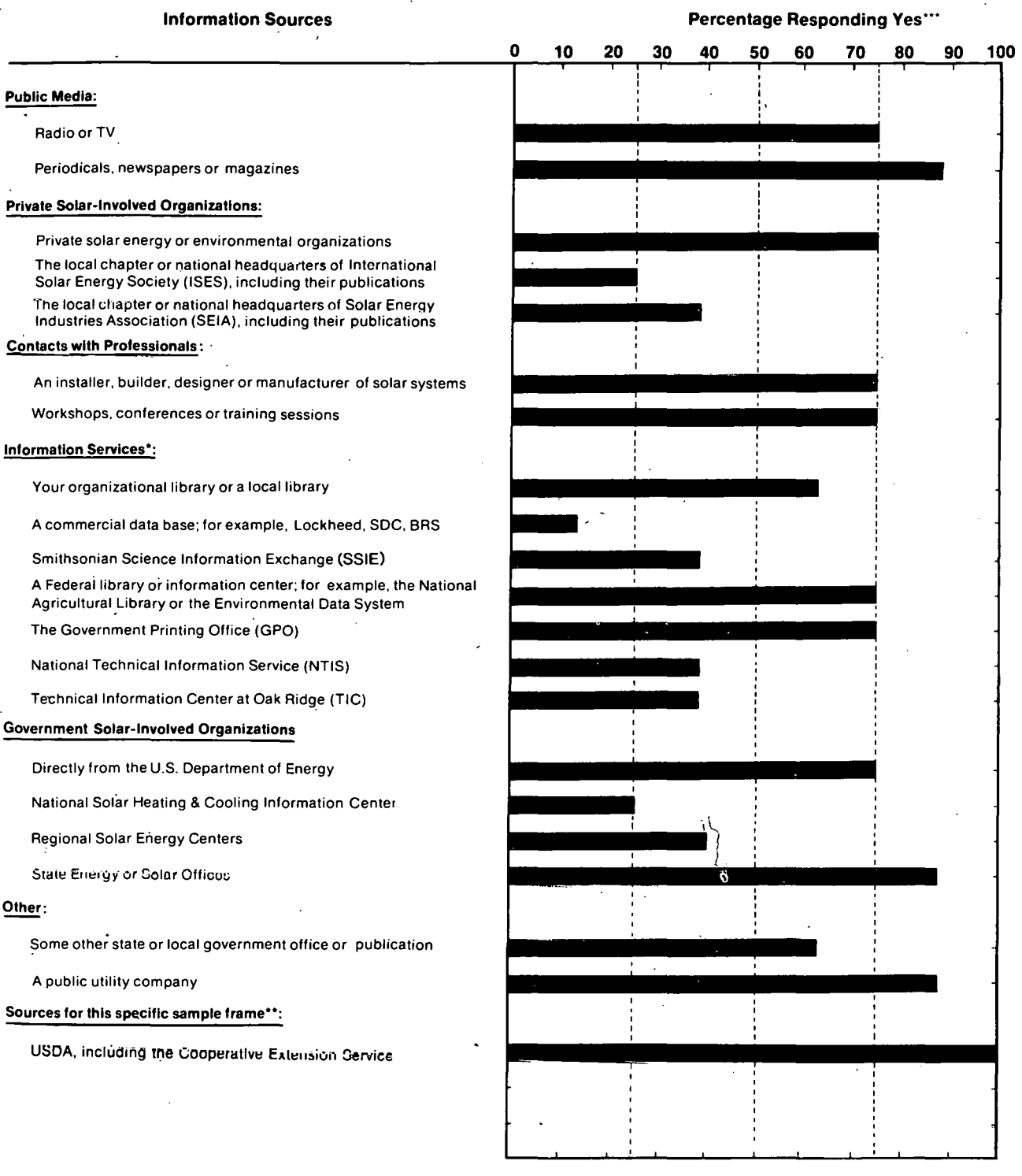
The information sources mentioned most often by State Agricultural Office Representatives were:

- United States Department of Agriculture (USDA);
- Periodicals, newspapers, or magazines;
- State energy or solar offices; and
- A public utility company.

There were seven other sources which 75% or more of the respondents had used. The information sources mentioned least often by State Agricultural Office Representatives were:

- A commercial data base,
- International Solar Energy Society (ISES), and
- National Solar Heating and Cooling Information Center (NSHCIC).

Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** Some sample frames were questioned about additional information sources which are applicable to their technology. For example, the manufacturers of biomass conversion equipment were also asked if they have obtained any type of solar information from: "the local or national office of the U.S. Department of Agriculture, including Extension and Forestry."
*** These data are based upon a total of 8 respondents.

Figure 8-2. Use of Selected Information Sources: State Agricultural Office Representatives

State Agricultural Office Representatives relied heavily on USDA for solar information, as did Extension Service Offices. However, their overall average across all sources (.61) was much higher than was that of the APH County Agents (.43), and thus they appeared to make more use of more sources. The State Agricultural Office Representatives were significantly ($P < 0.05$) more likely to use both "a federal library" and Regional Solar Energy Centers (RSECs) than were APH County Agents. They were significantly ($P < 0.05$) less likely to use both other libraries and "some other state or local government office" than were All State Specialists.

8.3.2 Membership in Solar-Interested Organizations

Three of the 8 (38%) State Agricultural Office Representatives interviewed were members of a professional, technical, or other organization with an interest in solar energy. These organizations (each mentioned by only one respondent) included:

- American Association for the Advancement of Science,
- American Society of Agricultural Engineers,
- National Association of State Departments of Agriculture, and
- North American Scientific Council for Agricultural Technology.

No solar-specific organizations were mentioned, which was also typical of APH County Agents.

8.3.3 Exposure to Publications on Solar Energy

During the past 6 months, all of the State Agricultural Office Representatives had read publications which included information on solar APH. The publications they could specify (each named by only one respondent) included:

- Archer-Daniel-Midland Company publications,
- U.S. Department of Energy (DOE) publications,
- Hoard's Dairyman,
- Kansas Energy Office publications,
- Kansas State University Extension Service publications,
- Progressive Farmer,
- Solar Energy for Agriculture; Review of Research (by W. K. Trotter, USDA Economics, Statistics, and Cooperatives Service #67), and
- USDA reports.

8.3.4 Use of Special Acquisition Methods

The respondents were asked whether they had obtained any information (not just APH or solar energy) in the past year by computer terminal, by Computer Output Microform (COM), or by other microform (e.g., microfiche, microfilm sheets or rolls). Few of the State Agricultural Office Representatives appeared accustomed to using these special

acquisition methods, a trait common to most groups included in this study. In the past year, none of the 8 had used computer terminals, only 1 had used COM, and 2 had used other microforms. Somewhat larger proportions of All State Specialists had used each of the three forms. Significantly more ($P < 0.05$) State Specialists had used computer terminals than State Agricultural Office Representatives. The employment of State Specialists at state universities may be a factor in their higher use of all three acquisition methods.

8.4 SUMMARY AND COMMENTS

Eight representatives from State Agricultural Offices were interviewed. All were involved in some aspect of providing information on solar agricultural process heat (APH), although most were only slightly involved in this area and not very informed. Most respondents expected to need information on solar APH off the job as well as on the job. Most respondents held top positions in the State Department of Agriculture.

State Agricultural Office Representatives assigned the greatest utility to information on:

- Lists of sources for information on solar APH;
- Tax credits, grants, and other economic incentives for solar APH applications;
- Costs and performance of solar APH systems;
- A nontechnical description of how a particular solar APH system works; and
- Solar APH system diagrams or schematics.

They gave low ratings to: marketing information, "APH programs . . . outside the United States," and "institutional, social, environmental, and legal aspects of solar agricultural process heat installations."

State Agricultural Office Representatives most often received solar information from USDA, "periodicals, newspapers, or magazines," "state energy or solar offices," and "a public utility company." These respondents appeared to be seeking out more information sources and needing both technical information for themselves as well as nontechnical information for public awareness distribution to the rural public. They obtained much of their information from professional agricultural organizations and publications, in addition to DOE and USDA.

SECTION 9.0

COUNTY AGENTS, COOPERATIVE EXTENSION SERVICE

9.1 DESCRIPTION OF RESPONDENTS

9.1.1 Description of Sample

This section describes the results of a telephone study to determine the needs of county agricultural agents in the Cooperative Extension Service (CES) for information on solar agricultural process heat (APH). Nine APH County Agents were interviewed.

The sample frame for APH County Agents was selected from the County Agents Directory [15] which lists CES staff members by state and county. In order to eliminate urban counties, the County and City Data Book [16] was consulted. From this source, any counties which had 35 percent or less of total land area in farms were eliminated from consideration. The 2,160 remaining rural counties were reduced to 300 by systematic random selection of every seventh county. (Counties were listed in alphabetical order within states, which were also in alphabetical order.) Every fifth county was then selected as a candidate for the solar agricultural process heat information study.* Senior Agricultural Agents (rather than Home Economics Agents, 4-H Agents, or Youth Agents) were identified for each county. The 9 interview candidates were randomly selected from a sample frame of 60 names.

Respondents. In making the telephone calls to contact the randomly selected interview candidates, it sometimes occurred that the person could not be reached. In this event another randomly selected name was substituted for the original name. When individuals were contacted, it was verified that they would be needing information on APH within the next year. If they were not both involved and needing information, they were asked if they could refer the interviewer to someone else in their organization who would be an appropriate respondent. If such a referral was made, a call was then made to this new candidate; if no intraorganizational referral was made, a new candidate was randomly selected from the sample frame. The results of this process may be seen in Table 9-1.

Comparisons. For additional insight into the information needs and the information habits of these APH County Agents, results from this group are compared to the results from state-level CES specialists in agriculture and information (All State Specialists) and from all of the CES county agricultural agents interviewed in this study (All County Agents). Other technologies included in All County Agents were active solar heating and cooling, wind, passive solar heating and cooling, and biomass energy. In performing any statistical comparisons, the totals for APH County Agents have been subtracted from the totals for All County Agents. Comparisons between APH County Agents and State Agricultural Office Representatives, who were also sampled for information needs on solar APH, are contained in Section 8. The data for APH County Agents, All County Agents, and All State Specialists can be found in Appendix F.

*The remaining counties were divided into similar groups, and studies were conducted on wind energy, active solar heating and cooling, passive solar heating and cooling, and biomass energy. The results of these studies are reported in other volumes.

Table 9-1. COMPLETION OF INTERVIEWS: AGRICULTURAL PROCESS HEAT COUNTY AGENTS

Event	Number of Candidates
Interview completed with sample frame candidate	9
Interview completed with referral candidate	0
Refusal or candidate termination	0
Contact attempted: could not reach candidate within three attempts or before interviews were completed	14
Subtotal	23
Contact attempted: invalid candidate (e.g.; inappropriate field of interest, no telephone)	2
TOTAL	25
Sample frame error rate[a]	8
Completion rate[b]	39

[a]Invalid candidates divided by Total
[b]Completed interviews divided by Subtotal

9.1.2 Current Status of Respondents

Respondents represented counties in the following eight states:

- Idaho,
- Kansas (2),
- Nebraska,
- North Carolina,
- Oklahoma,
- South Dakota,
- Tennessee, and
- Texas.

It will be noted that neither Northeastern nor far Western states were sampled. All County Agents accounted for 24 states, picking up somewhat more representation of the West. Similarly, All State Specialists did not include representatives from New England or the far West. (Geographic distribution by state of respondents in each of the County Agents' and State Specialists' groups are shown in Table B-1, Appendix B.)

Role. Three of the 9 APH County Agents were gathering information and/or identifying sources of information on agricultural process heat and distributing information to the public. Other activities mentioned included: research on tobacco curing, use of peanut dryers, grain drying (usually classified as agricultural process heat), promoting solar APH research, working with farmers to plan solar APH projects, and preparing for solar APH experiments.

Involvement. Two of the 9 (22%) respondents said that they were "moderately involved" in solar agricultural process heat. The other 7 were "slightly involved." While none of the APH County Agents were "very involved," 33% (6 of the 18) of All State Specialists were. This higher degree of involvement may be accounted for by the fact that State Specialists were asked about involvement in solar technologies generally, rather than just in solar agricultural process heat. Involvement levels of County Agents in other technologies were similar (29%, 13 of the 45 were at least "moderately involved") to APH County Agents.

Informedness. Seven of the 9 (78%) APH County Agents stated that they were only "slightly informed" about solar APH. Two (22%) were "moderately informed." Similarly, All County Agents were not very well informed about their respective solar technologies (only 10 of the 45 or 22% at least "moderately informed"), while significantly ($P < 0.05$) more All State Specialists (15 of the 18 or 83%) were at least "moderately informed" than were APH County Agents.

Need for Information. All respondents indicated they would need solar APH information on the job during the next year. Five (56%) of the 9 APH County Agents indicated they would also need information on solar agricultural process heat outside the job. This level of off-the-job information need was about the same as that found for All County Agents (21 of the 45 or 47%), but higher than for All State Specialists (7 of the 18 or 39%).

9.1.3 Background of Respondents

Five of the APH County Agents held master's degrees, the remainder held bachelor's degrees. Three had received their most recent degree in agriculture (animal husbandry) or agricultural education (2), 2 in animal science, 2 in adult education, 1 in biology, and 1 in engineering. Four of the 9 had received their most recent degrees within the past 10 years, 2 from 10-20 years ago, and 3 over 20 years ago.

Seven APH County Agents had been in their current profession for over 10 years, 2 for 3-5 years. Although their current profession might be assumed to be "county agricultural agent," professional statements included educator and agricultural professional, as well as Extension Agent.

9.2 INFORMATION NEEDS OF RESPONDENTS

9.2.1 Technical Areas

APH County Agents were asked to choose those areas in which they were "particularly interested in obtaining information" from a list of selected technical areas of solar agricultural process heat technology. Six expressed interest in all five areas about which they were asked. Eight of the 9 respondents were interested in "grain drying," 7 were interested in "livestock shelter heating," "crop drying," and "greenhouses." The topic of lowest interest (6 of the 9) was "food processing."

Three APH County Agents volunteered that they were also interested in solar heating of residences.

9.2.2 Types of Information

APH County Agents were asked to name the information about solar agricultural process heat technologies that was important for them to obtain. Eight of the 9 volunteered one or more items of information which they considered important. Responses ranged from "basic information" to "technical aspects" and included: breakthroughs, research results, new approaches for grain drying and swine house heating, identification of best solar collectors for agricultural applications, low-cost systems for installation on existing farms (retrofit), and comparison between solar and other sources for agricultural process heat.

Two APH County Agents volunteered that there was information they needed but were unable to get. This information included: any technical information, economics of solar APH, costs and performance of different systems, and new plans for systems.

Choice Between Specific Needs. A list of 11 types of solar agricultural process heat information products and 11 types of solar APH information categories was read to each respondent. Each respondent described the usefulness of each particular item by assigning it a value of "essential," "very useful," "somewhat useful," or "not at all useful." The results are displayed in Fig. 9-1. For the purpose of comparison, results for All County Agents are in Fig. 9-2, and those for All State Specialists in Fig. 9-3.

APH County Agents named both items in the cost category as the most important. The five top-rated information categories/products were:

- Costs of installing and operating a solar APH system compared to a conventional system;
- Costs and performance of systems;
- Tax credits, grants, or other economic incentives;
- A nontechnical description of how a particular system works; and
- Lists of technical experts.

"Lists of sources for information" and "system diagrams and schematics" also were ranked high.

APH County Agents assigned the lowest relative ratings to:

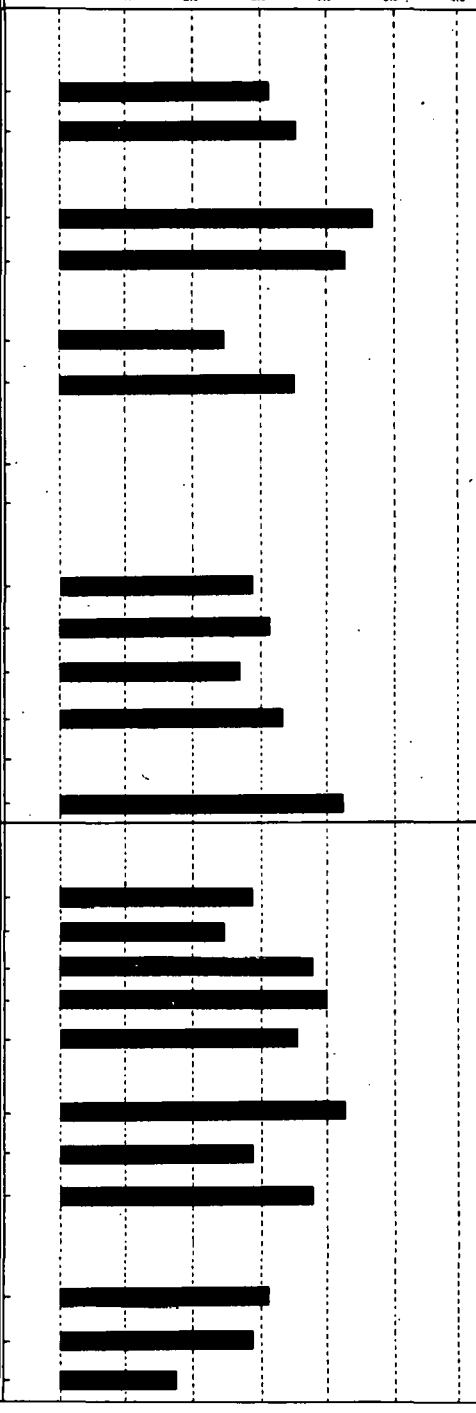
- Computer models for sizing and predicting performance or costs;
- Local building codes or other regulations;
- Calendars of conferences and programs; and
- Institutional, social, environmental, and legal aspects.

Statistical tests indicated that all five of the top categories/products were rated significantly ($P < 0.05$) higher than were the four lowest rated items.

It should be noted that these lower-rated items were not necessarily of no worth to the APH County Agents. For example, 3 of the 9 (33%) thought "local building codes" was either "essential," or "very useful." Thus, these information categories/products could be useful to some of the APH County Agents, but were of a lower relative priority to the entire group.

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:					
Research Information Categories:					
The state of the art	12	1	3	5	0
Research in progress	8	1	5	3	0
Cost Information Categories:					
Costs of installing and operating a solar system compared to a conventional system	1	3	6	0	0
Costs and performance of systems	2	3	4	2	0
Site-Specific Information Categories:					
Local building codes or other regulations affecting siting or installation of systems	20	1	2	4	2
Climatological data such as wind, weather, or amount of sunshine	8	1	6	1	1
Marketing Information Categories:					
Marketing statistics and sales projections	NA	NA	NA	NA	NA
Information on how to market and sell systems including guidelines on obtaining financial support	NA	NA	NA	NA	NA
Other Information Categories:					
Educational institutions and other organizations offering related courses on system design or application	15	1	3	4	1
Standards, specifications, or certification programs for equipment	12	1	3	5	0
Institutional, social, environmental, and legal aspects of system applications	19	1	1	7	0
Expected major developments during the next 10 years	11	1	5	2	1
Solar system programs, research, industries, and markets outside the United States	NA	NA	NA	NA	NA
Tax credits, grants, or other economic incentives	2	2	6	1	0
Information Products:					
Reference Information Products:					
A bibliography of general readings	15	1	2	6	0
A calendar of conferences and programs	20	0	3	5	1
A list of sources for information	6	1	6	2	0
A list of technical experts	5	2	6	0	1
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	8	1	5	3	0
Descriptive Information Products:					
A non-technical description of how a particular system works	2	2	6	1	0
A technical description of how a particular system works	15	1	3	4	1
System diagrams or schematics	6	2	4	3	0
Design Information Products:					
System design handbooks, installation handbooks, or reference tables	12	1	4	3	1
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	15	0	4	5	0
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	22	0	0	8	1



* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

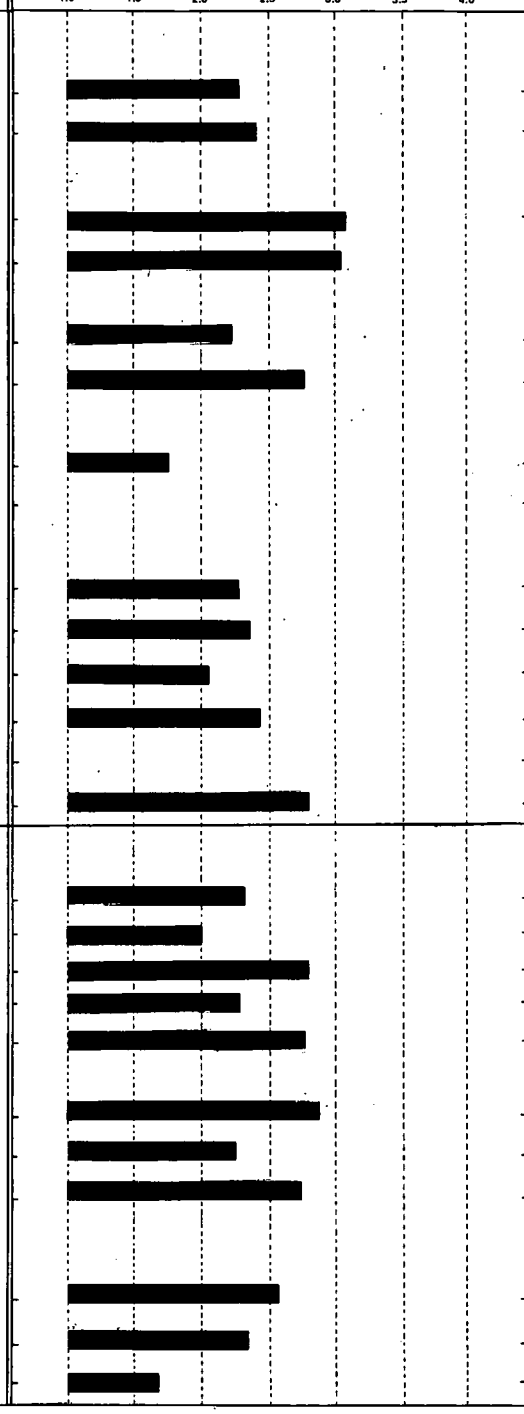
** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4."

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 9-1. Usefulness of Selected Information Items: Agricultural Process Heat Cooperative Extension Service County Agents

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Average Usefulness***	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:						
Research Information Categories:						
The state of the art	15		1	15	25	4
Research in progress	11		2	20	19	4
Cost Information Categories:						
Costs of installing and operating a solar system compared to a conventional system	1		8	33	4	0
Costs and performance of systems	2		6	34	5	0
Site-Specific Information Categories:						
Local building codes or other regulations affecting siting or installation of systems	19		4	11	21	9
Climatological data such as wind, weather, or amount of sunshine	6		8	23	9	5
Marketing Information Categories:						
Marketing statistics and sales projections	22		0	1	5	3
Information on how to market and sell systems including guidelines on obtaining financial support	NA		NA	NA	NA	NA
Other Information Categories:						
Educational institutions and other organizations offering related courses on system design or application	15		3	13	23	6
Standards, specifications, or certification programs for equipment	14		2	14	24	4
Institutional, social, environmental, and legal aspects of system applications	20		2	6	30	7
Expected major developments during the next 10 years	10		2	23	14	6
Solar system programs, research, industries, and markets outside the United States	NA		NA	NA	NA	NA
Tax credits, grants, or other economic incentives	4		7	24	12	2
Information Products:						
Reference Information Products:						
A bibliography of general readings	13		2	17	20	6
A calendar of conferences and programs	21		1	7	28	9
A list of sources for information	4		6	25	13	1
A list of technical experts	15		3	15	19	8
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	8		6	22	15	2
Descriptive Information Products:						
A non-technical description of how a particular system works	3		5	30	10	0
A technical description of how a particular system works	18		4	13	19	9
System diagrams or schematics	7		6	22	16	1
Design Information Products:						
System design handbooks, installation handbooks, or reference tables	9		3	22	16	4
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	12		2	19	18	6
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	23		0	5	24	15



* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4."

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 9-2. Usefulness of Selected Information Items: All Cooperative Extension Service County Agents

Question #8. I will read a list of potential information or information products on solar systems. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful?

Type of Information or Information Product*	Rank**	Average Usefulness*** (1.0 1.5 2.0 2.5 3.0 3.5 4.0)	Number of Responses: Essential (4)	Very useful (3)	Somewhat useful (2)	Not at all useful (1)
Information Categories:						
Research Information Categories:						
The state of the art	5		0	9	9	0
Research in progress	5		1	8	8	1
Cost Information Categories:						
Costs of installing and operating a solar system compared to a conventional system	9		2	6	7	3
Costs and performance of systems	3		2	9	5	2
Site-Specific Information Categories:						
Local building codes or other regulations affecting siting or installation of systems	9		2	4	11	1
Climatological data such as wind, weather, or amount of sunshine	1		5	7	2	4
Marketing Information Categories:						
Marketing statistics and sales projections	NA		NA	NA	NA	NA
Information on how to market and sell systems including guidelines on obtaining financial support	NA		NA	NA	NA	NA
Other Information Categories:						
Educational institutions and other organizations offering related courses on system design or application	22		0	1	9	8
Standards, specifications, or certification programs for equipment	13		2	6	4	6
Institutional, social, environmental, and legal aspects of system applications	21		0	2	9	7
Expected major developments during the next 10 years	5		2	7	7	2
Solar system programs, research, industries, and markets outside the United States	23		0	1	7	9
Tax credits, grants, or other economic incentives	3		2	8	7	1
Information Products:						
Reference Information Products:						
A bibliography of general readings	20		1	4	8	5
A calendar of conferences and programs	18		0	6	8	4
A list of sources for information	2		2	9	6	1
A list of technical experts	13		1	6	7	4
Lists of local lenders, insurers, builders, engineers, installers, manufacturers, or distributors	18		1	6	5	6
Descriptive Information Products:						
A non-technical description of how a particular system works	17		0	8	5	5
A technical description of how a particular system works	8		1	9	5	3
System diagrams or schematics	13		2	3	10	3
Design Information Products:						
System design handbooks, installation handbooks, or reference tables	11		2	4	8	3
Manual methods for sizing and predicting the engineering performance or life cycle costs of systems	12		1	7	6	4
Computer models for sizing and predicting the engineering performance or life cycle costs of systems	13		0	8	6	4

* Each sample frame of users was questioned on information and information products in the context of their specific technology. For example, biomass sample frames were asked about "a bibliography of general readings on biomass", "a calendar of upcoming biomass conferences and programs", etc.

** Rank—Each information product was assigned a rank based on average usefulness. Thus, the product with the highest average usefulness was assigned the rank of "1"; the product with the lowest average usefulness would be ranked "25" where all items were asked. If two or more information products were tied for 2nd, they were both assigned a "2". The next highest ranking was then assigned a "4".

*** Average usefulness was calculated by assigning the responses on a 1-4 scale from a "4" for "essential" to a "1" for "not very useful".

Figure 9-3. Usefulness of Selected Information Items: All Cooperative Extension Service State Specialists

Statistical tests were also used to determine whether the APH County Agents rated any of these information items significantly higher (or lower) than they were rated by All County Agents or by All State Specialists. Some groups, however, tended to give higher scores in general than did other groups. To compensate for this effect, these statistical tests compared the "relative rating" given by one group to the "relative rating" given by the other groups. The procedure for calculating the relative rating is described in Appendix E. The average overall rating for APH County Agents was 2.66, higher than that of All County Agents (2.47) or All State Specialists (2.27).

The results for APH County Agents were quite similar to the results for All County Agents. Statistical tests indicated that the only statistically significant differences in ratings given to individual information items by APH County Agents compared to All County Agents was the significantly ($P<0.05$) higher ratings of "lists of technical experts" by APH County Agents.

Ratings of APH County Agents differed significantly from those of All State Specialists in that APH County Agents rated "a nontechnical description" significantly ($P<0.05$) higher and "computer models" significantly ($P<0.05$) lower. APH County Agents also appeared to give higher ratings to "costs of installing," "lists of local lenders (etc.)," and "a list of technical experts," but to give lower ratings to "local building codes," "state of the art," "climatological data," "expected major developments," and "a technical description."

9.3 ACQUISITION OF INFORMATION BY RESPONDENTS

9.3.1 Use of Selected Information Sources

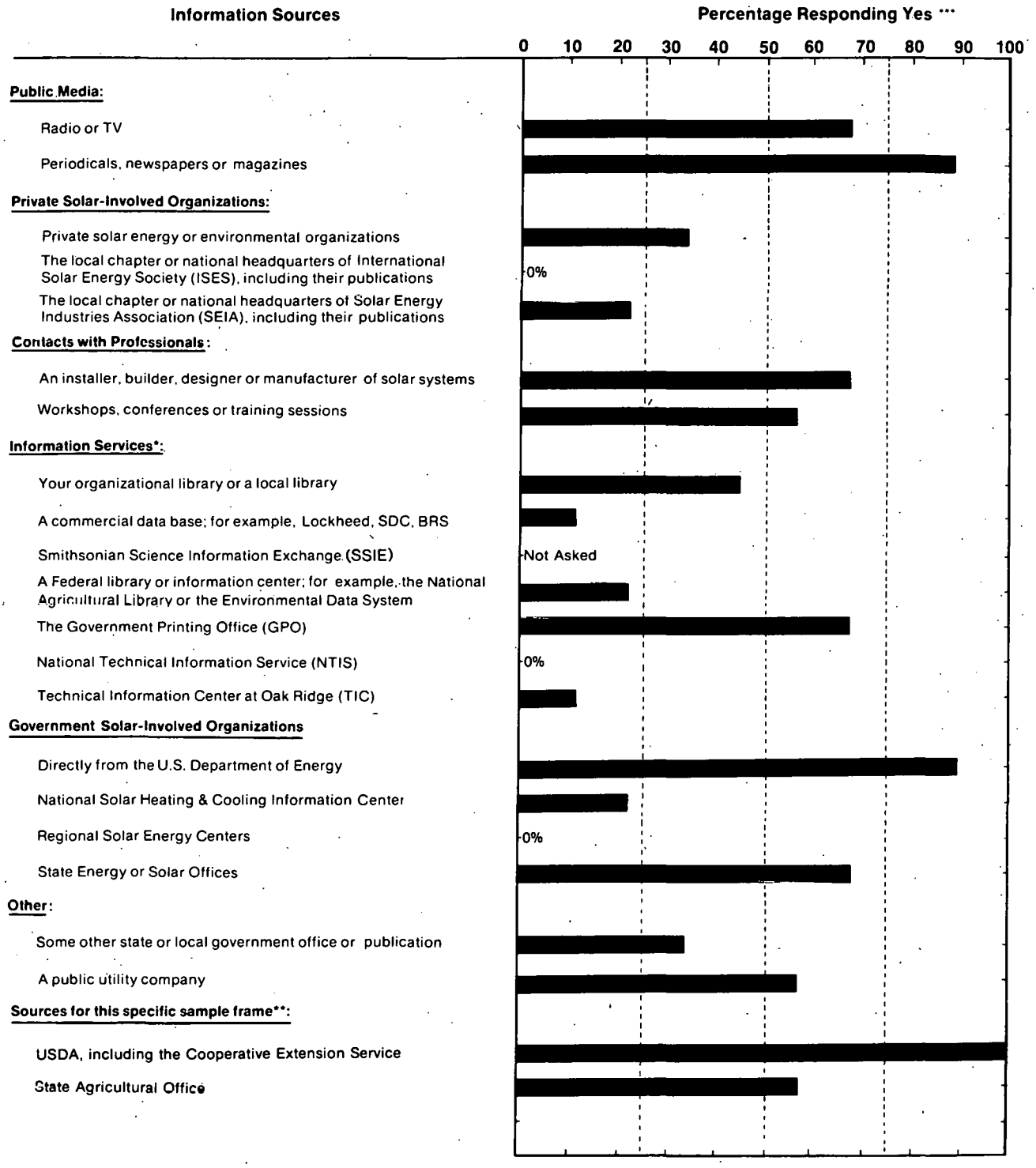
APH County Agents were asked which of 21 different potential sources of information they had used in the past few years. For this question the respondents were not asked if they had obtained information on solar agricultural process heat technologies, but instead were asked if they had obtained any solar information from each specific source. Thus, the question sought to determine which information sources were the most familiar to the respondents. The results are presented in Fig. 9-4. For comparison, results for All County Agents and All State Specialists are in Figs. 9-5 and 9-6.

The information sources mentioned most often by APH County Agents were:

- United States Department of Agriculture (USDA);
- Periodicals, newspapers, or magazines;
- Directly from the U.S. Department of Energy (DOE);
- Radio or TV;
- An installer, builder, designer, or manufacturer of solar systems;
- The Government Printing Office (GPO); and
- State energy or solar offices.

The information sources mentioned least often by APH County Agents (no more than 1 of the 9 had used them) were:

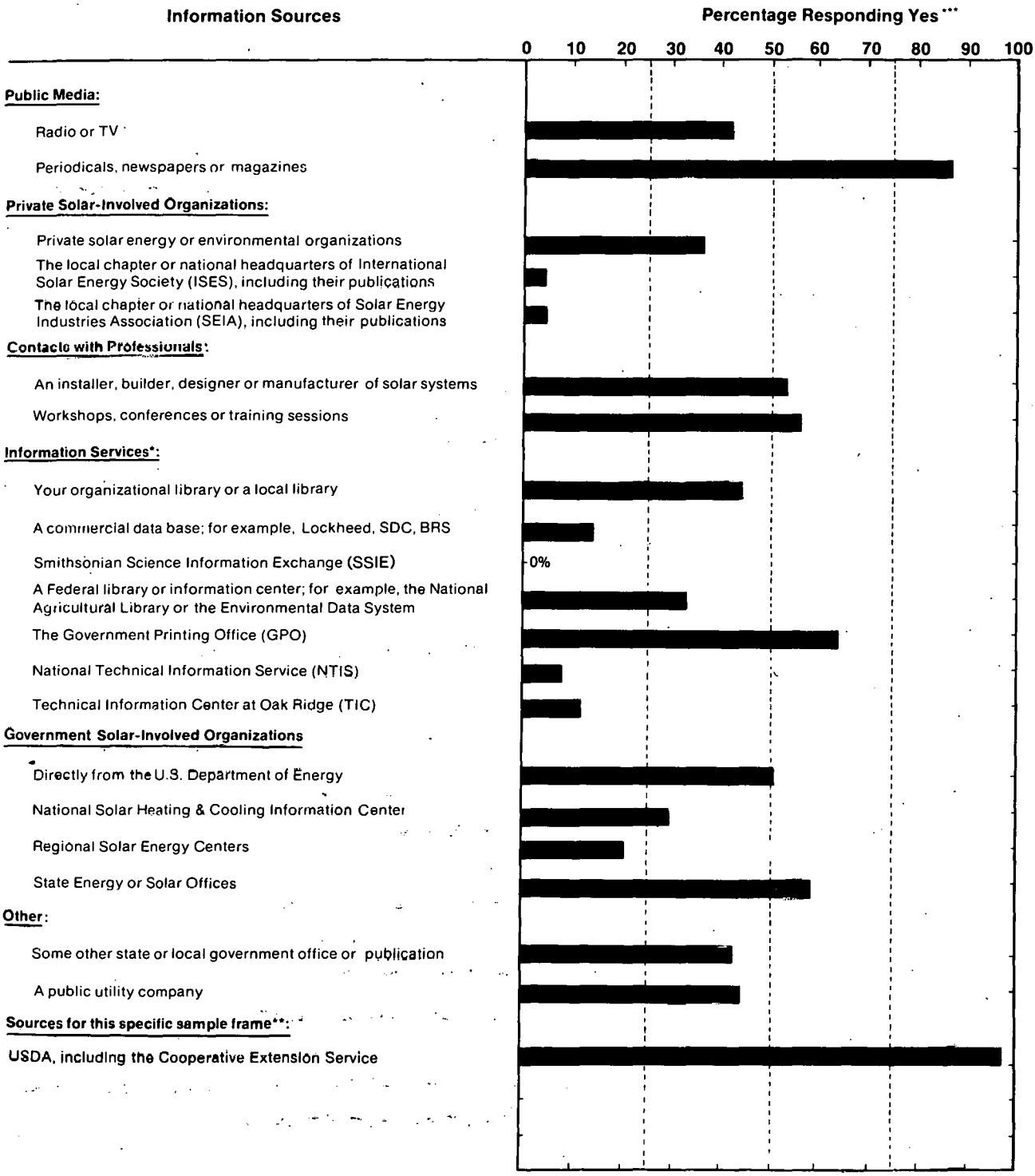
Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** Some sample frames were questioned about additional information sources which are applicable to their technology. For example, the manufacturers of biomass conversion equipment were also asked if they have obtained any type of solar information from: "the local or national office of the U.S. Department of Agriculture, including Extension and Forestry."
*** These data are based upon a total of 9 respondents.

Figure 9-4. Use of Selected Information Sources: Agricultural Process Heat Cooperative Extension Service County Agents

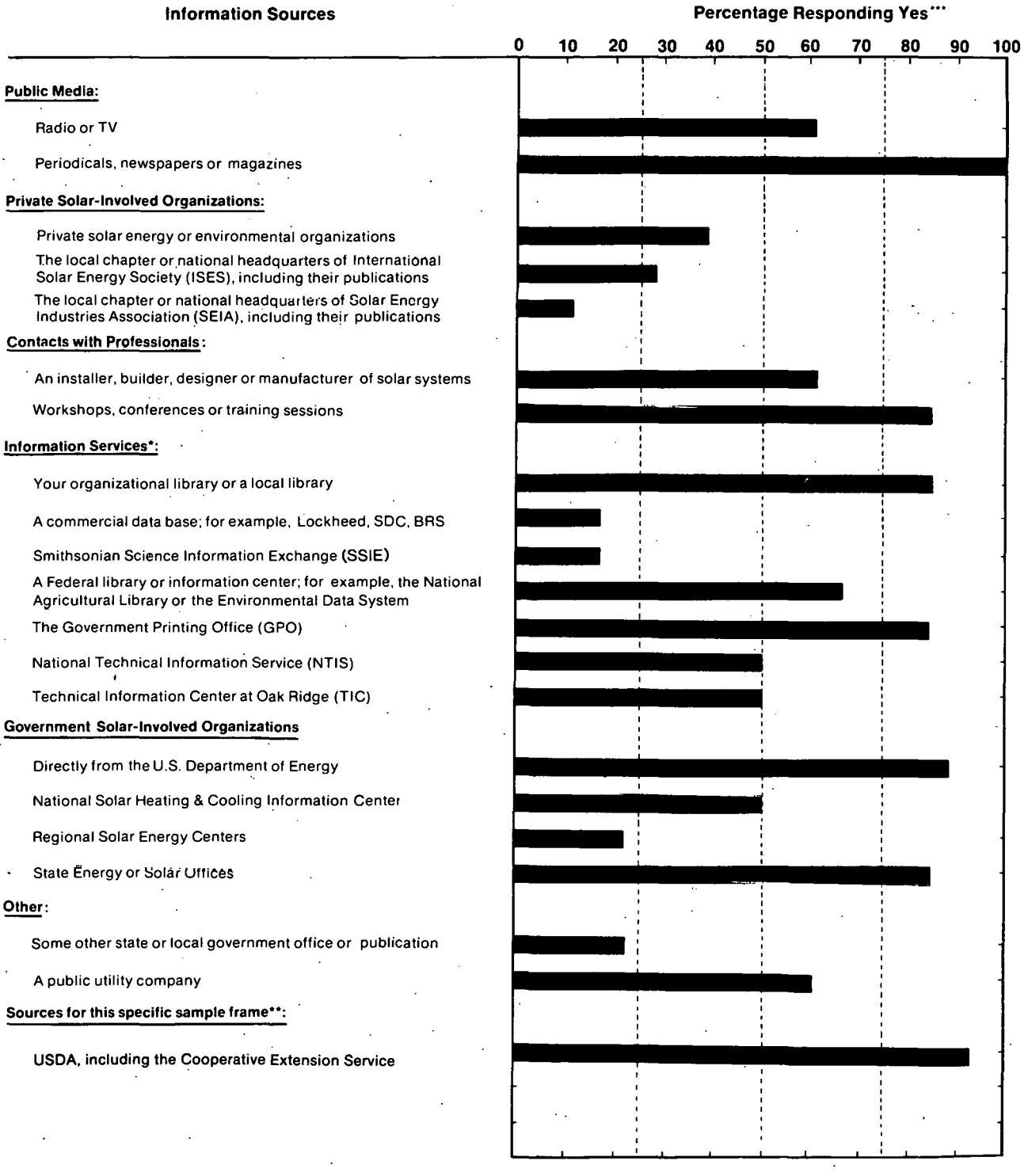
Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** Some sample frames were questioned about additional information sources which are applicable to their technology. For example, the manufacturers of biomass conversion equipment were also asked if they have obtained any type of solar information from: "the local or national office of the U.S. Department of Agriculture, including Extension and Forestry."
These data are based upon a total of 45 respondents.

Figure 9-5. Use of Selected Information Sources: All Cooperative Extension Service County Agents

Question #11. In the past few years, have you obtained any type of solar information from any of the following sources?



* Services and centers whose primary purpose is to disseminate information.
** Some sample frames were questioned about additional information sources which are applicable to their technology. For example, the manufacturers of biomass conversion equipment were also asked if they have obtained any type of solar information from: "the local or national office of the U.S. Department of Agriculture, including Extension and Forestry."
*** These data are based upon a total of 18 respondents.

Figure 9-6. Use of Selected Information Sources: All Cooperative Extension Service State Specialists

- International Solar Energy Society (ISES),
- National Technical Information Service (NTIS),
- Regional Solar Energy Centers (RSEC),
- A commercial data base, and
- Technical Information Center (TIC).

In reviewing Figs. 9-4 through 9-6, all three groups made high use of USDA, "periodicals (etc.)," GPO, and "state energy or solar offices." APH County Agents made significantly ($P<0.05$) more use of DOE than did All County Agents. All State Specialists were significantly ($P<0.05$) more likely to have used "radio or TV" and NTIS.

9.3.2 Membership in Solar-Interested Organizations

Five of the 9 APH County Agents interviewed were members of a professional, technical, or other organization with an interest in solar energy. These organizations (and the number of times mentioned) included:

- Alpha Zeta (agricultural professionals fraternity),
- National Association of County Agricultural Agents (2), and
- Texas County Agents Association.

Also mentioned was Kansas "EAAA," an organization which could not be verified by the authors. The absence of solar-specific organizations was typical of County Agents.

9.3.3 Exposure to Publications on Solar Energy

During the past 6 months, 8 of the 9 APH County Agents had read publications which included information on solar agricultural process heat. The publications they could specify (and the number of times mentioned) included:

- Crops and Soils,
- Extension publications,
- Irrigation Age,
- Kansas Solar Energy Commission publications,
- Kansas State Extension Engineering Department publications,
- Progressive Farmer, and
- Southeast Farm Press publications.

Also mentioned were several publications which could not be verified by the authors. These included "former stockmen," "Farney's papers," and a publication on work at Oakland State on greenhouses. No solar-specific or general interest publications were named.

9.3.4 Use of Special Acquisition Methods

The respondents were asked whether they had obtained any information (not just agricultural process heat or solar energy) in the past year by computer terminal, by Computer Output Microform (COM), or by other microform (e.g., microfiche, microfilm sheets or rolls). Few of the APH County Agents appeared accustomed to using these special acquisition methods, a trait common to All County Agents. In the past year, only 2 of the 9 had used computer terminals, and none had used COM or other microforms. Somewhat larger proportions of All State Specialists had used each of the three forms, but differences were not statistically significant.

9.4 SUMMARY AND COMMENTS

Nine senior agricultural agents in County CES Offices were interviewed. Most had only slight involvement with solar agricultural process heat applications. They were, however, in the process of identifying sources of information and planning experiments on solar APH.

Agricultural Process Heat County Agents were interested in a variety of solar APH applications. They assigned the greatest utility to information on:

- Costs of installing and operating a solar APH system compared to a conventional system;
- Costs and performance of solar APH;
- Tax credits, grants, and other economic incentives for solar APH applications;
- A nontechnical description of how a particular solar APH system works; and
- Lists of technical experts in solar agricultural process heat applications.

They gave low ratings to "computer models," "local building codes," "calendars of conferences and programs," and "institutional, social, environmental, and legal aspects."

APH County Agents were similar to County Agents in other solar technologies in stressing the importance of cost and incentives information and nontechnical descriptions. In their role as information disseminators, County Agents may be reflecting the kinds of information their constituents need.

APH County Agents most often receive solar information through USDA, DOE, and "periodicals, newspapers, and magazines." Most were members of extension or agricultural organizations and these organizations and various farm/agricultural publications also provided them with some solar information.

SECTION 10.0

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APPENDIX A

GROUPS INCLUDED IN STUDY

The following table (Table A-1) lists the 86 groups included in this study of solar information users. Major headings are the same as those of individual reports. Ten separate reports analyzing the study results by technology will be issued.

In general, results for each group are reported in only one volume, although comparisons to similar groups in other technologies are often part of the analysis. There are two exceptions: the results for Concentrating Collector Manufacturers are discussed in both the Solar Thermal Electric Power and the Industrial and Agricultural Process Heat reports; the results for Total Nonconcentrating Collector Manufacturers are discussed in both Active Solar Heating and Cooling and the Industrial and Agricultural Process Heat reports.

Table A-1. GROUPS STUDIED

A. PHOTOVOLTAICS

1. DOE-Funded Researchers
2. Non-DOE-Funded Researchers
3. Researcher Manufacturers
4. Manufacturers
5. Electric Power Engineers
6. Utilities
7. Educators

B. PASSIVE SOLAR HEATING AND COOLING

1. Federally Funded Researchers
2. Manufacturers
3. Architects
4. Builders
5. Educators
6. Cooperative Extension Service (CES) County Agents
7. Homeowners with Passive Systems

C. ACTIVE SOLAR HEATING AND COOLING

1. DOE-Funded Researchers

Table A-1. GROUPS STUDIED (Continued)

C. ACTIVE SOLAR HEATING AND COOLING (cont.)

2. Non-DOE-Funded Researchers
3. Heating and Cooling System Manufacturers
4. Water Heating System Manufacturers
5. Nonconcentrating Collector Manufacturers (see also Industrial and Agricultural Process Heat)
6. Other Component Manufacturers
7. Distributors
8. Installers
9. Architects
10. Builders
11. Planners
12. Heating, Ventilating, and Air Conditioning Engineers
13. Industrial Engineers
14. Utilities
15. Educators
16. CES County Agents
17. Homeowners with Space Heating Systems
18. Homeowners with Water Heating Systems
19. Owners/Managers of Buildings (with SHAC Systems)

D. BIOMASS ENERGY

1. Federally Funded Researchers in Production and Collection
2. Federally Funded Researchers in Conversion
3. Nonfederally Funded Researchers in Production and Collection
4. Nonfederally Funded Researchers in Conversion
5. Production and Collection Equipment Manufacturers

Table A-1. GROUPS STUDIED (Continued)

D. BIOMASS ENERGY (cont.)

6. Conversion Equipment Manufacturers
7. State Forestry Offices
8. Private Foresters
9. Forest Products Engineers and Consultants
10. Educators
11. CES County Agents
12. Owners/Managers of Biomass Systems

E. SOLAR THERMAL ELECTRIC POWER

1. DOE-Funded Researchers
2. Non-DOE-Funded Researchers
3. Concentrating Collector Manufacturers (see also Industrial and Agricultural Process Heat)
4. Electric Power Engineers
5. Utilities
6. Educators

F. INDUSTRIAL (IPH) AND AGRICULTURAL (APH) PROCESS HEAT

1. IPH Researchers
2. APH Researchers
3. Concentrating Collector Manufacturers (see also Solar Thermal Electric Power)
4. Total Nonconcentrating Collector Manufacturers (see also Active Solar Heating and Cooling)
5. Plant Engineers (IPH)
6. Industrial Engineers (IPH)
7. Private Agricultural Engineers (IPH)

Table A-1. GROUPS STUDIED (Continued)

F. INDUSTRIAL (IPH) AND AGRICULTURAL (APH) PROCESS HEAT (cont.)

8. Educators (IPH)
9. State Agricultural Offices (APH)
10. CES County Agents (APH)

G. WIND ENERGY

1. DOE-Funded Researchers
2. Non-DOE-Funded Researchers
3. Manufacturers
4. Distributors
5. Wind Engineers
6. Electric Power Engineers
7. Utilities
8. Educators
9. CES County Agents
10. Small Wind Energy System Owners

H. OCEAN ENERGY SYSTEMS

1. DOE-Funded Researchers
2. Non-DOE-Funded Researchers

I. ENERGY STORAGE

1. DOE-Funded Researchers
2. Non-DOE-Funded Researchers

J. GENERAL SOLAR

1. Loan Officers
2. Real Estate Appraisers

Table A-1. GROUPS STUDIED (Concluded)

J. GENERAL SOLAR (cont.)

3. Tax Assessors
4. Insurers
5. Lawyers
6. Nonsolar Utilities
7. Public Interest Groups
8. CES State Agricultural Specialists
9. CES State Information Specialists
10. State Energy/Solar Offices (Western SUN states)
11. State Energy/Solar Offices (MASEC states)
12. State Energy/Solar Offices (NESEC states)
13. State Energy/Solar Offices (SSEC states)

APPENDIX B

STUDY DEVELOPMENT AND PROCEDURE


SERI

This Appendix describes several aspects of the way in which the studies were developed and conducted.

FACTORS IN STUDY DESIGN

Studies of 86 groups, each interested either in one of nine specific solar technologies or in solar energy in general, provided an extremely broad view of the information needs of the solar community. Although the sample size of nine respondents per group was small, the data still proved to be quite adequate for planning purposes. It was possible to determine which information was the most important to the respondents and what was the best channel for disseminating that information. There were a number of valid statistical tests that could be made, both to compare the priorities a group gave to different information items and to compare the priorities different groups gave to the same item.

Several major factors resulted in the decision to conduct a study with these characteristics. First, there were very few data available on the information needs and information-acquiring activities of the various segments of the solar community, and those data that did exist were related almost exclusively to the area of active solar heating and cooling. Many people had strong opinions as to which information products should be developed first, but data obtained directly from the information users was virtually nonexistent. Due to this general lack of information, most of the potential users of the findings of these studies could not define highly specific questions that they needed to have answered by these studies. Instead, baseline data was needed. It did not make sense to ask a researcher detailed questions on whether he needed a calendar of solar events to be updated monthly or updated quarterly, when no one knew whether he even needed calendars at all. Thus, the lack of baseline data dictated that most of the potential users of study findings framed their questions at the level of "What information do you need the most?" For such a level of questions there was obviously no great need to use large sample sizes to obtain extremely precise, quantitative answers. Since qualitative data would be quite adequate, there was no need for a large sample size.

Further, there was a need to obtain this baseline data as rapidly as possible so that real-time programmatic decisions about development of information products and data bases could be based upon data rather than conjecture. As a result, the decision was made to conduct the studies by telephone in an attempt to speed up the data collection process. Interviewing by telephone also had the result of improving the response rates (over those using a mail questionnaire).

Thus, these factors dictated the final study design: a broad-based study (the final number of groups included, 86, was determined primarily by the number of meaningful sample frames that could be constructed) to collect qualitative data by obtaining completed telephone interviews, with approximately 9 randomly selected respondents from each of the 86 groups being interviewed.

Impact on Questionnaires

As a result of using telephone interviews to conduct the studies, it was necessary to limit the number of questions to be asked. Telephone interviews had to be kept relatively short (preferably under 20 minutes) to keep the respondents from prematurely terminating the interview. Even if a respondent did not hang up in mid- questionnaire, his attention span could be tried severely by lengthy interviews; respondents would then answer

questions without much thought in order to terminate the interview as rapidly as possible. In the final study the interviews took an average of about 18 minutes to complete (with a range from 10 minutes to 50 minutes) and incorporated very simple question formats, sometimes open-ended questions. For each of the 86 studies a separate and distinct sample frame, letter of introduction, and questionnaire were developed and separate computer runs and analyses were performed.

Perhaps a more important effect of deciding to do a telephone study was the necessity of using interviewers without solar backgrounds to conduct the study. With almost 800 interviews to be conducted, each requiring an average of 35 to 40 minutes to complete an 18-minute interview (due to callbacks, referrals, busy signals, wrong numbers, etc.), there was too much effort required to conduct the interviews using internal staff. Thus, the effort had to be contracted. The choice was whether to conduct the interviews by contracting solar experts (who would not know anything about interviewing techniques) or by contracting a professional telephone interview firm (whose interviewers would not know anything about solar energy). Due to the significantly lower cost and to the significantly reduced chance of biasing the responses, it was decided to use a professional telephone interview firm.

As a consequence of this decision, there were some problems caused by using nonsolar interviewers to pose questions of solar experts. If a respondent asked for a question to be clarified, the interviewer could not assist. Instead, the interviewer could only repeat the question. The biggest problem involved the open-ended questions. Sometimes the interviewer simply did not understand what the respondents were talking about. Interviewers were briefed in solar terminology and instructed to ask respondents to spell out words the interviewers did not understand. Nevertheless, some of the verbatims (i.e., quotes from the respondents that were copied down verbatim by the interviewers) were not intelligible. For example, one interviewer recorded "small square train feeders" when the respondent really said "small-scale terrain features," another recorded "nel lenses" instead of "Fresnel lenses." To minimize errors in translation, all of the questionable verbatim items listed in this report were reviewed and verified by Solar Energy Research Institute (SERI) technical experts. However, based upon listening to live interviews and comparing the results to the verbatims, usually the interviewers were able to transcribe the salient points of the responses.

Impact on Statistical Characteristics

The sample size of nine respondents per group was limiting for the analyst. To illustrate the lack of precision in the results, if five of the nine respondents answered "yes" to a particular question, there was a 95% chance that the true proportion saying "yes" was between 0.212 and 0.862. Obviously, this was an extremely wide confidence interval. For such a small sample size, it was not feasible to make national estimates (e.g., the number of Industrial Process Heat Researchers in the country who need bibliographies), and it was not meaningful to construct cross-classification tables (e.g., "type of information needed" versus "degree of informedness"). Because of these small sample sizes, the authors were sometimes forced to propose hypotheses rather than draw conclusions.

Nonetheless, the results were extremely useful when taken as qualitative, baseline results. Certain statistical tests could still be performed (see Appendix E). One could test whether Industrial Process Heat Researchers wanted "state-of-the-art" information significantly more than they wanted "marketing statistics." Several tests could be made comparing one group with another. Thus, one could test whether Passive Architects

wanted cost data significantly more than did Active Solar Heating and Cooling Architects. This type of a comparison usually highlighted basic differences between technologies. One could also test whether Industrial Process Heat Researchers responded differently from All Researchers.

Comparisons of this type were valuable for several reasons. First, they allowed the comparison of the information needs of a relatively unknown group against those of a more familiar group. For example, the information needs of Wind Manufacturers were easier to understand when compared to the more familiar information needs of Solar Heating and Cooling Manufacturers.

Second, if one can establish basic similarities in information habits and the types of information needed, it will eventually become possible to use the results of other information science studies. For example, many studies have detailed the types of information researchers need and the ways of getting information to them. Thus, if Industrial Process Heat Researchers were quite similar in needs to All Researchers, it was an indication that many of the well-known findings for researchers in general may also apply for Industrial Process Heat Researchers.

STUDY DEVELOPMENT

There were several tasks which had to be completed before the studies could be conducted. These tasks are described in the following subsection.

Development of Sample Frames

Sample frame development was the single most difficult, time-consuming task in the entire study. As discussed in Section 2.2, the initial attempt was to obtain lists of the names, addresses, and phone numbers of members of as many meaningful groups as possible. A total of about 86 such sample frames was the maximum that could be developed adequately within a reasonable amount of time.

The services of reference and research librarians were used in this process, much of it on a subcontractor basis. Over 200 documentary sources (printed, published and unpublished sources, and data bases) were consulted. Staff searched the Solar Energy Information Center and Denver-area public and academic libraries to examine directories, catalogs, periodicals, and data bases. Directories of professionals, organizations and associations, and solar-related individuals and groups were examined, both to obtain sample frames and to obtain individual names. Periodicals were searched both to identify associations whose members might be eligible for sample frames and to identify authors who could be contacted because they represented certain target groups. Various data bases were identifed which contained names of individuals categorized by sample frame categories (e.g.; educators, researchers, manufacturers). Lists of conference attendees were accumulated. Sample frames were also constructed by establishing numerous personal contacts with professional, technical, and special interest organizations; with authors of solar articles; technical staff at SERI; federal offices; publishers; solar groups; at least thirty state solar and state energy offices, etc.

Both the Mid-American Solar Energy Complex (MASEC) and the Northeast Solar Energy Center were subcontracted to provide additional names and addresses. Western SUN also provided many names on a voluntary basis. The Southern Solar Energy Center was asked

to participate on either a contractual or a voluntary basis, but declined. Additionally, the Technical Information Dissemination (TID) program subcontracted a consulting firm to develop lists of members of the solar community. Although the resulting lists were significantly smaller than had been anticipated, they provided valuable backup information for some sample frames. The National Solar Heating and Cooling Information Center provided several of the data bases and other lists used.

It sometimes occurred that the person contacted was not in the presumed field: for example an installer was no longer involved with solar energy. The proportion of the time that this or a similar sample-frame error occurred has been calculated for each group and is included in the section documenting the results for the group. Sample frame error included such factors as no known telephone number, individual not in the specified field or specified employment sector, etc. Averaging over all groups, 20%-25% of the candidates in the sample frames were no longer valid.

Pilot Testing

In August 1979 Market Opinion Research (MOR) conducted a pilot test by doing telephone studies of 10 groups (9 respondents for each). The groups were:

- Wind: Engineers,
- Wind: County Extension Agents,
- Active Solar Heating and Cooling: DOE-Funded Researchers,
- Active Solar Heating and Cooling: Installers,
- Active Solar Heating and Cooling: Utilities,
- Active Solar Heating and Cooling: Educators,
- Active Solar Heating and Cooling: Commercial Building Owners,
- Passive Solar Heating and Cooling: Equipment Manufacturers,
- Solar Industrial Process Heat: Industrial Engineers, and
- General Solar Energy: Lawyers.

These groups were selected specifically to test a range of questionnaires, the peculiarities of selected sample frames, and the receptiveness of certain target groups to telephone interviews on solar energy. The persons contacted in the pilot were not contacted in the full study.

The pilot test proved very useful. There were no major revisions resulting, but several refinements improved the interview procedure and the questionnaire content and format. The interviews were completed within a reasonable time, an average of about 18 minutes per interview. The most important finding of the pilot test was the enthusiasm of the respondents for solar energy. Most respondents were very cooperative and were excited about receiving solar information. Because of this attitude interviewers had no difficulty in getting respondents through long lists of information products and sources or in keeping respondents on the telephone to finish the interview.

SERI personnel visited MOR while the pilot test was being conducted, personally participating in monitoring interviews, reviewing tape recordings of previously conducted interviews, and debriefing interviewers. Based upon these inputs, several changes were made

in the basic questionnaire concept, resulting in changes for each of the 86 distinct questionnaires. Among these changes were the addition of a question designed to defuse the respondent by allowing expression of the respondent's individual concerns, deleting two questions which were not working, changing the sequence of a few questions, making a few small wording changes to sharpen questions, and changing MOR's suggested questionnaire format in order to minimize interviewer errors.

Upon realizing that there was more sample frame error than had been anticipated, the screening procedure was revised to a double screening procedure. Only people who said they needed solar information within the next year, and who were truly in the proper group (e.g., "an educator teaching industrial process heat courses") were to be interviewed. The rules for handling referrals were revised to allow interviews with intra-organizational referrals only.

Perhaps the most important change was in the interviewer training procedure. More specific instructions were developed for each question so that the interviewers would know the real point of the question, would ask the question properly, and would know what to emphasize. Lists of words being mispronounced by the interviewers were developed. Specific interviewers with pronunciation problems were singled out for additional coaching. Because of the interviewers' lack of familiarity with solar energy terminology, glossaries and other background information on solar energy were provided to interviewers.

Interviewer Training and Monitoring

The MOR interviewers used for these studies were all experienced interviewers. They went through three separate training sessions: a pilot test briefing, a pilot test debriefing (with question and reaction session), and a full study briefing. The full study briefing was held in four separate sessions so that the interviewers could be trained in small groups. SERI representatives were present for and assisted with the second two sessions.

These training sessions covered the purpose of the study, question wording, recording procedures, the screening procedure, and pronunciation of unfamiliar words. The training was built around the use of an annotated briefing questionnaire. Notes concerning each question were written on a questionnaire, which the interviewer studied during the briefing. Additional written materials covered included a list of solar energy terms, a list of common solar acronyms, and a list of words for pronunciation reminders.

Randomized Selection of Respondents

Once the sample frames were developed for each group, a random sample of 30 to 40 potential respondents was drawn by systematic sampling. (If the sample frame for a group only had 30 to 40 names in the beginning, this step was omitted.) These reduced sample frames were then forwarded to MOR. At MOR, these randomly selected names were put through a second randomization process which assigned the order in which these names were to be called. The MOR process used systematic sampling to identify the first nine candidates for interviewing: the total number of potential candidates was divided by nine to obtain "i," the "skip interval." Starting from a random point (R), every i^{th} name then became one of the first nine candidates.
An initial call and up to two callbacks (at different times of day on different days of the week) were made attempting to reach each designated respondent. If an interview was not completed after three attempts, the interviewer took the questionnaire to the inter-

viewing supervisor. The supervisor then designated the next person in the sequence as the substitute candidate: if the $(R + i)^{th}$ person could not be reached, the $(R + i + 1)^{th}$ became the replacement candidate. If after three attempts to reach the substitute, no interview was completed, this process was repeated. (This time the $(R + i + 2)^{th}$ person would become the candidate, etc.) For the entire study, 54% of the completed interviews were with the originally designated respondent and 26% were with the first substitute. The remainder were completed with a second or higher substitute.

There is evidence that for some sample frames MOR did not use a random starting point to commence the skip interval, but instead used the sequence of 1^{st}, $(1 + i)^{th}$, $(1 + 2i)^{th}$, etc., names for initial candidates. Such a practice clearly does not conform to professional standards. This practice was not critical in those sample frames with a large initial size or no particular order, since SERI did a valid random subsampling to reduce the sample size to 30 or 40. In small sample frames or in frames with a definite pattern, however, this procedure could have caused biases. All seven of the Cooperative Extension Service sample frames were arranged in a state-by-state order. As a result of not randomly changing the starting point, there was a strong tendency towards sampling from the same states for these sample frames. The final distribution of CES respondents by state is shown in Table B-1. Some clustering did occur for some states. Thus, for these groups results were geographically biased.

STUDY PROCEDURE

The procedure was the same for each study. Each of the potential respondents was sent a letter of introduction one to three weeks before they were telephoned (see Appendix C). This letter explained that the person was selected as a candidate and may be called by MOR, that MOR was calling for SERI, the purpose of the call, the type of information being sought, and that the respondent's identity would be kept confidential.

The telephone interviews were conducted in one of MOR's two telephone rooms, with each individual interviewer in an acoustically insulated booth. Throughout the study, interviews were monitored by MOR's phone room supervisors. They were responsible for randomly listening to interviews to determine whether the operators were conducting the interviews correctly. If mistakes were being made, the supervisor explained the proper procedure to the interviewer. The supervisors were able to monitor calls without the interviewers knowing they were being monitored.

Candidates were telephoned during business hours (except for homeowners who were called during the early evening and weekends). If the interview candidate could not be contacted in the initial call, as many as two additional callbacks were made. These callbacks were made at different times of the day and on different days of the week. If no interview was completed after three attempts, a substitute candidate replaced the initial candidate and the process started over. If a secretary indicated the candidate would be in later at a specified time and day, the callback was scheduled correspondingly. If a candidate was too busy to talk when initially contacted, an appointment was made to call back at a specified time. Only 3% of the candidates contacted refused to be interviewed or terminated the interview before it was completed. Once a candidate was contacted, a screening procedure was used to verify that the respondents being interviewed actually represented the group to which they ostensibly belonged. For example, a respondent who was presumably an educator teaching courses in solar industrial process heat was read the following statement at the beginning of the interview:

Table B-1. COOPERATIVE EXTENSION SERVICE (CES): STATES REPRESENTED IN SAMPLES[a] (Number of Respondents)

State	County Agents						State Specialists			All CES
	Bio-mass	Wind	APH	Pas-sive	Ac-tive	Total	Infor-mation	Agricul-tural	Total	
Alabama	-	1	-	1	-	2	-	-	-	2
California	-	1	-	-	-	1	-	-	-	1
Colorado	-	1	-	-	1	2	-	-	-	2
Connecticut	-	-	-	-	-	-	1	-	1	1
Delaware	-	-	-	-	-	-	-	1	1	1
Georgia	-	-	-	1	-	1	-	-	-	1
Idaho	-	-	1	-	-	1	1	1	2	3
Illinois	-	1	-	-	-	1	-	-	-	1
Indiana	2	1	-	1	1	5	-	-	-	5
Iowa	-	1	-	-	-	1	-	-	-	1
Kansas	-	-	2	-	1	3	-	-	-	3
Kentucky	-	1	-	1	-	2	1	1	2	4
Louisiana	-	-	-	-	-	-	1	-	1	1
Maryland	1	-	-	-	-	1	-	-	-	1
Michigan	-	1	-	-	-	1	1	1	2	3
Minnesota	-	-	-	1	1	2	-	-	-	2
Missouri	-	1	-	-	-	1	-	-	-	1
Montana	1	-	-	-	1	2	-	-	-	2
Nebraska	-	-	1	1	1	3	1	1	2	5
New Mexico	1	-	-	-	-	1	-	-	-	1
New York	-	-	-	-	-	-	1	1	2	2
N. Carolina	-	-	1	1	-	2	-	-	-	2
Ohio	1	-	-	-	1	2	-	-	-	2
Oklahoma	-	-	1	-	-	1	1	-	1	2
Oregon	1	-	-	-	-	1	-	-	-	1
S. Carolina	-	-	-	-	-	-	-	1	1	1
S. Dakota	-	-	1	1	1	3	1	-	1	4
Tennessee	1	-	1	1	-	3	-	-	-	3
Texas	1	-	1	-	1	3	-	1	1	4
W. Virginia	-	-	-	-	-	-	-	1	1	1
Sample Size by Technology	9	9	9	9	9	45	9	9	18	63
Total States Represented	8	9	8	9	9	24	9	9	13	30[a]

[a]States not represented in any CES samples are: Arizona, Arkansas, Florida, Maine, Massachusetts, Mississippi, Nevada, New Hampshire, New Jersey, North Dakota, Pennsylvania, Rhode Island, Utah, Vermont, Virginia, Washington, Wisconsin, and Wyoming. Alaska and Hawaii were not included in the sample frame.

> Hello (respondent's name). This is (interviewer's name) of Market Opinion Research. A week or so ago you were sent a letter from the Solar Energy Research Institute describing a survey of solar energy information needs and requesting your participation.
>
> Your name has been provided to us as someone who has been teaching courses related to solar industrial process heat. Is that correct?

If the respondent answered "yes," the interview continued. If the respondent answered "no," then the respondent was not interviewed but instead was asked if there was another person within the same university who was teaching courses related to solar industrial process heat. If the initial candidate could give the name of another person, the referral person (or "referral") was called as a substitute for the initial candidate. If no intra-organizational referral was given, another candidate was telephoned.

A second screen was used to eliminate those people who did not feel they would be needing information in the near future. For example, industrial process heat respondents were asked the following two questions:

- In the next year do you expect to need information on solar industrial process heat systems for your job?
- In the next year do you expect to need information on solar industrial process heat systems outside your job?

If the answer to both questions was "no," the interview was terminated and a substitute candidate telephoned. No request for a referral was made.

Once an interview was completed, the questionnaire was reviewed for completeness by the phone room supervisor. Incomplete questionnaires were returned to interviewers to recall the respondents.

Completed questionnaires were forwarded from the phone rooms to the Coding Department where they were checked in and assigned a unique identification number. They were subsequently sent to the Data Entry Department where they were keyed directly into computer data files. Since no computerized editing system could prevent the incorrect entry of a data value that was within the proper range (e.g., entering a "3" when the correct number was a "2" but where the numbers "1," "2," "3," and "4" are all valid numbers), SERI did a random sample of supposedly correct values to verify that they were correct. Out of 225 allowable values reviewed, only 1 had been incorrectly entered. Once the data were entered on the computer file, data tables were printed and analyzed.

Nonuniform Group Sample Size. The study was originally designed to sample nine respondents from each group. For most groups this was done correctly. Upon analysis of the completed questionnaires, however, it was sometimes apparent that a respondent obviously belonged in a group other than the one in which originally sampled. This was generally due to two simultaneous errors: a sample frame error and a screening error.

First, the person was included on the wrong sample frame. For example, a person listed as doing non-DOE-funded research could have received DOE funding after the sample frames were completed. Second, the screening process did not successfully remove this person from the Non-DOE-Funded Researchers; instead the interview was completed.

During the interview the respondent mentioned that he was receiving DOE funds for his/her research. As a result the analyst received eight interviews completed with Non-DOE-Funded Researchers and one completed with a DOE-Funded Researcher.

For such cases, the dissimilar interview was removed from the original group (in the example above, the Non-DOE-Funded Researchers). If there was another group into which that interview naturally fit (above, the DOE-Funded Researchers), the interview was included with the interviews for the second group. Although the added interview did not have exactly the same probability of selection as did the original interviews, the resulting inaccuracy was minimal given the qualitative nature of the data.

APPENDIX C

LETTER OF INTRODUCTION

All potential respondents from the initial sample frames were sent the following letter (see Fig. C-1) from one to three weeks prior to being contacted by telephone. There are three phrases (underlined in this example) which were changed to describe the group and the solar technology. For example, "a researcher" was changed to read "a manufacturer" or "an educator," etc., as appropriate for the specific sample frame. Similarly, "passive solar heating and cooling" read "photovoltaics" or "wind energy systems," etc., according to the technology about which this potential respondent was to be interviewed. About 3,500 such letters were mailed over a period of several weeks. Less than 100 were returned as undeliverable.

It should be noted that in cases where the actual respondent was a referral, the respondent had not necessarily received this letter.

There were numerous telephone calls to the Solar Energy Research Institute (SERI) from people who had received this letter. Most volunteered they were eager to participate (and concerned that they had not yet been called) or that they wanted study results. A few volunteered referrals or gave the best times for them to be called.

September, 1979

Dear Colleague:

The Solar Energy Research Institute (SERI) is currently developing a Solar Energy Information Data Bank (SEIDB). The SEIDB is designed to include many categories of solar information and will serve the needs of a variety of groups: among them, researchers, manufacturers, architects, builders, lawyers, and homeowners. Services provided to you by the SEIDB may include an inquiry response service, computer access to models or large sets of data and free brochures, handbooks, etc.

The U.S. Department of Energy has defined solar energy as encompassing technologies which involve both direct and indirect uses of sunlight; information for all of the following technologies will be included in the SEIDB:

Solar heating and cooling (active)
Solar heating and cooling (passive)
Solar agricultural process heat
Solar industrial process heat
Wind energy conversion systems
Biomass energy systems
Photovoltaics (direct conversion of sunlight to electricity)
Ocean energy systems
Solar thermal electric power
Solar energy storage

So that this data bank can be developed to meet your present or future solar information needs, SERI is surveying information users like yourself. You have been selected as a candidate for this interview because you are a researcher with an active or potential interest in passive solar heating and cooling.

We believe your participation in this survey will be beneficial to you and to the country. If called, you will have an opportunity to express your opinions and to define your solar information needs. This will help us ensure that the data bank will be responsive to the needs of researchers as well as those of other groups.

Market Opinion Research of Detroit, Michigan, has been chosen to conduct this survey for SERI. A trained interviewer may contact you within two weeks to interview you. The telephone interview will last no more than 20 minutes. You can be assured that your responses to this survey are strictly confidential. No names will be used in reporting the results.

If you have questions about this survey, its purpose, or the interview methods to be used, please feel free to contact me at (303) 231-1155. Thank you for your assistance.

Sincerely,

Barbara L. Wood

Barbara L. Wood,
Staff Market Research Information Specialist,
Information Dissemination Branch,
Information Systems Division

Figure C-1. Letter of Introduction

APPENDIX D

STUDY QUESTIONNAIRE

A different questionnaire was developed for each distinct group in this study. These questionnaires were very similar, however, in that the same type of information was being sought from each of the groups. The individual questionnaires were developed by constructing a core questionnaire, then making appropriate revisions, additions, and deletions to produce a distinctly tailored questionnaire for each group.

Two sample questionnaires are provided in this appendix. The first is for the solar industrial process heat groups and the second is for the solar agricultural process heat groups. The basic difference between these questionnaires is in Question 6, which either asks about applications for industrial process heat (IPH) or agricultural process heat (APH). The manufacturers discussed in this report were asked about active solar heating and cooling, or about solar energy in general, rather than about process heat. Otherwise their questionnaires were similar.

The questionnaires used in the IAPH studies were very similar to those used for the other studies. The two instruments which follow (see Figs. D-1 and D-2) contain references to solar industrial or agricultural process heat in Questions 1 through 9. Questionnaires that were used for respondents from other technologies substituted references to their appropriate technologies instead of to industrial or agricultural process heat.

Certain variations were made in the solar industrial and agricultural process heat questionnaires for different IAPH groups in Questions 8a, 8b, and 11, in that certain items were not asked of groups if the item seemed inappropriate. For example, Industrial Process Heat Researchers were not asked Question 8b (11) about "how to market," and Agricultural Process Heat Cooperative Extension Service (CES) County Agents were not asked Question 11 (7) about Smithsonian Science Information Exchange (SSIE). While it would have been less complicated to have all questions asked of all respondents, concern over questionnaire length and the desire to avoid asking questions that were not relevant to the group led to deleting questions wherever possible. Questions that were not asked of each group may be noted in the data tables (Appendix F) whenever an individual group shows no entries for that item.

Slight variations in wording were made on the questionnaire of each individual group. For example, in Question 11(18), which asked if information had been obtained from "some other state or local government office or publication," the phrase "other than your own" was inserted for APH State Agricultural Office Representatives and APH CES County Agents.

Standard Core Questionnaire

Question 5. This question asked, "What is the most important information that could be provided to you about solar industrial or agricultural process heat?" This question allowed respondents to volunteer the information need that came to mind spontaneously, without reflecting any of the biases of the questionnaire designers as to what was the most important. Most of the time, however, it did not result in an answer which could be compared to another respondent's answer: for nine respondents, there were typically seven or eight distinct answers given. Since each respondent did not rate each of these items, it was impossible to determine which of these information needs was the most important. Afforded a second thought, respondents often gave items they had mentioned as "most important" in Question 5 a lower rating in Question 8 than they gave to items that they had not even mentioned in Question 5. As a result, the data from Question 5 could not provide a valid measurement of the most important information items which

Cd 1

1. In the next year do you expect to need information on solar industrial process heat. . . .

(a) For your job? Yes. 1
No 2
Don't know 8
NA 9

(IF "YES", CONTINUE. OTHERWISE TERMINATE)

(b) NOT ASKED. 0

31
32

---

2. To what extent are you currently involved with solar energy for industrial process heat? Would you say you are:

Very involved. 4
Moderately involved or 3
Slightly involved. 2
Not at all involved. (VOLUNTEERED) .1
Don't know. 8
NA. 9

33

---

3. What are you doing in the field of solar energy for industrial process heat? (ASK AS OPEN END)

Verb.

---

4. How well informed would you say you are about solar energy for industrial process heat? Would you say you are:

Very informed. 4
Moderately informed or 3
Slightly informed. 2
Not at all informed. (VOLUNTEERED) . 1
Don't know. 8
NA. 9

34

---

5. What is the most important information that could be provided to you about solar industrial process heat? (INTERVIEWER: THIS INCLUDES INFORMATION WHICH COULD BE PROVIDED BY AN INFORMATION CENTER)

1st mention

35
C+V

2nd mention

36-42 Blk

Figure D-1. Questionnaire

Cd 2
1-10 as 1
11-75 Blk
76 Cd #
77-80 Job #

6. For which of the following areas of solar industrial process heat are you particularly interested in obtaining information? (READ LIST. CIRCLE ONE RESPONSE PER ITEM.)

		Yes	No	Don't Know	NA	Cd 3 1-10 as 1 11-19 Blk
(1)	Hot water	1	2	8	9	20
(2)	Low-temperature steam (UNDER 350 DEGREES F)	1	2	8	9	21
(3)	High-temperature steam	1	2	8	9	22
(4)	Hot air (UNDER 350 DEGREES F)	1	2	8	9	23
(5)	Direct heat (OVER 650 DEGREES F)	1	2	8	9	24
(6)	Refrigeration	1	2	8	9	25

26-43 Blk

Are there any other areas of solar industrial process heat for which you are especially interested in obtaining information? (SPECIFY)

44 C+V

45-51 Blk

(1st Mention) _____

(2nd Mention) _____

7. What publications have you read in the past six months that include information on solar industrial process heat?

None. 001

Read, but can't remember titles (VOLUNTEERED) . 002

52-54

Read too many to name 003
(VOLUNTEERED)
(ASK) Which are most important?
(RECORD TITLES)

Names publications (RECORD TITLES) 004

1st Mention _____

2nd Mention _____

3rd Mention _____ CL

55-75 Blk
76 Cd #
77-80 Job #

Figure D-1. Questionnaire (continued)

Cd 1

8a. I will read a list of potential information products on solar industrial process heat. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful or not at all useful? (READ LIST. ROTATE. CIRCLE ONE RESPONSE PER ITEM.)

		Essential	Very Useful	Somewhat Useful	Not At All Useful	Don't Know	NA	
(1)	A bibliography of general readings on solar industrial process heat applications.	4	3	2	1	8	9	43
(2)	A list of sources for information on solar industrial process heat. . .	4	3	2	1	8	9	44
(3)	A calendar of upcoming solar industrial process heat conferences and programs.	4	3	2	1	8	9	45
(4)	Diagrams or schematics of a solar industrial process heat system.	4	3	2	1	8	9	46
(5)	A non-technical description of how a particular solar industrial process heat system works.	4	3	2	1	8	9	47
(6)	A technical description of how a particular solar industrial process heat system works. . .	4	3	2	1	8	9	48
(7)	Lists of local lenders, insurers, builders, installers or distributors for solar industrial process heat systems.	4	3	2	1	8	9	49
(8)	Solar industrial process heat design handbooks, installation handbooks, or reference tables. . .	4	3	2	1	8	9	50
(9)	A list of technical experts in solar industrial process heat. . .	4	3	2	1	8	9	51
(10)	Manual methods for sizing and predicting the engineering performance or life cycle costs of solar industrial process heat systems. . .	4	3	2	1	8	9	52
(11)	Computer models for sizing and predicting the engineering performance or life cycle costs. . . .	4	3	2	1	8	9	53

Figure D-1. Questionnaire (continued)

8b. I will next read a list of types of information on solar industrial process heat. For each, please tell me how useful information of that type would be to you. Would the following be: essential, very useful, somewhat useful or not at all useful? (READ LIST. ROTATE. CIRCLE ONE RESPONSE PER ITEM). Cd 1 54 8

		Essential	Very Useful	Somewhat Useful	Not At All Useful	Don't Know	NA	
(1)	Educational institutions and other organizations offering courses on solar industrial process heat. . .	4	3	2	1	8	9	55
(2)	Solar industrial process heat research currently in progress. . .	4	3	2	1	8	9	56
(3)	The state-of-the-art in solar industrial process heat.	4	3	2	1	8	9	57
(4)	Costs and performance of solar industrial process heat installations. . .	4	3	2	1	8	9	58
(5)	Costs of installing and operating a solar industrial process heat system compared to a conventional system. .	4	3	2	1	8	9	59
(6)	Local building codes or other regulations affecting siting or installation of solar industrial process heat systems	4	3	2	1	8	9	60
(7)	Tax credits, grants, or other economic incentives for solar industrial process heat applications	4	3	2	1	8	9	61
(8)	Standards, specifications, or certification programs for solar industrial process heat equipment and installations. . . .	4	3	2	1	8	9	62
(9)	Marketing statistics and sales projections for solar industrial process heat equipment.	4	3	2	1	8	9	63
(10)	Solar industrial process heat programs, research, industries and markets outside the United States. . .	4	3	2	1	8	9	64
(11)	Information on how to market and sell solar industrial process heat systems, including guidelines on obtaining financial support.	4	3	2	1	8	9	65
(12)	Institutional, social, environmental, and legal aspects of solar industrial process heat applications.	4	3	2	1	8	9	66
(13)	Expected major developments in solar industrial process heat during the next ten years.	4	3	2	1	8	9	67
(14)	Climatological data such as wind, weather, or amount of sunshine. . .	4	3	2	1	8	9	68

Figure D-1. Questionnaire (continued)

Cd 4
1-10 as 1

9. Is there solar industrial process heat information which you need but are not able to get?

- Yes 1
- Yes (BUT CAN'T DESCRIBE) 2
- No 3
- Don't know 8
- NA 9

11

(IF YES) What information do you need?

1st mention

2nd mention

Verb.

10. In the past year have you obtained any information, not just solar, in the following forms? (READ LIST. CIRCLE ONE RESPONSE PER ITEM)

	Yes	No	Don't Know	NA	
(a) On-line access to a central data bank via computer terminal	1	2	8	9	12
(b) Microform from a computer, sometimes referred to as C-O-M	1	2	8	9	13
(c) Other microforms, for example, microfiche, microfilm sheets or rolls	1	2	8	9	14

15-16 Blk

Figure D-1. Questionnaire (continued)

Cd 4

11. Solar information refers to information about any solar technology, and factors which may relate to its use such as weather, economics, legislation, architecture, environment, etc. In the past few years, have you obtained any type of solar information from any of the following sources? (READ LIST. CIRCLE ONE RESPONSE PER ITEM.)

		Yes	No	Don't Know	NA	
(1)	Your organizational library or a local library. . .	1	2	8	9	17
(2)	A public utility company. . .	1	2	8	9	18
(3)	An installer, builder, designer or manufacturer of solar systems. . .	1	2	8	9	19
(4)	Workshops, conferences or training sessions. . .	1	2	8	9	20
(5)	A commercial data base, for example, Lockheed, SDC, BRS. .	1	2	8	9	21
(6)	A federal library or information center, for example, the National Agricultural Library or the Environmental Data System. . .	1	2	8	9	22
(7)	Smithsonian Science Information Exchange (SSIE) . . .	1	2	8	9	23
(8)	The Government Printing Office (GPO) . .	1	2	8	9	24

How would you evaluate the service you received from GPO?

Good	3
Fair	2
Poor	1
Don't know	8
NA	9

25

What are some of the reasons you do not consider their service "good"?

1st Mention_____

2nd Mention_____

Verb.

(9)	National Technical Information Service (NTIS). . . .	1	2	8	9	26

How would you evaluate the service you received from NTIS?

Good	3
Fair	2
Poor	1
Don't know	8
NA	9

27

What are some of the reasons you do not consider their service "good"?

1st Mention_____

2nd Mention_____

Verb.

Figure D-1. Questionnaire (continued)

(Cont'd)

Cd 4

	Yes	No	Don't know	NA	
(10) Technical Information Center at Oak Ridge (TIC) . . .	1	2	8	9	28

How would you evaluate the service you received from TIC?

Good	3
Fair	2
Poor	1
Don't know	8
NA	9

29

What are some of the reasons you do not consider their service "good"?

1st Mention_____

2nd Mention_____

Verb.

(11) National Solar Heating and Cooling Information Center. .	1	2	8	9	30

How would you evaluate the service you received from the center?

Good	3
Fair	2
Poor	1
Don't know	8
NA	9

31

What are some of the reasons you do not consider their service "good"?

1st Mention_____

2nd Mention_____

Verb.

(12) Regional Solar Energy Centers. . . .	1	2	8	9	32

How would you evaluate the service you received from your regional center?

Good	3
Fair	2
Poor	1
Don't know	8
NA	9

33

What are some of the reasons you do not consider their service "good"?

1st Mention_____

2nd Mention_____

Verb.

Figure D-1. Questionnaire (continued)

Cd 4

(Cont'd)	Yes	No	Don't Know	NA	
(13) Directly from the U. S. Department of Energy. . .	1	2	8	9	34
(14) Radio or TV	1	2	8	9	35
(15) Periodicals, newspapers or magazines.	1	2	8	9	36
(16) Private solar energy or environmental organizations . . .	1	2	8	9	37
(17) State Energy or Solar Offices . . .	1	2	8	9	38
(18) Some other state or local government office or publication.	1	2	8	9	39
(19) The local chapter or national headquarters of the International Solar Energy Society (ISES), including their publications.	1	2	8	9	40
(20) The local chapter or national headquarters of the Solar Energy Industries Association (SEIA), including their publications. . . .	1	2	8	9	41
(21) NOT ASKED				0	42
(22) NOT ASKED				0	43
(23) NOT ASKED				0	44
(24) NOT ASKED				0	45

46-47 Blk

Figure D-1. Questionnaire (continued)

Cd 4

In conclusion, I would like to ask you some questions about yourself. Your answers will be kept completely confidential.

D1a. What is the highest level of education you have completed? (DO NOT READ)

8th grade or less	01	48-49
Some high school	02	
High school graduate	03	
Post high school vocational/ Technical	04	
Attended college/University:		
No degree	05	
Associate (2 year junior/ Community college)	06	
Bachelors	07	
Masters	08	
Ph.D/Doctorate	09	
JD/LLD	10	
Other _____ (SPECIFY)	11	
Don't know	98	
NA	99	

D1b. In what field is your most recent degree? _____ (RECORD) Verb.

D1c. In what year did you get that degree? _____ (YEAR) 50-51

D2a. Please describe your present profession by completing the following statement: "Based on my total education and experience, I now regard myself professionally as a (an) "_____." (AVOID USING JOB TITLE IF POSSIBLE). Verb.

D2b. How many years have you been in this profession? (CIRCLE CODE)

0-2	1	52
3-5	2	
6-10	3	
Over 10	4	
NA	9	

Figure D-1. Questionnaire (continued)

Cd 4

D3. Do you belong to any professional, technical, or other organizations which have an interest in solar?

- Yes 1
- Yes (BUT CAN'T NAME) 2
- No 3
- Don't know 8
- NA 9

53

a. What organizations?

1st Mention _____

2nd Mention _____ CL

3rd Mention _____

4th Mention _____

54-69 Blk

Thank you very much for your time.

Figure D-1. Questionnaire (concluded)

Cd 1

1. In the next year, do you expect to need information on solar agricultural process heat. . . .

(a) For your job? Yes. . . . . [1]
No. 2
Don't know. 8
NA. 9

(b) Outside of your job? Yes. . . . . [1]
No 2
Don't know 8
NA 9

(IF "YES" TO EITHER, CONTINUE OTHERWISE TERMINATE)

31
32

---

2. To what extent are you currently involved with solar agricultural process heat? Would you say you are:

Very involved. 4
Moderately involved, or. 3
Slightly involved. 2
Not at all involved (VOLUNTEERED). .1
Don't know 8
NA. 9

33

---

3. What are you doing in the field of solar agricultural process heat? (ASK AS OPEN END)

Verb.

---

4. How well informed would you say you are about solar agricultural process heat? Would you say you are:

Very informed 4
Moderately informed, or 3
Slightly informed 2
Not at all informed (VOLUNTEERED) . 1
Don't know. 8
NA. 9

34

---

5. What is the most important information that could be provided to you about solar agricultural process heat? (INTERVIEWER: THIS INCLUDES INFORMATION WHICH COULD BE PROVIDED BY AN INFORMATION CENTER)

1st Mention

2nd Mention

35 C+V

36-42 Blk

Figure D-2. User Questionnaire

Cd 2 1-10 as 1
11-75 Blk
76 Cd #
77-80 Job #
Cd 3
1-10 as 1
11-26 Blk

6. For which of the following areas of solar agricultural process heat are you particularly interested in obtaining information? [READ LIST. CIRCLE ONE RESPONSE PER ITEM.]

	Yes	No	Don't Know	NA	
(1) Livestock shelter heating	1	2	8	9	27
(2) Grain drying	1	2	8	9	28
(3) Crop drying	1	2	8	9	29
(4) Greenhouses	1	2	8	9	30
(5) Food processing	1	2	8	9	31

Are there any other areas of solar agricultural process heat for which you are especially interested in obtaining information? (SPECIFY) 32-43 Blk

44 C+V
45-51 Blk

1st Mention _____

2nd Mention _____

7. What publications have you read in the past six months that include information on solar agricultural process heat?

None. 001

Read but can't remember titles. 002
(VOLUNTEERED)

Read too many to name
(VOLUNTEERED). 003
(ASK) Which are most important?
(RECORD TITLES)

Names publications
(RECORD TITLES) 004

52-54

1st Mention _____

2nd Mention _____

3rd Mention _____

CL

55-75 Blk
76 Cd #
77-80 Job #

Figure D-2. User Questionnaire (continued)

Cd 1

8a. I will read a list of potential information products on solar agricultural process heat. For each, please tell me how useful that information would be to you. Would the following be: essential, very useful, somewhat useful, or not at all useful? (READ LIST. ROTATE. CIRCLE ONE RESPONSE PER ITEM)

	Essential	Very Useful	Somewhat Useful	Not At All Useful	Don't Know	NA	
(1) A bibliography of general readings on solar agricultural process heat. . . .	4	3	2	1	8	9	43
(2) A list of sources for information on solar agricultural process heat. . .	4	3	2	1	8	9	44
(3) A calendar of upcoming solar agricultural process heat conferences and programs.	4	3	2	1	8	9	45
(4) Diagrams or schematics of a solar agricultural process heat system. .	4	3	2	1	8	9	46
(5) A non-technical description of how a particular solar agricultural process system works. . .	4	3	2	1	8	9	47
(6) A technical description of how a particular solar agricultural process system works. . .	4	3	2	1	8	9	48
(7) Lists of lenders, insurers, builders, engineers, installers, manufacturers or distributors for solar agricultural process heat systems.	4	3	2	1	8	9	49
(8) Solar agricultural process heat design handbooks, installation handbooks, or reference tables	4	3	2	1	8	9	50
(9) A list of technical experts in solar agricultural process heat applications. . . .	4	3	2	1	8	9	51
(10) Manual methods for sizing and predicting the engineering performance or life cycle costs of solar agricultural process systems. . .	4	3	2	1	8	9	52
(11) Computer models for sizing and predicting the engineering performance or life cycle costs . . .	4	3	2	1	8	9	53

Figure D-2. User Questionnaire (continued)

Cd 1

8b. I will next read a list of types of information on solar agricultural process heat. For each, please tell me how useful information of that type would be to you. Would the following be: essential, very useful, somewhat useful or not at all useful? (READ LIST. ROTATE. CIRCLE ONE RESPONSE PER ITEM).

		Essential	Very Useful	Somewhat Useful	Not At All Useful	Don't Know	NA	
(1)	Educational institutions and other organizations offering courses on solar agricultural process heat . . .	4	3	2	1	8	9	55
(2)	Solar agricultural process heat research currently in process. . .	4	3	2	1	8	9	56
(3)	The state-of-the-art in solar agricultural process heat . . .	4	3	2	1	8	9	57
(4)	Costs and performance of solar agricultural process heat installations.	4	3	2	1	8	9	58
(5)	Costs of installing and operating a solar agricultural process heat system compared to a conventional system. .	4	3	2	1	8	9	59
(6)	Local building codes or other regulations affecting siting or installation of solar agricultural process heat systems.	4	3	2	1	8	9	60
(7)	Tax credits, grants, or other economic incentives for solar agricultural process heat applications.	4	3	2	1	8	9	61
(8)	Standards, specifications, or certification programs for solar agricultural process heat equipment and installations.	4	3	2	1	8	9	62
(9)	Marketing statistics and sales projections for solar agricultural process heat equipment.	4	3	2	1	8	9	63
(10)	Solar agricultural process heat programs, research, industries and markets outside the United States. .	4	3	2	1	8	9	64
(11)	Information on how to market and sell solar agricultural process heat systems, including guidelines on obtaining financial support. . . .	4	3	2	1	8	9	65
(12)	Institutional, social, environmental, and legal aspects of solar agricultural process heat applications. .	4	3	2	1	8	9	66
(13)	Expected major developments in solar agricultural process heat during the next ten years.	4	3	2	1	8	9	67
(14)	Climatological data such as wind, weather, or amount of sunshine. . .	4	3	2	1	8	9	68

69-75B
76 Cd #
77-80 Job#

Figure D-2. User Questionnaire (continued)

Cd 4
1-10 as 1

9. Is there solar agricultural process heat information which you need but are not able to get?

- Yes 1
- Yes (BUT CAN'T DESCRIBE) 2
- No 3
- Don't know 8
- NA 9

11

(IF YES) What information do you need?

1st Mention Verb.

2nd Mention

10. In the past year, have you obtained any information, not just solar, in the following forms? (READ LIST. CIRCLE ONE RESPONSE PER ITEM)

	Yes	No	Don't know	NA	
(a) On-line access to a central data bank via computer terminal	1	2	8	9	12
(b) Microform from a computer, sometimes referred to as C-O-M	1	2	8	9	13
(c) Other microforms, for example, microfiche, microfilm sheets or rolls	1	2	8	9	14

15-16 Blk

Figure D-2. User Questionnaire (continued)

Cd 4

11. Solar information refers to information about any solar technology, and factors which may relate to its use such as weather, economics, legislation, architecture, environment, etc. In the past few years, have you obtained any type of solar information from any of the following sources? [READ LIST. CIRCLE ONE RESPONSE PER ITEM.]

		Yes	No	Don't Know	NA	
(1)	Your organizational library or a local library. . .	1	2	8	9	17
(2)	A public utility company. . .	1	2	8	9	18
(3)	An installer, builder, designer or manufacturer of solar systems. . .	1	2	8	9	19
(4)	Workshops, conferences or training sessions. . .	1	2	8	9	20
(5)	A commercial data base, for example, Lockheed, SDC, BRS. .	1	2	8	9	21
(6)	A Federal library or information center, for example, the National Agricultural Library or the Environmental Data System. . .	1	2	8	9	22
(7)	Smithsonian Science Information Exchange (SSIE) . . .	1	2	8	9	23
(8)	The Government Printing Office (GPO)	1	2	8	9	24

How would you evaluate the service you received from GPO?

Good 3
Fair 2
Poor 1
Don't know 8
NA 9

25

What are some of the reasons you do not consider their service "good"?

1st Mention _____

2nd Mention _____

Verb.

(9)	National Technical Information Service (NTIS). . . .	1	2	8	9	26

How would you evaluate the service you received from (NTIS)?

Good 3
Fair 2
Poor 1
Don't know 8
NA 9

27

What are some of the reasons you do not consider their service "good"?

1st Mention _____

2nd Mention _____

Verb.

Figure D-2. User Questionnaire (continued)

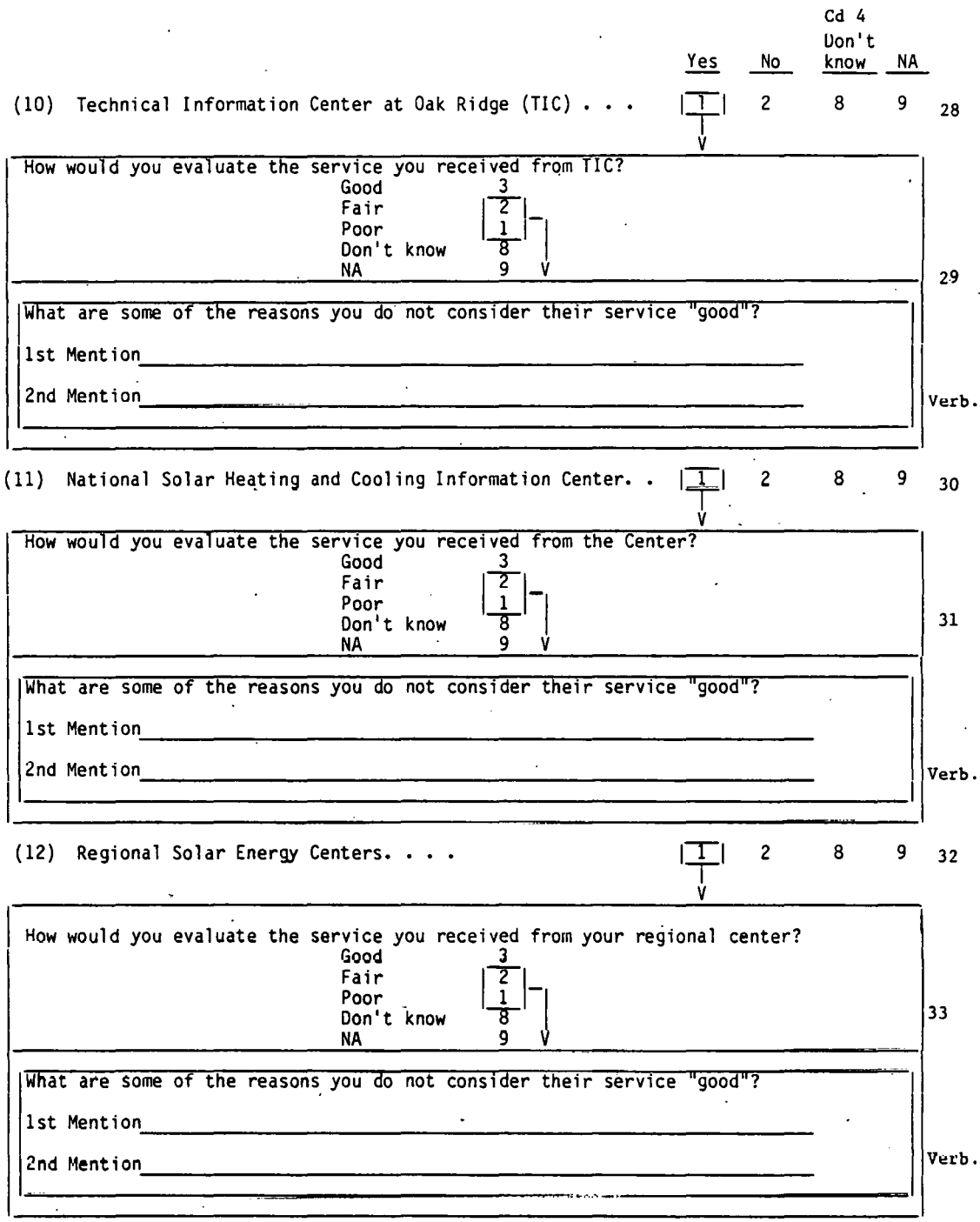

Figure D-2. User Questionnaire (continued)

Cd 4

		Yes	No	Don't Know	NA	
(13)	Directly from the U. S. Department of Energy. . .	1	2	8	9	34
(14)	Radio or TV	1	2	8	9	35
(15)	Periodicals, newspapers or magazines. . . .	1	2	8	9	36
(16)	Private solar energy or environmental organizations . . .	1	2	8	9	37
(17)	State Energy or Solar Offices . . .	1	2	8	9	38
(18)	Some other state or local government office or publication (other than your own)	1	2	8	9	39
(19)	The local chapter or national headquarters of the International Solar Energy Society (ISES), including their publications.	1	2	8	9	40
(20)	The local chapter or national headquarters of the Solar Energy Industries Association (SEIA), including their publications. . . .	1	2	8	9	41
(21)	USDA, including the Cooperative Extension Service. . . .	1	2	8	9	42
(22)	NOT ASKED				0	43
(23)	NOT ASKED				0	44
(24)	NOT ASKED				0	45

46-47 Blk

Figure D-2. User Questionnaire (continued)

Cd 4

In conclusion, I would like to ask you some questions about yourself. Your answers will be kept completely confidential.

D1a. What is the highest level of education you have completed? (DO NOT READ)

8th grade or less	01	48-49
Some high school	02	
High school graduate	03	
Post high school vocational/ Technical	04	
Attended college/University:		
No degree	05	
Associate (2 year junior/ Community college)	06	
Bachelors	07	
Masters	08	
Ph.D/Doctorate	09	
JD/LLD	10	
Other _____ (SPECIFY)	11	
Don't know	98	
NA	99	

D1b. In what field is your most recent degree? _____ (RECORD) Verb

D1c. In what year did you get that degree? _____ (YEAR) 50-51

D2a. Please describe your present profession by completing the following statement: "Based on my total education and experience, I now regard myself professionally as a (an) _____." (AVOID USING JOB TITLE IF POSSIBLE).

Verb.

D2b. How many years have you been in this profession? (CIRCLE CODE)

0-2	1	52
3-5	2	
6-10	3	
Over 10	4	
NA	9	

Figure D-2. User Questionnaire (continued)

Cd 4

D3. Do you belong to any professional, technical, or other organizations which have an interest in solar?

- Yes 1
- Yes (BUT CAN'T NAME) 2
- No 3
- Don't know 8
- NA 9

53

a. What organizations?

1st Mention _____

2nd Mention _____ CL

3rd Mention _____

4th Mention _____

54-69 Blk

Thank you very much for your time.

Figure D-2. User Questionnaire (concluded)

could be provided to the respondent. Therefore, this report refers to the responses to Question 5 as "information which was important for the respondents to obtain."

Question 6. In this question, a list of different solar industrial or agricultural process heat (IAPH) applications was read to the respondent, and the respondent was asked which application he/she was particularly interested in obtaining information for. After this was completed, respondents were asked, "Are there any other areas of solar IAPH for which you are particularly interested in obtaining information?" Responses to this question fell into one of two areas: additional IAPH applications of interest or specific types of information wanted. The former were discussed with other results from Question 6; the latter were included with the responses from Question 5.

Question 8. In this question a list of up to 25 specific information products or types of information was read to the respondent. The respondent rated each item as "essential," "very useful," "somewhat useful," or "not at all useful" as it applied to himself. In contrast to Question 5, this question assessed each respondent's ratings for each of a set of items that the study designers thought might be important to the respondents. Question 8 did not allow respondents to add and rate items not already on the list. To reduce the possibility of introducing bias due to item order within Question 8, the interviewers rotated their starting point by randomly selecting which item would be read to the respondent first. Items in Question 8a were rotated separately from those in Question 8b.

Question 9. This question asked, "Is there any solar IAPH information which you need but are not able to get?" Unfortunately, this question just did not work. Answering Questions 8a and 8b required the respondent to assign a rating to each of 22-25 information items. By the time the respondents had completed Question 8 they were usually starting to get fatigued with the interview. As a result many did not answer Question 9 at all.

Question 11. In this question respondents were not asked if they had obtained solar information from the Solar Energy Research Institute (SERI). The principal reason was the probability of obtaining biased responses. All respondents had received a letter describing the Solar Energy Information Data Bank (SEIDB) and introducing SERI. It was felt that many respondents would attempt to encourage information flows from SERI by responding positively when asked whether they had used SERI as an information source—whether or not they actually received information directly from SERI. Since explaining the nature of SERI and the SEIDB was necessary to promote a good response rate, no questions about SERI were included.

In Question 11, items 21-23 require some explanation: they are shown as "NOT ASKED" on the sample questionnaire (readers may note that data for items 21-23 does occur on the tables in Appendix F for some groups). These items were left open for the inclusion of specific organizations which seemed most appropriate for each group. Table D-1 lists the organizations, the respondent groups, and the question numbers for each item used for the groups covered in this report.

Table D-1. SELECTED ORGANIZATIONS ABOUT WHICH INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (I/APH) RESPONDENTS WERE ASKED

Group	Item[a]	Organization
APH Researchers	21	U.S. Department of Agriculture(USDA), including the Cooperative Extension Service (CES)
IPH Plant Engineers	21	Association of Energy Engineers (AEE)
IPH Industrial Engineers	21	AEE
	22	Institute of Electrical and Electronics Engineers (IEEE)
Active Solar Heating and Cooling Industrial Engineers	21	AEE
IPH Agricultural Engineers	21	AEE
	22	American Society of Agricultural Engineers
State Agricultural Office Representatives	21	USDA, including CES
APH CES County Agents	21	USDA, including CES
All CES County Agents	21	USDA, including CES
	22	State Agricultural Office Representatives
All CES State Specialists	21	USDA, including CES

[a]The number of the item in which the group was asked about the particular organization. For example, 21 is Item 21 of Question 11.


SERI

APPENDIX E

STATISTICAL TESTING

Despite the small sample sizes, selected statistical tests could be used. All of these tests used a 5% rejection region unless otherwise noted. Thus, if a test result indicated that a difference between two means was statistically significant ($P < 0.05$), it meant that there was only a one-out-of-twenty chance that the two means were not different. Actual calculations were made with the Statistical Package for the Social Sciences (SPSS) software and other computer packages.

The tests conducted fell into three main types: tests of proportions between two groups, t-Tests between two groups, and Paired t-Tests within a group. Each of these are discussed below.

For all except Question 8, tests of proportions were used. For example, the proportion of Industrial Process Heat Researchers using computer terminals was compared to the proportion of Agricultural Process Heat Researchers using computer terminals. If the sample sizes were small, Exact Binomial Tests were used. When the sample sizes were larger (e.g., a comparison of Industrial Process Heat Researchers to All Researchers), Chi-Square Tests were used.

For analysis of the results from Question 8, t-Tests were used. In Question 8 each respondent was asked to describe the usefulness of up to 25 information products/categories as either "essential," "very useful," "somewhat useful," or "not at all useful." The "average usefulness" rating that the group assigned an item was then calculated by assigning the responses a "4" for "essential," a "3" for "very useful," a "2" for "somewhat useful," and a "1" for "not very useful," then calculating the average for the entire group. A t-Test was used to determine whether group A rated a specific information item significantly higher (or lower) than it was rated by group B. Some groups, however, tended to give higher scores in general than did other groups. To compensate for this effect, these statistical tests compared the "relative rating" given by one group to the "relative rating" given by the other groups. The relative rating given by a group to a particular item was calculated as follows: take the average usefulness rating the group gave that item (for example, suppose "a bibliography" received a 3.15 rating), then subtract the average overall rating this group gave to all items (suppose the average rating the group gave all items was 2.75); the difference was the relative rating (for this example 3.15 - 2.75 = +0.40). The t-Test then was used for the comparison of the relative rating group A gave to the item to the relative rating group B gave the item.

For the tests of proportions (or the t-Tests involving Question 8), if group A was being compared to group B and group A was a subset of group B (e.g., a comparison of Industrial Process Heat Researchers to All Researchers), the totals for group A were subtracted from the totals for group B and the proportions (or the relative ratings) for group B were recalculated from the adjusted totals.

For Question 8 it sometimes occurred that the researcher wanted to compare the rating a group gave one item to the rating they gave another item. For example, did Industrial Process Heat Educators rate "lists of sources for information" significantly higher (or lower) than they rated "lists of technical experts"? This test was conducted using a Paired t-Test.

APPENDIX F

SOLAR INDUSTRIAL AND AGRICULTURAL PROCESS HEAT DATA TABLES

In the following data tables, each table entry shows counts and percentages displayed in the format (%#), where % is the column percentage for each group and # is the number of respondents in each group who gave the response shown in the row title. Each column shows the results for an individual group or for a combination of groups.

Table F-1 lists the groups and combinations for which data are shown in the data tables. Table F-2 shows which groups are included in each of the combination groups listed in Table F-1. Table F-3 lists the data tables and Fig. F-1 contains the data tables themselves.

Table F-1. GROUPS AND COMBINATION GROUPS WITH DATA INCLUDED IN APPENDIX F

Group	Report Section
Industrial Process Heat Researchers (IPH RES)	3.0
Agricultural Process Heat Researchers (APH RES)	3.0
Total Industrial and Agricultural Process Heat Researchers (TOTAL IAPH RES)	3.0
All Researchers (ALL RES)	3.0
Concentrating Collector Manufacturer Representatives (CONC COLL MANUF)	4.0
Total Nonconcentrating Collector Manufacturer Representatives (TOTAL NCONC COLL MANUF)	5.0
All Manufacturer Representatives (ALL MANUF)	4.0, 5.0
Industrial Process Heat Plant Engineers (IPH PLANT ENG)	6.0
Industrial Process Heat Industrial Engineers (IPH INDUS ENG)	6.0
Active Solar Heating and Cooling Industrial Engineers (SHAC INDUS ENG)	6.0
Industrial Process Heat Agricultural Engineers (IPH AGRIC ENG)	6.0
All Engineers (ALL ENG)	6.0
Industrial Process Heat Educators (IPH EDUC)	7.0
All Educators (ALL EDUC)	7.0
Agricultural Process Heat State Agricultural Office Representatives (APH STATE AGRIC OFF)	8.0
Agricultural Process Heat Cooperative Extension Service (CES) County Agents (APH CES CO AGENT)	9.0
All CES County Agents (ALL CES CO AGENT)	9.0
All CES State Specialists (ALL CES STATE SPEC)	9.0

Table F-2. COMBINATION GROUPS

Total Industrial And Agricultural Process Heat Researchers (TOTAL IAPH RES)

- Industrial Process Heat (IPH) Researchers
- Agricultural Process Heat (APH) Researchers

All Researchers (ALL RES)

- Photovoltaics (PV) DOE-Funded Researchers
- PV Non-DOE-Funded Researchers
- PV Researcher Manufacturers
- Biomass Federally Funded Production and Collection Researchers
- Biomass Federally Funded Conversion Researchers
- Biomass Nonfederally Funded Production and Collection Researchers
- Biomass Nonfederally Funded Conversion Researchers
- Wind DOE-Funded Researchers
- Wind Non-DOE-Funded Researchers
- Solar Thermal Electric Power (STEP) DOE-Funded Researchers
- STEP Non-DOE-Funded Researchers
- Ocean Energy DOE-Funded Researchers
- Ocean Energy Non-DOE-Funded Researchers
- Solar Energy Storage DOE-Funded Researchers
- Solar Energy Storage Non-DOE-Funded Researchers
- Active Solar Heating and Cooling (SHAC) DOE-Funded Researchers
- SHAC Non-DOE-Funded Researchers
- Passive Federally Funded Researchers
- IPH Researchers
- APH Researchers

Total Nonconcentrating Manufacturer Representatives (TOTAL NCONC COLL MANUF)

- SHAC Heating/Cooling System Manufacturer Representatives
- SHAC Water Heating System Manufacturer Representatives
- SHAC Nonconcentrating Collector Manufacturer Representatives

All Manufacturer Representatives (ALL MANUF)

- PV Manufacturer Representatives
- Biomass Production and Collection Equipment Manufacturer Representatives
- Biomass Conversion Equipment Manufacturer Representatives
- Wind Manufacturer Representatives
- STEP and IPH Concentrating Collector Manufacturer Representatives

Table F-2. COMBINATION GROUPS (Concluded)

SHAC Heating/Cooling System Manufacturer Representatives
SHAC Water Heating System Manufacturer Representatives
SHAC Nonconcentrating Collector Manufacturer Representatives
SHAC Other Component Manufacturer Representatives
Passive Manufacturer Representatives

All Engineers (ALL ENG)

PV Electric Power Engineers
Biomass Forest Products Engineers and Consultants
Wind Engineers
Wind Electric Power Engineers
STEP Engineers
SHAC Heating, Ventilating and Air Conditioning Engineers
SHAC Industrial Engineers
IPH Plant Engineers
IPH Industrial Engineers
IPH Agricultural Engineers
State Level Cooperative Extension Service (CES) Agricultural Specialists (Agricultural Engineers)

All Educators (ALL EDUC)

PV Educators
Biomass Educators
Wind Educators
STEP Educators
SHAC Educators
Passive Educators
IPH Educators

All Cooperative Extension Service County Agents (ALL CES CO AGENT)

Biomass CES County Agents
Wind CES County Agents
SHAC CES County Agents
Passive CES County Agents
APH CES County Agents

All Cooperative Extension Service State Specialists (ALL CES STATE SPEC)

State Level CES Agricultural Specialists
State Level CES Information Specialists

Table F-3. LIST OF DATA TABLES

[a]See Appendix D, Figs. D-1 and D-2 for the wording of each question.

T-001

(OCTOBER, 1979)

NEED FOR INFORMATION ON THE JOB AND OUTSIDE THE JOB (QUESTION 1)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
YES FOR JOB	9 100.	8 89.	17 94.	178 98.	8 100.	28 97.	93 97.	9 100.	9 100.	9 100.	9 100.	93 97.
NO FOR JOB				2 1.		1 3.	2 2.					3 3.
DON'T KNOW/NA		1 11.	1 6.	1 1.			1 1.					
Q1B TOTAL		9 100.	9 100.	117 100.	8 100.	29 100.	96 100.			9 100.		62 100.
YES OUTSIDE JOB		2 22.	2 22.	48 41.	3 38.	16 55.	47 49.			4 44.		29 47.
NO OUTSIDE JOB		5 56.	5 56.	60 51.	3 38.	8 28.	33 34.			5 56.		27 44.
DON'T KNOW/NA		2 22.	2 22.	9 8.	2 25.	5 17.	16 17.					6 10.
YES, JOB + OUTSIDE		2 22.	2 22.	46 39.	3 38.	16 55.	46 48.			4 44.		26 42.

Figure F-1. Industrial and Agricultural Process Heat Data Tables

T-001

(OCTOBER, 1979)

NEED FOR INFORMATION ON THE JOB AND OUTSIDE THE JOB (QUESTION 1)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
YES FOR JOB	9 100.	63 100.	8 100.	9 100.	44 98.	18 100.
NO FOR JOB						
DON'T KNOW/NA					1 2.	
Q1B TOTAL		45 100.	8 100.	9 100.	45 100.	18 100.
YES OUTSIDE JOB		31 69.	5 63.	5 56.	21 47.	7 39.
NO OUTSIDE JOB		12 27.	2 25.	3 33.	22 49.	10 56.
DON'T KNOW/NA		2 4.	1 13.	1 11.	2 4.	1 6.
YES, JOB + OUTSIDE		31 69.	5 63.	5 56.	20 44.	7 39.

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

T-002

(OCTOBER, 1979)

INVOLVEMENT (QUESTION 2)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
4. VERY INVOLVED	7 78.	4 44.	11 61.	107 59.	7 88.	23 79.	77 80.			3 33.	3 33.	25 26.
3. MODERATELY INVOLVED	1 11.	4 44.	5 28.	43 24.	1 13.	3 10.	10 10.	1 11.	1 11.	3 33.	1 11.	21 22.
2. SLIGHTLY INVOLVED	1 11.		1 6.	29 16.		2 7.	7 7.	5 56.	7 78.	2 22.	4 44.	43 45.
1. NOT AT ALL INVOLVED				1 1.			1 1.	3 33.	1 11.	1 11.	1 11.	7 7.
DON'T KNOW/NA		1 11.	1 6.	1 1.		1 3.	1 1.					
AVERAGE	3.67	3.50	3.59	3.42	3.88	3.75	3.72	1.78	2.00	2.89	2.67	2.67
STANDARD DEVIATION	.64	.50	.58	.78	.26	.57	.61	.62	.47	.99	1.04	.93

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

T-002

(OCTOBER, 1979)

INVOLVEMENT (QUESTION 2)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
4. VERY INVOLVED	2 22.	27 43.	2 25.		1 2.	6 33.
3. MODERATELY INVOLVED	3 33.	22 35.	1 13.	2 22.	12 27.	7 39.
2. SLIGHTLY INVOLVED	4 44.	14 22.	5 63.	7 78.	32 71.	5 28.
1. NOT AT ALL INVOLVED						
DON'T KNOW/NA						
AVERAGE	2.78	3.21	2.63	2.22	2.31	3.06
STANDARD DEVIATION	.77	.76	.84	.42	.51	.76

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

T-003

(OCTOBER, 1979)

INFORMEDNESS (QUESTION 3)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	5 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
4. VERY INFORMED	5 56.	4 44.	9 50.	117 65.	7 88.	26 90.	72 75.	2 22.	1 11.	5 56.	3 33.	35 36.
3. MODERATELY INFORMED	3 33.	5 56.	8 44.	59 33.	1 13.	2 7.	21 22.	2 22.	5 56.	4 44.	6 67.	44 46.
2. SLIGHTLY INFORMED	1 11.		1 6.	5 3.		1 3.	3 3.	5 56.	3 33.			17 18.
1. NOT AT ALL INFORMED												
DON'T KNOW/NA												
AVERAGE	3.44	3.44	3.44	3.62	3.88	3.86	3.72	2.67	2.78	3.56	3.33	3.19
STANDARD DEVIATION	.70	.52	.62	.53	.26	.45	.50	.80	.61	.46	.49	.70

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

T-003

(OCTOBER, 1979)

INFORMEDNESS (QUESTION 3)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
4. VERY INFORMED	4 44.	31 49.	1 13.		1 2.	8 44.
3. MODERATELY INFORMED	3 33.	27 43.	2 25.	2 22.	9 20.	7 39.
2. SLIGHTLY INFORMED	2 22.	5 8.	5 63.	7 78.	33 73.	3 17.
1. NOT AT ALL INFORMED						
DON'T KNOW/NA					2 4.	
AVERAGE	3.22	3.41	2.50	2.22	2.26	3.28
STANDARD DEVIATION	.79	.64	.70	.42	.46	.72

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

INTEREST IN SPECIFIED INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (QUESTION 6)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	100.9		100.9	100.9				100.9	100.9		100.9	100.27
HOT WATER												
1. YES	89.8		89.8	89.8				89.8	89.8		89.8	89.24
2. NO	11.1		11.1	11.1				11.1	11.1		11.1	11.3
DON'T KNOW/NA												
LOW-TEMPERATURE STEAM												
1. YES	78.7		78.7	78.7				56.5	78.7		67.6	67.18
2. NO	22.2		22.2	22.2				44.4	22.2		33.3	33.9
DON'T KNOW/NA												
HIGH-TEMPERATURE STEAM												
1. YES	56.5		56.5	56.5				11.1	22.2		22.2	19.5
2. NO	44.4		44.4	44.4				89.8	78.7		78.7	81.22
DON'T KNOW/NA												
HOT AIR												
1. YES	67.6		67.6	67.6				56.5	89.8		78.7	74.20
2. NO	33.3		33.3	33.3				44.4	11.1		22.2	26.7
DON'T KNOW/NA												
DIRECT HEAT												
1. YES	33.3		33.3	33.3				33.5	22.2		33.3	30.8
2. NO	56.5		56.5	56.5				67.6	78.7		67.6	70.19
DON'T KNOW/NA	11.1		11.1	11.1								
REFRIGERATION												
1. YES	78.7		78.7	78.7				67.6	78.7		78.7	74.20
2. NO	22.2		22.2	22.2				33.5	22.2		22.2	26.7
DON'T KNOW/NA												

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

INTEREST IN SPECIFIED INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (QUESTION 61

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	9 100.				
HOT WATER						
1. YES	8 89.	8 89.				
2. NO	1 11.	1 11.				
DON'T KNOW/NA						
LOW-TEMPERATURE STEAM						
1. YES	8 89.	8 89.				
2. NO	1 11.	1 11.				
DON'T KNOW/NA						
HIGH-TEMPERATURE STEAM						
1. YES	6 67.	6 67.				
2. NO	3 33.	3 33.				
DON'T KNOW/NA						
HOT AIR						
1. YES	8 89.	8 89.				
2. NO	1 11.	1 11.				
DON'T KNOW/NA						
DIRECT HEAT						
1. YES	4 44.	4 44.				
2. NO	5 56.	5 56.				
DON'T KNOW/NA						
REFRIGERATION						
1. YES	7 78.	7 78.				
2. NO	2 22.	2 22.				
DON'T KNOW/NA						

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

INTEREST IN SPECIFIED INDUSTRIAL AND AGRICULTURAL PROCESS HEAT - CONTINUED (QUESTION 6)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
		100.9	100.9	100.9								
LIVESTOCK SHELTER HEATING												
1. YES		56.5	56.5	56.5								
2. NO		44.4	44.4	44.4								
DON'T KNOW/NA												
GRAIN DRYING												
1. YES		67.6	67.6	67.6								
2. NO		33.3	33.3	33.3								
DON'T KNOW/NA												
CROP DRYING												
1. YES		67.6	67.6	67.6								
2. NO		33.3	33.3	33.3								
DON'T KNOW/NA												
GREENHOUSES												
1. YES		22.2	22.2	22.2								
2. NO		78.7	78.7	78.7								
DON'T KNOW/NA												
FOOD PROCESSING												
1. YES		56.5	56.5	56.5								
2. NO		44.4	44.4	44.4								
DON'T KNOW/NA												

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

INTEREST IN SPECIFIED INDUSTRIAL AND AGRICULTURAL PROCESS HEAT - CONTINUED (QUESTION 6)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUc	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
			100.[8]	100.[9]	100.[9]	
LIVESTOCK SHELTER HEATING						
1. YES			88.[7]	78.[7]	78.[7]	
2. NO			13.[1]	22.[2]	22.[2]	
DON'T KNOW/NA						
GRAIN DRYING						
1. YES			75.[6]	89.[8]	89.[8]	
2. NO			25.[2]	11.[1]	11.[1]	
DON'T KNOW/NA						
CROP DRYING						
1. YES			88.[7]	78.[7]	78.[7]	
2. NO			13.[1]	22.[2]	22.[2]	
DON'T KNOW/NA						
GREENHOUSES						
1. YES			88.[7]	78.[7]	78.[7]	
2. NO			13.[1]	22.[2]	22.[2]	
DON'T KNOW/NA						
FOOD PROCESSING						
1. YES			88.[7]	67.[6]	67.[6]	
2. NO			13.[1]	33.[3]	33.[3]	
DON'T KNOW/NA						

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

T-024

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q8A(1) BIBLIOGRAPHY	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	95 100.	9 100.	9 100.	9 100.	9 100.	96 100.
ESSENTIAL	1 11.	1 11.	2 11.	15 8.		1 3.	5 5.				3 33.	6 6.
VERY USEFUL	3 33.	3 33.	6 33.	55 30.		2 7.	14 15.	3 33.	5 56.		4 44.	25 26.
SOMEWHAT USEFUL	5 56.	4 44.	9 50.	89 49.	6 75.	15 52.	52 55.	3 33.	2 22.	8 89.	1 11.	51 53.
NOT AT ALL USEFUL		1 11.	1 6.	22 12.	2 25.	11 38.	24 25.	3 33.	2 22.	1 11.	1 11.	14 15.
ESSENTIAL + VERY USEFUL	4 44.	4 44.	8 44.	70 39.		3 10.	19 20.	3 33.	5 56.		7 78.	31 32.
DON'T KNOW												
AVERAGE	2.56	2.44	2.50	2.35	1.75	1.76	2.00	2.00	2.33	1.89	3.00	2.24
STANDARD DEVIATION	.66	.84	.76	.79	.43	.72	.78	.81	.82	.30	.94	.77
Q8A(2) LIST OF SOURCES	9 100.	9 100.	18 100.	180 100.	8 100.	28 100.	95 100.	9 100.	9 100.	9 100.	9 100.	96 100.
ESSENTIAL		1 11.	1 6.	23 13.		3 11.	10 11.	1 11.	3 33.		1 11.	14 15.
VERY USEFUL	5 56.	3 33.	8 44.	79 44.	4 50.	6 21.	37 39.	3 33.	3 33.	2 22.	6 67.	41 43.
SOMEWHAT USEFUL	4 44.	5 56.	9 50.	67 37.	3 38.	12 43.	34 36.	2 22.	1 11.	6 67.	2 22.	32 33.
NOT AT ALL USEFUL				11 6.	1 13.	7 25.	14 15.	3 33.	2 22.	1 11.		9 9.
ESSENTIAL + VERY USEFUL	5 56.	4 44.	9 50.	102 57.	4 50.	9 32.	47 49.	4 44.	6 67.	2 22.	7 78.	55 57.
DON'T KNOW												
AVERAGE	2.56	2.56	2.56	2.63	2.38	2.18	2.45	2.22	2.78	2.11	2.89	2.63
STANDARD DEVIATION	.47	.66	.57	.79	.67	.92	.87	1.03	1.12	.57	.56	.82

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q8A(1) BIBLIOGRAPHY	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
ESSENTIAL	1 11.	12 19.	1 13.	1 11.	2 4.	1 6.
VERY USEFUL	2 22.	27 43.	3 38.	2 22.	17 38.	4 22.
SOMEWHAT USEFUL	6 67.	21 33.	3 38.	6 67.	20 44.	8 44.
NOT AT ALL USEFUL		3 5.	1 13.		6 13.	5 28.
ESSENTIAL + VERY USEFUL	3 33.	39 62.	4 50.	3 33.	19 42.	5 28.
DON'T KNOW						
AVERAGE	2.44	2.76	2.50	2.44	2.33	2.06
STANDARD DEVIATION	.70	.81	.86	.70	.77	.83
Q8A(2) LIST OF SOURCES	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
ESSENTIAL		11 17.	2 25.	1 11.	6 13.	2 11.
VERY USEFUL	6 67.	32 51.	4 50.	6 67.	25 56.	9 50.
SOMEWHAT USEFUL	3 33.	17 27.	2 25.	2 22.	13 29.	6 33.
NOT AT ALL USEFUL		3 5.			1 2.	1 6.
ESSENTIAL + VERY USEFUL	6 67.	43 68.	6 75.	7 78.	31 69.	11 61.
DON'T KNOW						
AVERAGE	2.67	2.81	3.00	2.89	2.80	2.67
STANDARD DEVIATION	.45	.77	.70	.56	.68	.73

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q8A(3) CALENDAR-CONFERENCES/ PROGRAMS	9 100.	9 100.	18 100.	181 100.	8 100.	28 100.	95 100.	9 100.	9 100.	9 100.	9 100.	96 100.
ESSENTIAL		1 11.	1 6.	19 10.	2 25.	1 4.	10 11.			1 11.	1 11.	5 5.
VERY USEFUL	6 67.	2 22.	8 44.	69 38.	2 25.	12 43.	33 35.	2 22.	2 22.	1 11.	2 22.	23 24.
SOMEWHAT USEFUL	3 33.	5 56.	8 44.	71 39.	4 50.	12 43.	36 38.	4 44.	5 56.	4 44.	5 56.	45 47.
NOT AT ALL USEFUL		1 11.	1 6.	22 12.		3 11.	16 17.	3 33.	2 22.	3 33.	1 11.	23 24.
ESSENTIAL + VERY USEFUL	6 67.	3 33.	9 50.	88 49.	4 50.	13 46.	43 45.	2 22.	2 22.	2 22.	3 33.	28 29.
DON'T KNOW												
AVERAGE	2.67	2.33	2.50	2.47	2.75	2.39	2.39	1.89	2.00	2.00	2.33	2.10
STANDARD DEVIATION	.45	.82	.68	.83	.82	.73	.88	.73	.66	.94	.82	.83
Q8A(4) DIAGRAMS/SCHEMATICS	9 100.	9 100.	18 100.	179 100.	8 100.	28 100.	95 100.	9 100.	9 100.	9 100.	9 100.	96 100.
ESSENTIAL	2 22.		2 11.	14 8.		1 4.	5 5.		1 11.	3 33.	3 33.	20 21.
VERY USEFUL	4 44.	2 22.	6 33.	62 35.	3 38.	12 43.	44 46.	4 44.	4 44.	5 56.	3 33.	30 31.
SOMEWHAT USEFUL	3 33.	6 67.	9 50.	78 44.	4 50.	12 43.	39 41.	5 56.	2 22.		2 22.	32 33.
NOT AT ALL USEFUL		1 11.	1 6.	25 14.	1 13.	3 11.	7 7.		1 11.	1 11.	1 11.	13 14.
ESSENTIAL + VERY USEFUL	6 67.	2 22.	8 44.	76 42.	3 38.	13 46.	49 52.	4 44.	5 56.	8 89.	6 67.	50 52.
DON'T KNOW									1 11.			1 1.
AVERAGE	2.89	2.11	2.50	2.36	2.25	2.39	2.49	2.44	2.63	3.11	2.89	2.60
STANDARD DEVIATION	.73	.57	.76	.82	.66	.73	.72	.51	.84	.87	.99	.96

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q8A(3) CALENDAR-CONFERENCES/ PROGRAMS	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
ESSENTIAL	1 11.	6 10.			1 2.	
VERY USEFUL	3 33.	30 48.	3 38.	3 33.	7 16.	6 33.
SOMEWHAT USEFUL	3 33.	21 33.	4 50.	5 56.	28 62.	8 44.
NOT AT ALL USEFUL	2 22.	6 10.	1 13.	1 11.	9 20.	4 22.
ESSENTIAL + VERY USEFUL	4 44.	36 57.	3 38.	3 33.	8 18.	6 33.
DON'T KNOW						
AVERAGE	2.33	2.57	2.25	2.22	2.00	2.11
STANDARD DEVIATION	.95	.79	.66	.63	.66	.74
Q8A(4) DIAGRAMS/SCHEMATICS	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
ESSENTIAL	1 11.	12 19.		2 22.	6 13.	2 11.
VERY USEFUL	4 44.	28 44.	6 75.	4 44.	22 49.	3 17.
SOMEWHAT USEFUL	3 33.	18 29.	2 25.	3 33.	16 36.	10 56.
NOT AT ALL USEFUL	1 11.	5 8.			1 2.	3 17.
ESSENTIAL + VERY USEFUL	5 56.	40 63.	6 75.	6 67.	28 62.	5 28.
DON'T KNOW						
AVERAGE	2.56	2.75	2.75	2.89	2.73	2.22
STANDARD DEVIATION	.81	.84	.43	.73	.72	.85

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	36 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q8A(5) NON-TECHNICAL DESCRIPTION	9 100.	9 100.	18 100.	153 100.	8 100.	28 100.	68 100.	9 100.	9 100.	9 100.	9 100.	62 100.
ESSENTIAL				3 2.		1 4.	3 4.	1 11.				3 5.
VERY USEFUL				18 12.	1 13.	5 18.	13 19.	3 33.	4 44.	2 22.	1 11.	16 26.
SOMEWHAT USEFUL	7 78.	6 67.	13 72.	62 41.	4 50.	11 39.	32 47.	2 22.	2 22.	4 44.	5 56.	22 35.
NOT AT ALL USEFUL	2 22.	3 33.	5 28.	70 46.	3 38.	11 39.	20 29.	3 33.	3 33.	3 33.	3 33.	21 34.
ESSENTIAL + VERY USEFUL				21 14.	1 13.	6 21.	16 24.	4 44.	4 44.	2 22.	1 11.	19 31.
DON'T KNOW												
AVERAGE	1.78	1.67	1.72	1.70	1.75	1.86	1.99	2.22	2.11	1.89	1.78	2.02
STANDARD DEVIATION	.40	.45	.45	.74	.66	.82	.80	1.03	.87	.73	.62	.88
Q8A(6) TECHNICAL DESCRIPTION	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	36 100.	9 100.	9 100.	9 100.	9 100.	96 100.
ESSENTIAL		1 11.	1 6.	18 10.		3 10.	13 14.	3 33.	2 22.	1 11.	2 22.	20 21.
VERY USEFUL	8 89.	5 56.	13 72.	84 46.	5 63.	13 45.	45 47.	4 44.	4 44.	6 67.	3 33.	44 46.
SOMEWHAT USEFUL	1 11.	3 33.	4 22.	63 35.	2 25.	10 34.	25 26.	1 11.	3 33.	1 11.	4 44.	21 22.
NOT AT ALL USEFUL				16 9.	1 13.	2 7.	12 13.	1 11.		1 11.		11 11.
ESSENTIAL + VERY USEFUL	8 89.	6 67.	14 78.	102 56.	5 63.	16 55.	58 60.	7 78.	6 67.	7 78.	5 56.	64 67.
DON'T KNOW						1 3.	1 1.					
AVERAGE	2.89	2.78	2.83	2.57	2.50	2.61	2.62	3.00	2.89	2.78	2.78	2.76
STANDARD DEVIATION	.30	.61	.51	.80	.70	.76	.87	.94	.73	.77	.77	.91

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q8A(5) NON-TECHNICAL DESCRIPTION	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
ESSENTIAL	2 22.	9 14.		2 22.	5 11.	
VERY USEFUL	2 22.	11 17.	7 88.	6 67.	30 67.	8 44.
SOMEWHAT USEFUL	3 33.	25 40.		1 11.	10 22.	5 28.
NOT AT ALL USEFUL	2 22.	18 29.	1 13.			5 28.
ESSENTIAL + VERY USEFUL	4 44.	20 32.	7 88.	8 89.	35 78.	8 44.
DON'T KNOW						
AVERAGE	2.44	2.17	2.75	3.11	2.89	2.17
STANDARD DEVIATION	1.07	1.01	.66	.57	.56	.82
Q8A(6) TECHNICAL DESCRIPTION	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
ESSENTIAL	2 22.	12 19.		1 11.	4 9.	1 6.
VERY USEFUL	5 56.	37 59.	4 50.	3 33.	13 29.	9 50.
SOMEWHAT USEFUL	2 22.	11 17.	3 38.	4 44.	19 42.	5 28.
NOT AT ALL USEFUL		2 3.	1 13.	1 11.	9 20.	3 17.
ESSENTIAL + VERY USEFUL	7 78.	49 78.	4 50.	4 44.	17 38.	10 56.
DON'T KNOW		1 2.				
AVERAGE	3.00	2.95	2.38	2.44	2.27	2.44
STANDARD DEVIATION	.66	.71	.67	.84	.87	.84

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q8A(7) LISTS OF SUPPLIERS	9 100.	9 100.	18 100.	146 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
ESSENTIAL	1 11.	1 11.	2 11.	12 8.		6 21.	19 20.		1 11.		2 22.	11 11.
VERY USEFUL	2 22.	3 33.	5 28.	39 27.	5 63.	14 48.	36 38.		2 22.	5 56.	2 22.	26 27.
SOMEWHAT USEFUL	5 56.	3 33.	8 44.	56 38.	2 25.	4 14.	27 28.	5 56.	2 22.	1 11.	2 22.	33 34.
NOT AT ALL USEFUL	1 11.	2 22.	3 17.	39 27.	1 13.	5 17.	13 14.	4 44.	4 44.	3 33.	3 33.	26 27.
ESSENTIAL + VERY USEFUL	3 33.	4 44.	7 39.	51 35.	5 63.	20 69.	55 57.		3 33.	5 56.	4 44.	37 39.
DON'T KNOW							1 1.					
AVERAGE	2.33	2.33	2.33	2.16	2.50	2.72	2.64	1.56	2.00	2.22	2.33	2.23
STANDARD DEVIATION	.82	.95	.89	.92	.70	.99	.95	.48	1.05	.92	1.16	.97
Q8A(8) HANDBOOKS/TABLES	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	95 100.
ESSENTIAL		1 11.	1 6.	17 9.		1 3.	9 9.		3 33.	2 22.	3 33.	17 18.
VERY USEFUL	4 44.	5 56.	9 50.	67 37.	4 50.	13 45.	40 42.	7 78.	3 33.	6 67.	3 33.	45 47.
SOMEWHAT USEFUL	5 56.	3 33.	8 44.	65 36.	2 25.	9 31.	33 34.	2 22.	2 22.		3 33.	28 29.
NOT AT ALL USEFJL				31 17.	2 25.	6 21.	14 15.		1 11.	1 11.		5 5.
ESSENTIAL + VERY USEFUL	4 44.	6 67.	10 56.	84 46.	4 50.	14 48.	49 51.	7 78.	6 67.	8 89.	6 67.	62 65.
DON'T KNOW				1 1.								
AVERAGE	2.44	2.78	2.61	2.39	2.25	2.31	2.46	2.78	2.89	3.00	3.00	2.78
STANDARD DEVIATION	.51	.61	.59	.87	.82	.83	.84	.40	.99	.81	.81	.79

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q8A(7) LISTS OF SUPPLIERS	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
ESSENTIAL	3 33.	9 14.		1 11.	6 13.	1 6.
VERY USEFUL		22 35.	4 50.	5 56.	22 49.	6 33.
SOMEWHAT USEFUL	5 56.	20 32.	4 50.	3 33.	15 33.	5 28.
NOT AT ALL USEFUL	1 11.	12 19.			2 4.	6 33.
ESSENTIAL + VERY USEFUL	3 33.	31 49.	4 50.	6 67.	28 62.	7 39.
DON'T KNOW						
AVERAGE	2.56	2.44	2.50	2.78	2.71	2.11
STANDARD DEVIATION	1.05	.96	.50	.61	.75	.93
Q8A(8) HANDBOOKS/TABLES	9 100.	63 100.	8 100.	9 100.	45 100.	17 100.
ESSENTIAL		14 22.		1 11.	3 7.	2 12.
VERY USEFUL	3 33.	25 40.	5 63.	4 44.	22 49.	4 24.
SOMEWHAT USEFUL	6 67.	20 32.	3 38.	3 33.	16 36.	8 47.
NOT AT ALL USEFUL		4 6.		1 11.	4 9.	3 18.
ESSENTIAL + VERY USEFUL	3 33.	39 62.	5 63.	5 56.	25 56.	6 35.
DON'T KNOW						
AVERAGE	2.33	2.78	2.63	2.56	2.53	2.29
STANDARD DEVIATION	.48	.85	.45	.81	.75	.90

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT		IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
		9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q8A(9)	TECHNICAL EXPERTS LIST	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
	ESSENTIAL		1 11.	1 6.	16 9.	1 13.		11 11.		1 11.		1 11.	9 9.
	VERY USEFUL	3 33.	2 22.	5 28.	66 36.	5 63.	7 24.	30 31.	1 11.	1 11.	2 22.	2 22.	27 28.
	SOMEWHAT USEFUL	6 67.	4 44.	10 56.	72 40.	1 13.	14 48.	36 38.	5 56.	6 67.	5 56.	6 67.	44 46.
	NOT AT ALL USEFUL		2 22.	2 11.	27 15.	1 13.	8 28.	19 20.	3 33.	1 11.	2 22.		16 17.
	ESSENTIAL + VERY USEFUL	3 33.	3 33.	6 33.	82 45.	6 75.	7 24.	41 43.	1 11.	2 22.	2 22.	3 33.	36 38.
	DON'T KNOW												
	AVERAGE	2.33	2.22	2.28	2.39	2.75	1.97	2.34	1.78	2.22	2.00	2.44	2.30
	STANDARD DEVIATION	.48	.92	.72	.85	.82	.70	.93	.62	.79	.66	.70	.86
Q8A(10)	MANUAL METHODS	9 100.	9 100.	18 100.	181 100.	8 100.	28 100.	95 100.	9 100.	9 100.	9 100.	9 100.	96 100.
	ESSENTIAL		3 33.	3 17.	30 17.	1 13.	2 7.	19 20.		1 11.	3 33.	3 33.	19 20.
	VERY USEFUL	7 78.	2 22.	9 50.	65 36.	5 63.	11 39.	34 36.	4 44.	6 67.	4 44.	4 44.	45 47.
	SOMEWHAT USEFUL	2 22.	3 33.	5 28.	53 29.	1 13.	9 32.	26 27.	5 56.		2 22.	2 22.	27 28.
	NOT AT ALL USEFUL		1 11.	1 6.	33 18.	1 13.	6 21.	16 17.		2 22.			5 5.
	ESSENTIAL + VERY USEFUL	7 78.	5 56.	12 67.	95 52.	6 75.	13 46.	53 56.	4 44.	7 78.	7 78.	7 78.	64 67.
	DON'T KNOW												
	AVERAGE	2.78	2.78	2.78	2.51	2.75	2.32	2.59	2.44	2.67	3.11	3.11	2.81
	STANDARD DEVIATION	.40	1.02	.77	.96	.82	.89	.98	.51	.93	.74	.74	.81

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q8A(9) TECHNICAL EXPERTS LIST	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
ESSENTIAL	1 11.	7 11.	1 13.	2 22.	3 7.	1 6.
VERY USEFUL	2 22.	19 30.	3 38.	6 67.	15 33.	6 33.
SOMEWHAT USEFUL	5 56.	30 48.	4 50.		19 42.	7 39.
NOT AT ALL USEFUL	1 11.	7 11.		1 11.	8 18.	4 22.
ESSENTIAL + VERY USEFUL	3 33.	26 41.	4 50.	8 89.	18 40.	7 39.
DON'T KNOW						
AVERAGE	2.33	2.41	2.63	3.00	2.29	2.22
STANDARD DEVIATION	.82	.83	.67	.81	.83	.85
Q8A(10) MANUAL METHODS	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
ESSENTIAL	2 22.	15 24.			2 4.	1 6.
VERY USEFUL	4 44.	25 40.	3 38.	4 44.	19 42.	7 39.
SOMEWHAT USEFUL	2 22.	16 25.	4 50.	5 56.	18 40.	6 33.
NOT AT ALL USEFUL	1 11.	6 10.	1 13.		6 13.	4 22.
ESSENTIAL + VERY USEFUL	6 67.	40 63.	3 38.	4 44.	21 47.	8 44.
DON'T KNOW		1 2.				
AVERAGE	2.78	2.79	2.25	2.44	2.38	2.28
STANDARD DEVIATION	.90	.91	.66	.51	.76	.86

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

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(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
COMPUTER MODELS	9 100.	9 100.	18 100.	181 100.	8 100.	28 100.	95 100.	9 100.	9 100.	9 100.	9 100.	96 100.
ESSENTIAL	1 11.	1 11.	2 11.	28 15.		2 7.	8 8.			2 22.	2 22.	11 11.
VERY USEFUL	2 22.	2 22.	4 22.	51 28.	5 63.	8 29.	33 35.	3 33.	4 44.	3 33.	5 56.	35 36.
SOMEWHAT USEFUL	6 67.	6 67.	12 67.	62 34.	1 13.	11 39.	29 31.	2 22.	3 33.	1 11.	2 22.	28 29.
NOT AT ALL USEFUL				40 22.	2 25.	7 25.	25 26.	4 44.	2 22.	3 33.		22 23.
ESSENTIAL/VERY USEFUL	3 33.	3 33.	6 33.	79 44.	5 63.	10 36.	41 43.	3 33.	4 44.	5 56.	7 78.	46 48.
DON'T KNOW												
AVERAGE	2.44	2.44	2.44	2.37	2.38	2.18	2.25	1.89	2.22	2.44	3.00	2.36
STANDARD DEVIATION	.70	.70	.70	.99	.84	.88	.94	.87	.79	1.17	.66	.97

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
COMPUTER MODELS	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
ESSENTIAL	3 33.	11 17.	1 13.			
VERY USEFUL	2 22.	23 37.	2 25.		5 11.	8 44.
SOMEWHAT USEFUL	3 33.	23 37.	3 38.	8 89.	24 53.	6 33.
NOT AT ALL USEFUL	1 11.	6 10.	2 25.	1 11.	15 33.	4 22.
ESSENTIAL/VERY USEFUL	5 56.	34 54.	3 38.		5 11.	8 44.
DON'T KNOW					1 2.	
AVERAGE	2.78	2.62	2.25	1.89	1.77	2.22
STANDARD DEVIATION	1.02	.87	.96	.30	.64	.79

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q8B(1) EDUCATIONAL INSTITUTIONS	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
ESSENTIAL				1 1.			8 8.				1 11.	4 4.
VERY USEFUL		1 11.	1 6.	26 14.	2 25.	4 14.	15 16.	3 33.	1 11.	1 11.	3 33.	19 20.
SOMEWHAT USEFUL	5 56.	7 78.	12 67.	99 55.	3 38.	16 55.	43 45.	3 33.	6 67.	6 67.	3 33.	49 51.
NOT AT ALL USEFUL	4 44.	1 11.	5 28.	54 30.	3 38.	9 31.	30 31.	3 33.	2 22.	2 22.	2 22.	24 25.
ESSENTIAL + VERY USEFUL		1 11.	1 6.	27 15.	2 25.	4 14.	23 24.	3 33.	1 11.	1 11.	4 44.	23 24.
DON'T KNOW				1 1.								
AVERAGE	1.56	2.00	1.78	1.86	1.88	1.83	2.01	2.00	1.89	1.89	2.33	2.03
STANDARD DEVIATION	.48	.47	.52	.65	.76	.64	.89	.81	.56	.56	.95	.78
Q8B(2) RESEARCH IN PROGRESS	9 100.	9 100.	18 100.	181 100.	8 100.	28 100.	95 100.	9 100.	9 100.	9 100.	9 100.	96 100.
ESSENTIAL	2 22.	2 22.	4 22.	33 18.	1 13.	4 14.	22 23.			1 11.	2 22.	11 11.
VERY USEFUL	5 56.	5 56.	10 56.	102 55.	5 63.	12 43.	38 40.	2 22.	2 22.	4 44.	3 33.	35 36.
SOMEWHAT USEFUL	2 22.	2 22.	4 22.	39 22.	2 25.	8 29.	26 27.	6 67.	5 56.	3 33.	3 33.	42 44.
NOT AT ALL USEFUL				7 4.		4 14.	9 9.	1 11.	2 22.	1 11.	1 11.	8 8.
ESSENTIAL + VERY USEFUL	7 78.	7 78.	14 78.	135 75.	6 75.	16 57.	60 63.	2 22.	2 22.	5 56.	5 56.	46 48.
DON'T KNOW												
AVERAGE	3.00	3.00	3.00	2.89	2.88	2.57	2.77	2.11	2.00	2.56	2.67	2.51
STANDARD DEVIATION	.66	.66	.66	.73	.57	.90	.90	.57	.66	.81	.93	.80

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
QAB(1) EDUCATIONAL INSTITUTIONS	9 100.	63 100.	7 100.	9 100.	45 100.	18 100.
ESSENTIAL	1 11.	8 13.		1 11.	3 7.	
VERY USEFUL		26 41.	3 43.	3 33.	13 29.	1 6.
SOMEWHAT USEFUL	4 44.	17 27.	3 43.	4 44.	23 51.	9 50.
NOT AT ALL USEFUL	4 44.	12 19.	1 14.	1 11.	6 13.	8 44.
ESSENTIAL + VERY USEFUL	1 11.	34 54.	3 43.	4 44.	16 36.	1 6.
DON'T KNOW						
AVERAGE	1.78	2.48	2.29	2.44	2.29	1.61
STANDARD DEVIATION	.91	.93	.68	.84	.77	.59
QAB(2) RESEARCH IN PROGRESS	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
ESSENTIAL	1 11.	14 22.		1 11.	2 4.	1 6.
VERY USEFUL	4 44.	33 52.	5 63.	5 56.	20 44.	8 44.
SOMEWHAT USEFUL	4 44.	14 22.	2 25.	3 33.	19 42.	8 44.
NOT AT ALL USEFUL		2 3.	1 13.		4 9.	1 6.
ESSENTIAL + VERY USEFUL	5 56.	47 75.	5 63.	6 67.	22 49.	9 50.
DON'T KNOW						
AVERAGE	2.67	2.94	2.50	2.78	2.44	2.50
STANDARD DEVIATION	.65	.73	.70	.61	.73	.68

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q8B(3) STATE OF ART	9 100.	9 100.	18 100.	181 100.	8 100.	28 100.	95 100.	9 100.	9 100.	9 100.	8 100.	95 100.
ESSENTIAL		1 11.	1 6.	34 19.	1 13.	6 21.	23 24.	1 11.	1 11.	1 11.	4 50.	19 20.
VERY USEFUL	6 67.	5 56.	11 61.	93 51.	4 50.	11 39.	34 36.	3 33.	3 33.	3 33.	1 13.	38 40.
SOMEWHAT USEFUL	3 33.	2 22.	5 28.	44 24.	3 38.	6 21.	26 27.	5 56.	4 44.	4 44.	2 25.	34 36.
NOT AT ALL USEFUL		1 11.	1 6.	9 5.		4 14.	10 11.		1 11.	1 11.	1 13.	4 4.
ESSENTIAL + VERY USEFUL	6 67.	6 67.	12 67.	127 70.	5 63.	17 61.	57 60.	4 44.	4 44.	4 44.	5 63.	57 60.
DON'T KNOW				1 1.		1 4.	2 2.					
AVERAGE	2.67	2.67	2.67	2.84	2.75	2.70	2.75	2.56	2.44	2.44	3.00	2.76
STANDARD DEVIATION	.45	.80	.65	.79	.66	.98	.95	.66	.84	.84	1.11	.81
Q8B(4) COSTS/PERFORMANCE	9 100.	9 100.	18 100.	180 100.	8 100.	28 100.	95 100.	9 100.	9 100.	9 100.	9 100.	96 100.
ESSENTIAL	2 22.	2 22.	4 22.	39 22.	1 13.	5 18.	19 20.	2 22.	3 33.	1 11.	3 33.	24 25.
VERY USEFUL	5 56.	5 56.	10 56.	78 43.	6 75.	16 57.	44 46.	2 22.	5 56.	5 56.	4 44.	47 49.
SOMEWHAT USEFUL	2 22.	2 22.	4 22.	49 27.	1 13.	5 18.	26 27.	5 56.		3 33.	2 22.	21 22.
NOT AT ALL USEFUL				14 8.		2 7.	6 6.		1 11.			4 4.
ESSENTIAL + VERY USEFUL	7 78.	7 78.	14 78.	117 65.	7 88.	21 75.	63 66.	4 44.	8 89.	6 67.	7 78.	71 74.
DON'T KNOW												
AVERAGE	3.00	3.00	3.00	2.79	3.00	2.86	2.80	2.67	3.11	2.78	3.11	2.95
STANDARD DEVIATION	.66	.66	.66	.86	.50	.77	.82	.80	.87	.61	.74	.78

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9	63	8	9	45	18
	100.	100.	100.	100.	100.	100.
Q8B(3) STATE OF ART	9	63	8	9	45	18
	100.	100.	100.	100.	100.	100.
ESSENTIAL	1	15		1	1	
	11.	24.		11.	2.	
VERY USEFUL	4	35	4	3	15	9
	44.	56.	50.	33.	33.	50.
SOMEWHAT USEFUL	4	11	3	5	25	9
	44.	17.	38.	56.	56.	50.
NOT AT ALL USEFUL		2	1		4	
		3.	13.		9.	
ESSENTIAL + VERY USEFUL	5	50	4	4	16	9
	56.	79.	50.	44.	36.	50.
DON'T KNOW						
AVERAGE	2.67	3.00	2.38	2.56	2.29	2.50
STANDARD DEVIATION	.65	.73	.67	.66	.65	.50
Q8B(4) COSTS/PERFORMANCE	9	63	8	9	45	18
	100.	100.	100.	100.	100.	100.
ESSENTIAL	2	20		3	6	2
	22.	32.		33.	13.	11.
VERY USEFUL	5	23	6	4	34	9
	56.	37.	75.	44.	76.	50.
SOMEWHAT USEFUL	2	20	2	2	5	5
	22.	32.	25.	22.	11.	28.
NOT AT ALL USEFUL						2
						11.
ESSENTIAL + VERY USEFUL	7	43	6	7	40	11
	78.	68.	75.	78.	89.	61.
DON'T KNOW						
AVERAGE	3.00	3.00	2.75	3.11	3.02	2.61
STANDARD DEVIATION	.66	.79	.43	.74	.50	.82

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q8B(5) COSTS INSTALL/OPERATE	9 100.	9 100.	18 100.	163 100.	8 100.	28 100.	94 100.	9 100.	9 100.	9 100.	9 100.	96 100.
ESSENTIAL	2 22.	2 22.	4 22.	32 20.	2 25.	5 18.	19 20.	1 11.	3 33.		3 33.	22 23.
VERY USEFUL	4 44.	6 67.	10 56.	70 43.	4 50.	15 54.	43 46.	3 33.	5 56.	7 78.	4 44.	47 49.
SOMEWHAT USEFUL	3 33.	1 11.	4 22.	45 28.	1 13.	5 18.	23 24.	5 56.		2 22.	2 22.	21 22.
NOT AT ALL USEFUL				16 10.	1 13.	3 11.	8 9.		1 11.			6 6.
ESSENTIAL + VERY USEFUL	6 67.	8 89.	14 78.	102 63.	6 75.	20 71.	62 66.	4 44.	8 89.	7 78.	7 78.	69 72.
DON'T KNOW							1 1.					
AVERAGE	2.89	3.11	3.00	2.72	2.88	2.79	2.78	2.56	3.11	2.78	3.11	2.89
STANDARD DEVIATION	.73	.57	.66	.90	.91	.84	.88	.66	.87	.40	.74	.81
Q8B(6) BUILDING CODES/REGS	9 100.	9 100.	18 100.	163 100.	8 100.	29 100.	95 100.	9 100.	9 100.	9 100.	9 100.	96 100.
ESSENTIAL	2 22.		2 11.	19 12.	2 25.	7 24.	21 22.	1 11.		4 44.	1 11.	18 19.
VERY USEFUL	1 11.		1 6.	38 23.	3 38.	11 38.	32 34.	1 11.	3 33.	1 11.		24 25.
SOMEWHAT USEFUL	5 56.	7 78.	12 67.	59 36.	1 13.	6 21.	23 24.	4 44.	3 33.	2 22.	7 78.	38 40.
NOT AT ALL USEFUL	1 11.	2 22.	3 17.	48 29.	2 25.	5 17.	19 20.	3 33.	3 33.	2 22.	1 11.	16 17.
ESSENTIAL + VERY USEFUL	3 33.		3 17.	57 35.	5 63.	18 62.	53 56.	2 22.	3 33.	5 56.	1 11.	42 44.
DON'T KNOW												
AVERAGE	2.44	1.78	2.11	2.17	2.63	2.69	2.58	2.00	2.00	2.78	2.11	2.46
STANDARD DEVIATION	.96	.40	.81	.98	1.09	1.01	1.03	.94	.81	1.22	.74	.97

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 / 100.	63 / 100.	8 / 100.	9 / 100.	45 / 100.	18 / 100.
Q8B(5) COSTS INSTALL/OPERATE	9 / 100.	63 / 100.	8 / 100.	9 / 100.	45 / 100.	18 / 100.
ESSENTIAL	3 / 33.	19 / 30.		3 / 33.	8 / 18.	2 / 11.
VERY USEFUL	4 / 44.	29 / 46.	6 / 75.	6 / 67.	33 / 73.	6 / 33.
SOMEWHAT USEFUL	1 / 11.	10 / 16.	1 / 13.		4 / 9.	7 / 39.
NOT AT ALL USEFUL	1 / 11.	5 / 8.	1 / 13.			3 / 17.
ESSENTIAL + VERY USEFUL	7 / 78.	48 / 76.	6 / 75.	9 / 100.	41 / 91.	8 / 44.
DON'T KNOW						
AVERAGE	3.00	2.98	2.63	3.33	3.09	2.39
STANDARD DEVIATION	.94	.89	.67	.49	.50	.88
Q8B(6) BUILDING CODES/REGS	9 / 100.	63 / 100.	8 / 100.	9 / 100.	45 / 100.	18 / 100.
ESSENTIAL	1 / 11.	10 / 16.		1 / 11.	4 / 9.	2 / 11.
VERY USEFUL	3 / 33.	22 / 35.	4 / 50.	2 / 22.	11 / 24.	4 / 22.
SOMEWHAT USEFUL	3 / 33.	20 / 32.	1 / 13.	4 / 44.	21 / 47.	11 / 61.
NOT AT ALL USEFUL	2 / 22.	11 / 17.	3 / 38.	2 / 22.	9 / 20.	1 / 6.
ESSENTIAL + VERY USEFUL	4 / 44.	32 / 51.	4 / 50.	3 / 33.	15 / 33.	6 / 33.
DON'T KNOW						
AVERAGE	2.33	2.49	2.13	2.22	2.22	2.39
STANDARD DEVIATION	.95	.96	.91	.92	.87	.75

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q8B(7) TAX/ECONOMIC INCENTIVE	9 100.	9 100.	18 100.	163 100.	8 100.	28 100.	95 100.	9 100.	9 100.	9 100.	9 100.	96 100.
ESSENTIAL	3 33.	2 22.	5 28.	27 17.	3 38.	10 36.	30 32.	1 11.	1 11.	1 11.	1 11.	16 17.
VERY USEFUL		2 22.	2 11.	44 27.	4 50.	16 57.	41 43.	3 33.	6 67.	6 67.	2 22.	41 43.
SOMEWHAT USEFUL	6 67.	3 33.	9 50.	52 32.	1 13.	1 4.	15 16.	4 44.	1 11.	1 11.	6 67.	28 29.
NOT AT ALL USEFUL		2 22.	2 11.	40 25.		1 4.	9 9.	1 11.	1 11.	1 11.		11 11.
ESSENTIAL + VERY USEFUL	3 33.	4 44.	7 39.	71 44.	7 88.	26 93.	71 75.	4 44.	7 78.	7 78.	3 33.	57 59.
DON'T KNOW												
AVERAGE	2.67	2.44	2.56	2.36	3.25	3.25	2.97	2.44	2.78	2.78	2.44	2.65
STANDARD DEVIATION	.93	1.07	1.00	1.01	.66	.68	.91	.84	.77	.77	.70	.87
Q8B(8) STANDARDS/SPECS	9 100.	9 100.	18 100.	163 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
ESSENTIAL	1 11.	1 11.	2 11.	18 11.	5 63.	9 31.	29 30.	1 11.		1 11.		13 14.
VERY USEFUL	2 22.	3 33.	5 28.	55 34.	1 13.	8 28.	28 29.	1 11.	3 33.	4 44.	4 44.	29 30.
SOMEWHAT USEFUL	5 56.	5 56.	10 56.	53 33.	1 13.	10 34.	31 32.	7 78.	4 44.	4 44.	4 44.	42 44.
NOT AT ALL USEFUL	1 11.		1 6.	37 23.	1 13.	2 7.	8 8.		2 22.		1 11.	12 13.
ESSENTIAL + VERY USEFUL	3 33.	4 44.	7 39.	73 45.	6 75.	17 59.	57 59.	2 22.	3 33.	5 56.	4 44.	42 44.
DON'T KNOW												
AVERAGE	2.33	2.56	2.44	2.33	3.25	2.83	2.81	2.33	2.11	2.67	2.33	2.45
STANDARD DEVIATION	.82	.66	.77	.95	1.08	.94	.96	.67	.74	.65	.67	.87

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)		IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
		9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q8B(7)	TAX/ECONOMIC INCENTIVE	9 100.	63 100.	7 100.	9 100.	45 100.	18 100.
	ESSENTIAL	2 22.	19 30.		2 22.	7 16.	1 11.
	VERY USEFUL	2 22.	19 30.	6 86.	6 67.	24 53.	8 44.
	SOMEWHAT USEFUL	5 56.	22 35.	1 14.	1 11.	12 27.	7 39.
	NOT AT ALL USEFUL		3 5.			2 4.	1 6.
	ESSENTIAL + VERY USEFUL	4 44.	38 60.	6 86.	8 89.	31 69.	10 56.
	DON'T KNOW						
	AVERAGE	2.67	2.86	2.86	3.11	2.80	2.61
	STANDARD DEVIATION	.80	.89	.32	.57	.74	.75
Q8B(8)	STANDARDS/SPECS	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
	ESSENTIAL	1 11.	11 17.		1 11.	2 4.	1 11.
	VERY USEFUL	1 11.	18 29.	3 38.	3 33.	14 31.	6 33.
	SOMEWHAT USEFUL	3 33.	26 41.	4 50.	5 56.	24 53.	4 22.
	NOT AT ALL USEFUL	4 44.	8 13.	1 13.		4 9.	6 33.
	ESSENTIAL + VERY USEFUL	2 22.	29 46.	3 38.	4 44.	16 36.	8 44.
	DON'T KNOW					1 2.	
	AVERAGE	1.89	2.51	2.25	2.56	2.32	2.22
	STANDARD DEVIATION	.99	.91	.66	.66	.69	1.03

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q8B(9) MARKETING/SALES DATA	9 100.	9 100.	18 100.	146 100.	8 100.	28 100.	95 100.	9 100.	9 100.	9 100.	9 100.	78 100.
ESSENTIAL				14 10.	2 25.	7 25.	22 23.					3 4.
VERY USEFUL	4 44.	1 11.	5 28.	38 26.	3 38.	8 29.	30 32.				2 22.	13 17.
SOMEWHAT USEFUL	4 44.	5 56.	9 50.	56 38.	3 38.	12 43.	34 36.	5 56.	4 44.	4 44.	4 44.	34 44.
NOT AT ALL USEFUL	1 11.	3 33.	4 22.	38 26.		1 4.	9 9.	4 44.	5 56.	5 56.	3 33.	28 36.
ESSENTIAL + VERY USEFUL	4 44.	1 11.	5 28.	52 36.	5 63.	15 54.	52 55.				2 22.	16 21.
DON'T KNOW												
AVERAGE	2.33	1.78	2.06	2.19	2.88	2.75	2.68	1.56	1.44	1.44	1.89	1.88
STANDARD DEVIATION	.67	.62	.69	.93	.76	.87	.94	.48	.50	.50	.73	.82
Q8B(10) OUTSIDE US RESEARCH/ INDUSTRY	9 100.	9 100.	18 100.	180 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
ESSENTIAL		1 11.	1 6.	13 7.	1 13.		14 15.				2 22.	5 5.
VERY USEFUL	4 44.		4 22.	51 29.	3 38.	7 24.	25 26.		1 11.		1 11.	13 14.
SOMEWHAT USEFUL	4 44.	5 56.	9 50.	58 33.	3 38.	12 41.	34 35.	4 44.	2 22.	2 22.	4 44.	30 31.
NOT AT ALL USEFUL	1 11.	3 33.	4 22.	48 27.	1 13.	10 34.	23 24.	5 56.	6 67.	7 78.	2 22.	48 50.
ESSENTIAL + VERY USEFUL	4 44.	1 11.	5 28.	64 36.	4 50.	7 24.	39 41.		1 11.		3 33.	18 19.
DON'T KNOW												
AVERAGE	2.33	1.89	2.11	2.16	2.50	1.90	2.31	1.44	1.44	1.22	2.33	1.74
STANDARD DEVIATION	.67	.87	.81	.90	.86	.74	.99	.50	.69	.42	1.06	.88

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q8B(9) MARKETING/SALES DATA	9 100.	63 100.	8 100.			
ESSENTIAL		5 8.				
VERY USEFUL	2 22.	15 24.	3 38.			
SOMEWHAT USEFUL	3 33.	26 41.	1 13.			
NOT AT ALL USEFUL	4 44.	17 27.	4 50.			
ESSENTIAL + VERY USEFUL	2 22.	20 32.	3 38.			
DON'T KNOW						
AVERAGE	1.78	2.13	1.88			
STANDARD DEVIATION	.78	.89	.91			
Q8B(10) OUTSIDE US RESEARCH/ INDUSTRY	9 100.	63 100.	8 100.			17 100.
ESSENTIAL		5 8.				
VERY USEFUL	2 22.	14 22.	1 13.			1 6.
SOMEWHAT USEFUL	4 44.	23 37.	2 25.			7 41.
NOT AT ALL USEFUL	3 33.	21 33.	5 63.			9 53.
ESSENTIAL + VERY USEFUL	2 22.	19 30.	1 13.			1 6.
DON'T KNOW						
AVERAGE	1.89	2.05	1.50			1.53
STANDARD DEVIATION	.73	.92	.70			.60

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT		IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
		9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q8B(11)	INFO ON MARKETING		9 100.	9 100.	18 100.	8 100.	28 100.	95 100.					35 100.
	ESSENTIAL				3 17.	1 13.	6 21.	22 23.					2 6.
	VERY USEFUL					3 38.	7 25.	17 18.					7 20.
	SOMEWHAT USEFUL		3 33.	3 33.	7 39.	4 50.	11 39.	33 35.					11 31.
	NOT AT ALL USEFUL		6 67.	6 67.	8 44.		4 14.	23 24.					15 43.
	ESSENTIAL + VERY USEFUL				3 17.	4 50.	13 46.	39 41.					9 26.
	DON'T KNOW												
	AVERAGE		1.33	1.33	1.89	2.63	2.54	2.40					1.89
	STANDARD DEVIATION		.48	.48	1.04	.67	.97	1.08					.90
Q8B(12) LEGAL	INST/SOCIAL/ENVIRON./	9 100.	9 100.	18 100.	163 100.	8 100.	28 100.	95 100.	9 100.	9 100.	9 100.	9 100.	95 100.
	ESSENTIAL				13 8.		2 7.	9 9.			1 11.	1 11.	11 12.
	VERY USEFUL		2 22.	2 11.	51 31.	3 38.	8 29.	24 25.	1 11.	2 22.		3 33.	26 27.
	SOMEWHAT USEFUL	9 100.	6 67.	15 83.	73 45.	4 50.	11 39.	41 43.	7 78.	4 44.	4 44.	2 22.	33 35.
	NOT AT ALL USEFUL		1 11.	1 6.	25 16.	1 13.	7 25.	21 22.	1 11.	3 33.	4 44.	3 33.	25 26.
	ESSENTIAL + VERY USEFUL		2 22.	2 11.	64 39.	3 38.	10 36.	33 35.	1 11.	2 22.	1 11.	4 44.	37 39.
	DON'T KNOW												
	AVERAGE	2.00	2.11	2.06	2.31	2.25	2.18	2.22	2.00	1.89	1.78	2.22	2.24
	STANDARD DEVIATION		.57	.38	.84	.66	.88	.89	.47	.73	.91	1.03	.97

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)		IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
		9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q8B(11)	INFO ON MARKETING	9 100.	63 100.	8 100.			
	ESSENTIAL		5 8.				
	VERY USEFUL	1 11.	17 27.	1 13.			
	SOMEWHAT USEFUL	6 67.	21 33.	3 38.			
	NOT AT ALL USEFJL	2 22.	20 32.	4 50.			
	ESSENTIAL + VERY USEFUL	1 11.	22 35.	1 13.			
	DON'T KNOW						
	AVERAGE	1.89	2.11	1.63			
	STANDARD DEVIATION	.56	.94	.68			
Q8B(12) LEGAL	INST/SOCIAL/ENVIRON/	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
	ESSENTIAL	1 11.	6 10.		1 11.	2 4.	
	VERY USEFUL	3 33.	30 48.	1 13.	1 11.	6 13.	2 11.
	SOMEWHAT USEFUL	4 44.	19 30.	5 63.	7 78.	30 67.	9 50.
	NOT AT ALL USEFUL	1 11.	8 13.	2 25.		7 16.	7 39.
	ESSENTIAL + VERY USEFUL	4 44.	36 57.	1 13.	2 22.	8 18.	2 11.
	DON'T KNOW						
	AVERAGE	2.44	2.54	1.88	2.33	2.07	1.72
	STANDARD DEVIATION	.84	.83	.58	.67	.66	.65

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

	INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
		9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q8B(13)	EXPECTED DEVELOPMENTS	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
	ESSENTIAL		1 11.	1 6.	24 13.		3 10.	19 20.			1 11.	3 33.	13 14.
	VERY USEFUL	5 56.	3 33.	8 44.	88 49.	4 50.	11 38.	36 38.	6 67.	3 33.	3 33.	2 22.	39 41.
	SOMEWHAT USEFUL	4 44.	5 56.	9 50.	51 28.	4 50.	10 34.	33 34.	2 22.	4 44.	4 44.	4 44.	34 35.
	NOT AT ALL USEFUL				17 9.		5 17.	8 8.	1 11.	2 22.	1 11.		10 10.
	ESSENTIAL + VERY USEFUL	5 56.	4 44.	9 50.	112 62.	4 50.	14 48.	55 57.	6 67.	3 33.	4 44.	5 56.	52 54.
	DON'T KNOW				1 1.								
	AVERAGE	2.56	2.56	2.56	2.66	2.50	2.41	2.69	2.56	2.11	2.44	2.89	2.57
	STANDARD DEVIATION	.47	.66	.57	.82	.50	.90	.87	.66	.74	.84	.87	.85
Q8B(14)	CLIMATOLOGICAL DATA	9 100.	9 100.	18 100.	163 100.	8 100.	28 100.	95 100.	9 100.	9 100.	9 100.	9 100.	96 100.
	ESSENTIAL	2 22.	4 44.	6 33.	34 21.	3 38.	4 14.	28 29.	2 22.		2 22.	3 33.	29 30.
	VERY USEFUL	4 44.	3 33.	7 39.	55 34.	3 38.	11 39.	28 29.	4 44.	5 56.	5 56.	4 44.	38 40.
	SOMEWHAT USEFUL	3 33.	2 22.	5 28.	46 28.	1 13.	9 32.	20 21.	2 22.	2 22.	1 11.	1 11.	16 17.
	NOT AT ALL USEFUL				28 17.	1 13.	4 14.	19 20.	1 11.	2 22.	1 11.	1 11.	13 14.
	ESSENTIAL + VERY USEFUL	6 67.	7 78.	13 72.	89 55.	6 75.	15 54.	56 59.	6 67.	5 56.	7 78.	7 78.	67 70.
	DON'T KNOW												
	AVERAGE	2.89	3.22	3.06	2.58	3.00	2.54	2.68	2.78	2.33	2.89	3.00	2.86
	STANDARD DEVIATION	.73	.79	.76	1.00	1.00	.89	1.10	.90	.82	.87	.94	1.00

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USEFULNESS OF SPECIFIED INFORMATION ITEMS - CONTINUED (QUESTION 8)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)		IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
		9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q8B(13)	EXPECTED DEVELOPMENTS	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
	ESSENTIAL	4 44.	17 27.		1 11.	2 4.	2 11.
	VERY USEFUL	4 44.	31 49.	4 50.	5 56.	23 51.	7 39.
	SOMEWHAT USEFUL	1 11.	10 16.	4 50.	2 22.	14 31.	7 39.
	NOT AT ALL USEFUL		4 6.		1 11.	6 13.	2 11.
	ESSENTIAL + VERY USEFUL	8 89.	48 76.	4 50.	6 67.	25 56.	9 50.
	DON'T KNOW		1 2.				
	AVERAGE	3.33	2.98	2.50	2.67	2.47	2.50
	STANDARD DEVIATION	.68	.84	.50	.80	.76	.83
Q8B(14)	CLIMATOLOGICAL DATA	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
	ESSENTIAL	3 33.	21 33.	1 13.	1 11.	8 18.	5 28.
	VERY USEFUL	2 22.	24 38.	3 38.	6 67.	23 51.	7 39.
	SOMEWHAT USEFUL	3 33.	15 24.	3 38.	1 11.	9 20.	2 11.
	NOT AT ALL USEFUL	1 11.	3 5.	1 13.	1 11.	5 11.	4 22.
	ESSENTIAL + VERY USEFUL	5 56.	45 71.	4 50.	7 78.	31 69.	12 67.
	DON'T KNOW						
	AVERAGE	2.78	3.00	2.50	2.78	2.76	2.72
	STANDARD DEVIATION	1.02	.87	.86	.77	.85	1.10

SCALE: ESSENTIAL = 4, VERY USEFUL = 3, SOMEWHAT USEFUL = 2, NOT AT ALL USEFUL = 1

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

T-038

(OCTOBER, 1979)

USE OF SPECIAL ACQUISITION METHODS (QUESTION 10)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q10A COMPUTER TERMINAL												
1. YES	3 33.	4 44.	7 39.	62 34.	2 25.	7 24.	22 23.	2 22.	5 56.	1 11.	4 44.	33 34.
2. NO	6 67.	5 56.	11 61.	116 64.	6 75.	22 76.	74 77.	7 78.	4 44.	8 89.	5 56.	62 65.
8. DON'T KNOW/NA				3 2.								1 1.
Q10B MICROFORM - COMPUTER												
1. YES	1 11.		1 6.	16 9.	1 13.	2 7.	5 5.		1 11.		1 11.	13 14.
2. NO	7 78.	7 78.	14 78.	155 86.	6 75.	26 90.	87 91.	9 100.	8 89.	9 100.	7 78.	78 81.
8. DON'T KNOW/NA	1 11.	2 22.	3 17.	10 6.	1 13.	1 3.	4 4.				1 11.	5 5.
Q10C OTHER MICROFORM												
1. YES	4 44.	3 33.	7 39.	72 40.	3 38.	3 10.	19 20.	1 11.	2 22.		4 44.	24 25.
2. NO	5 56.	5 56.	10 56.	108 60.	5 63.	25 86.	76 79.	8 89.	7 78.	9 100.	5 56.	72 75.
8. DON'T KNOW/NA		1 11.	1 6.	1 1.		1 3.	1 1.					

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

T-038

(OCTOBER, 1979)

USE OF SPECIAL ACQUISITION METHODS (QUESTION 10)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q10A COMPUTER TERMINAL						
1. YES	3 33.	14 22.		2 22.	7 16.	8 44.
2. NO	6 67.	49 78.	8 100.	7 78.	38 84.	10 56.
8. DON'T KNOW/NA						
Q10B MICROFORM - COMPUTER						
1. YES		4 6.	1 13.		3 7.	5 28.
2. NO	9 100.	58 92.	7 88.	8 89.	41 91.	11 61.
8. DON'T KNOW/NA		1 2.		1 11.	1 2.	2 11.
Q10C OTHER MICROFORM						
1. YES	3 33.	21 33.	2 25.		4 9.	6 33.
2. NO	6 67.	42 67.	6 75.	9 100.	41 91.	12 67.
8. DON'T KNOW/NA						

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USE OF SELECTED SOLAR INFORMATION SOURCES (QUESTION 11)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	131 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q11(1) LIBRARY (ORG/LOCAL)	9 100.	9 100.	18 100.	179 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
1. YES	8 89.	9 100.	17 94.	150 84.	6 75.	21 72.	63 66.	2 22.	2 22.	4 44.	8 89.	61 64.
2. NO	1 11.		1 6.	28 16.	2 25.	8 28.	33 34.	7 78.	7 78.	5 56.	1 11.	35 36.
8. DON'T KNOW				1 1.								
Q11(2) PUBLIC UTILITY	9 100.	9 100.	18 100.	180 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
1. YES	4 44.	4 44.	8 44.	91 51.	5 63.	15 52.	41 43.	2 22.	1 11.	5 56.	4 44.	48 50.
2. NO	5 56.	5 56.	10 56.	88 49.	3 38.	14 48.	55 57.	7 78.	8 89.	4 44.	5 56.	48 50.
8. DON'T KNOW				1 1.								
Q11(3) INSTALLER/BUILDER/ DESIGNER	9 100.	9 100.	18 100.	180 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
1. YES	7 78.	6 67.	13 72.	117 65.	8 100.	24 83.	65 69.	8 89.	7 78.	7 78.	8 89.	83 86.
2. NO	2 22.	3 33.	5 28.	63 35.		5 17.	31 31.	1 11.	2 22.	2 22.	1 11.	13 14.
8. DON'T KNOW												
Q11(4) WORKSHOPS/CONFERENCES	9 100.	9 100.	18 100.	180 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
1. YES	9 100.	9 100.	18 100.	159 88.	7 88.	23 79.	72 75.	4 44.	6 67.	9 100.	6 67.	69 72.
2. NO				21 12.	1 13.	6 21.	24 25.	5 56.	3 33.		3 33.	27 28.
8. DON'T KNOW												

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USE OF SELECTED SOLAR INFORMATION SOURCES (QUESTION 11)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q11(1) LIBRARY (ORG/LOCAL)	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	9 100.	54 86.	5 63.	4 44.	20 44.	15 83.
2. NO		9 14.	3 38.	5 56.	25 56.	3 17.
8. DON'T KNOW						
Q11(2) PUBLIC UTILITY	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	7 78.	36 57.	7 88.	5 56.	20 44.	11 61.
2. NO	2 22.	27 43.	1 13.	3 33.	23 51.	7 39.
8. DON'T KNOW				1 11.	2 4.	
Q11(3) INSTALLER/BUILDER/ DESIGNER	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	7 78.	56 89.	6 75.	6 67.	24 53.	11 61.
2. NO	2 22.	7 11.	2 25.	3 33.	21 47.	7 39.
8. DON'T KNOW						
Q11(4) WORKSHOPS/CONFERENCES	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	8 89.	57 90.	6 75.	5 56.	25 56.	15 83.
2. NO	1 11.	6 10.	2 25.	4 44.	20 44.	3 17.
8. DON'T KNOW						

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

T-040

(OCTOBER, 1979)

USE OF SELECTED SOLAR INFORMATION SOURCES - CONTINUED (QUESTION 11)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q11(5) COMMERCIAL DATA BASE	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	8 100.	9 100.	9 100.	9 100.	95 100.
1. YES	3 33.	1 11.	4 22.	68 38.	2 25.	6 21.	21 22.		1 11.		6 67.	23 24.
2. NO	6 67.	8 89.	14 78.	110 61.	6 75.	23 79.	75 78.	8 100.	8 89.	9 100.	3 33.	70 74.
8. DON'T KNOW				3 2.								2 2.
Q11(6) FEDERAL LIBRARY/INFO CENTER	9 100.	9 100.	18 100.	180 100.	8 100.	29 100.	95 100.	9 100.	9 100.	9 100.	9 100.	96 100.
1. YES	4 44.	7 78.	11 61.	97 54.	8 100.	13 45.	44 46.	1 11.	5 56.	3 33.	4 44.	44 46.
2. NO	5 56.	2 22.	7 39.	78 43.		16 55.	50 53.	8 89.	4 44.	6 67.	5 56.	50 52.
8. DON'T KNOW				5 3.			1 1.					2 2.
Q11(7) SSIE - SMITHSONIAN	9 100.	9 100.	18 100.	181 100.	8 100.	11 100.	42 100.	9 100.	9 100.		9 100.	70 100.
1. YES	2 22.	2 22.	4 22.	30 17.	1 13.	1 9.	3 7.				2 22.	8 11.
2. NO	7 78.	7 78.	14 78.	146 81.	7 88.	10 91.	39 93.	9 100.	9 100.		7 78.	61 87.
8. DON'T KNOW				5 3.								1 1.

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USE OF SELECTED SOLAR INFORMATION SOURCES - CONTINUED (QUESTION 11)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q11(5) COMMERCIAL DATA BASE	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	2 22.	17 27.	1 13.	1 11.	6 13.	3 17.
2. NO	7 78.	46 73.	7 88.	8 89.	39 87.	15 83.
8. DON'T KNOW						
Q11(6) FEDERAL LIBRARY/INFO CENTER	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	5 56.	33 52.	6 75.	2 22.	15 33.	12 67.
2. NO	4 44.	30 48.	2 25.	7 78.	30 67.	6 33.
8. DON'T KNOW						
Q11(7) SSIE - SMITHSONIAN	9 100.	63 100.	8 100.		9 100.	18 100.
1. YES	1 11.	13 21.	3 38.			3 17.
2. NO	7 78.	48 76.	5 63.		9 100.	14 78.
8. DON'T KNOW	1 11.	2 3.				1 6.

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

T-041

(OCTOBER, 1979)

USE OF SELECTED SOLAR INFORMATION SOURCES - CONTINUED (QUESTION 11)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	100.9	100.9	100.18	100.161	100.8	100.29	100.96	100.9	100.9	100.9	100.9	100.96
Q11(8) GOV'T PRINTING OFFICE-GPO	100.9	100.9	100.18	100.161	100.8	100.29	100.96	100.9	100.9	100.9	100.9	100.96
1. YES	89.8	78.7	83.15	74.134	88.7	79.23	75.72	44.4	89.8	78.7	78.7	76.73
2. NO	11.1	11.1	11.2	24.44	13.1	21.6	25.24	56.5	11.1	22.2	22.2	24.23
8. DON'T KNOW		11.1	6.1	2.3								
	100.9	100.9	100.18	100.181	100.8	100.29	100.96	100.9	100.9	100.9	100.9	100.96
Q11(9) NATIONAL TECHNICAL INFORMATION SERVICE-NTIS	100.9	100.9	100.18	100.181	100.8	100.29	100.96	100.9	100.9	100.9	100.9	100.96
1. YES	89.8	33.3	51.11	64.115	63.5	48.14	44.42	11.1	33.3	56.5	56.5	47.45
2. NO	11.1	44.4	28.5	33.59	38.3	52.15	54.52	89.8	56.5	44.4	44.4	51.49
8. DON'T KNOW		22.2	11.2	4.7			2.2		11.1			2.2
	100.9	100.9	100.18	100.181	100.8	100.29	100.96	100.9	100.9	100.9	100.9	100.96
Q11(10) TECHNICAL INFORMATION CENTER - TIC	100.9	100.9	100.18	100.180	100.8	100.29	100.96	100.9	100.9	100.9	100.9	100.96
1. YES	89.8	33.3	61.11	40.72	38.3	21.6	21.20	22.2	56.5	33.3	22.2	33.32
2. NO	11.1	56.5	33.6	56.100	50.4	79.23	76.73	67.6	44.4	67.6	78.7	63.60
8. DON'T KNOW		11.1	6.1	4.8	13.1		3.3	11.1				4.4

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USE OF SELECTED SOLAR INFORMATION SOURCES - CONTINUED (QUESTION 11)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q11(8) GOV'T PRINTING OFFICE-GPO	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	5 56.	50 79.	6 75.	6 67.	29 64.	15 83.
2. NO	3 33.	12 19.	2 25.	3 33.	15 33.	3 17.
8. DON'T KNOW	1 11.	1 2.			1 2.	
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q11(9) NATIONAL TECHNICAL INFORMATION SERVICE-NTIS	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	7 78.	40 63.	3 38.		3 7.	9 50.
2. NO	2 22.	22 35.	5 63.	8 89.	39 87.	9 50.
8. DON'T KNOW		1 2.		1 11.	3 7.	
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q11(10) TECHNICAL INFORMATION CENTER - TIC	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	5 56.	28 44.	3 38.	1 11.	5 11.	9 50.
2. NO	3 33.	31 49.	5 63.	8 89.	39 87.	9 50.
8. DON'T KNOW	1 11.	4 6.			1 2.	

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

T-044

(OCTOBER, 1979)

USE OF SELECTED SOLAR INFORMATION SOURCES - CONTINUED (QUESTION 11)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q11(11) NATL SOLAR HEATING + COOLING INFO CTR	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	78 100.
1. YES	2 22.	4 44.	6 33.	53 29.	2 25.	22 76.	40 42.	1 11.	2 22.	5 56.	2 22.	28 36.
2. NO	6 67.	4 44.	10 55.	120 66.	5 63.	7 24.	54 56.	8 89.	6 67.	4 44.	7 78.	47 60.
8. DON'T KNOW	1 11.	1 11.	2 11.	8 4.	1 13.		2 2.		1 11.			3 4.
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q11(12) REGIONAL SOLAR ENERGY CENTERS	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
1. YES		4 44.	4 22.	41 23.	2 25.	17 59.	34 35.		1 11.	2 22.	2 22.	26 27.
2. NO	9 100.	4 44.	13 72.	133 73.	6 75.	12 41.	62 65.	9 100.	8 89.	7 78.	7 78.	66 69.
8. DON'T KNOW		1 11.	1 6.	7 4.								4 4.

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USE OF SELECTED SOLAR INFORMATION SOURCES - CONTINUED (QUESTION 11)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q11(11) NATL SOLAR HEATING + COOLING INFO CTR	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	4 44.	29 46.	2 25.	2 22.	13 29.	9 50.
2. NO	5 56.	34 54.	6 75.	6 67.	30 67.	8 44.
8. DON'T KNOW				1 11.	2 4.	1 6.
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q11(12) REGIONAL SOLAR ENERGY CENTERS	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	3 33.	27 43.	4 50.		9 20.	4 22.
2. NO	6 67.	34 54.	3 38.	7 78.	32 71.	13 72.
8. DON'T KNOW		2 3.	1 13.	2 22.	4 9.	1 6.

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

T-046

(OCTOBER, 1979)

USE OF SELECTED SOLAR INFORMATION SOURCES - CONTINUED (QUESTION 11)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q11(13) US DEPT. OF ENERGY	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
1. YES	8 89.	7 78.	15 83.	144 80.	7 88.	21 72.	71 74.	2 22.	6 67.	6 67.	7 78.	60 63.
2. NO	1 11.	2 22.	3 17.	36 20.		8 28.	24 25.	7 78.	3 33.	3 33.	2 22.	34 35.
8. DON'T KNOW				1 1.	1 13.		1 1.					2 2.
Q11(14) RADIO/TV	9 100.		9 100.	80 100.	8 100.	11 100.	51 100.					
1. YES	3 33.		3 33.	22 28.	2 25.	4 36.	21 41.					
2. NO	6 67.		6 67.	57 71.	6 75.	7 64.	30 59.					
8. DON'T KNOW				1 1.								
Q11(15) PERIODICALS/ NEWSPAPERS	9 100.	9 100.	18 100.	109 100.	8 100.	29 100.	86 100.			9 100.		51 100.
1. YES	8 89.	9 100.	17 94.	103 94.	7 88.	29 100.	83 97.			9 100.		50 98.
2. NO	1 11.		1 6.	6 6.	1 13.		3 3.					1 2.
8. DON'T KNOW												
Q11(16) PRIVATE SOLAR/ ENVIRONMENTAL ORG.	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
1. YES	4 44.	4 44.	8 44.	96 53.	5 63.	23 79.	62 65.	1 11.	5 56.	3 33.	1 11.	39 41.
2. NO	5 56.	5 56.	10 56.	82 45.	3 38.	6 21.	31 32.	8 89.	4 44.	6 67.	8 89.	56 58.
8. DON'T KNOW				3 2.			3 3.					1 1.

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

USE OF SELECTED SOLAR INFORMATION SOURCES - CONTINUED (QUESTION 11)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q11(13) US DEPT. OF ENERGY	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	8 89.	53 84.	6 75.	8 89.	23 51.	16 89.
2. NO	1 11.	10 16.	1 13.	1 11.	20 44.	2 11.
8. DON'T KNOW			1 13.		2 4.	
Q11(14) RADIO/TV	9 100.	62 100.	8 100.	9 100.	45 100.	18 100.
1. YES	2 22.	33 53.	6 75.	6 67.	19 42.	11 61.
2. NO	6 67.	28 45.	2 25.	3 33.	25 56.	7 39.
8. DON'T KNOW	1 11.	1 2.			1 2.	
Q11(15) PERIODICALS/ NEWSPAPERS	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	9 100.	61 97.	7 88.	8 89.	39 87.	18 100.
2. NO		2 3.	1 13.	1 11.	6 13.	
8. DON'T KNOW						
Q11(16) PRIVATE SOLAR/ ENVIRONMENTAL ORG.	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	5 56.	42 67.	6 75.	3 33.	16 36.	7 39.
2. NO	4 44.	21 33.	2 25.	5 56.	27 60.	11 61.
8. DON'T KNOW				1 11.	2 4.	

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

T-047

(OCTOBER, 1979)

USE OF SELECTED SOLAR INFORMATION SOURCES - CONTINUED (QUESTION 11)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
Q11(17) STATE ENERGY OR SOLAR OFFICES	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
1. YES	5 56.	8 89.	13 72.	86 48.	7 88.	24 83.	56 58.	5 56.	4 44.	8 89.	5 56.	54 56.
2. NO	4 44.	1 11.	5 28.	94 52.	1 13.	5 17.	40 42.	4 44.	5 56.		4 44.	40 42.
8. DON'T KNOW				1 1.						1 11.		2 2.
Q11(18) OTHER STATE/ LOCAL GOV'T. SOURCE	9 100.	9 100.	18 100.	178 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
1. YES	4 44.	2 22.	6 33.	49 28.	4 50.	16 55.	40 42.	1 11.	2 22.	3 33.	4 44.	29 30.
2. NO	5 56.	7 78.	12 67.	128 72.	4 50.	12 41.	54 56.	8 89.	7 78.	6 67.	5 56.	66 69.
8. DON'T KNOW				1 1.		1 3.	2 2.					1 1.
Q11(19) INTL SOLAR ENERGY SOCIETY-ISES	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
1. YES	7 78.	6 67.	13 72.	87 48.	7 88.	17 59.	48 50.	1 11.		3 33.	8 89.	36 38.
2. NO	2 22.	2 22.	4 22.	92 51.	1 13.	12 41.	47 49.	8 89.	9 100.	6 67.	1 11.	60 63.
8. DON'T KNOW		1 11.	1 6.	2 1.			1 1.					
Q11(20) SOLAR ENERGY INDUSTRIES ASSOC.-SEIA	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
1. YES	6 67.	2 22.	8 44.	60 33.	7 88.	21 72.	45 47.		1 11.	1 11.	2 22.	21 22.
2. NO	3 33.	7 78.	10 56.	118 65.	1 13.	8 28.	49 51.	8 89.	8 89.	8 89.	7 78.	73 76.
8. DON'T KNOW				3 2.			2 2.	1 11.				2 2.

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USE OF SELECTED SOLAR INFORMATION SOURCES - CONTINUED (QUESTION 11)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
Q11(17) STATE ENERGY OR SOLAR OFFICES	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	6 67.	48 76.	7 88.	6 67.	26 58.	15 83.
2. NO	3 33.	15 24.	1 13.	3 33.	19 42.	3 17.
8. DON'T KNOW						
Q11(18) OTHER STATE/ LOCAL GOV'T. SOURCE	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	5 56.	32 51.	5 63.	3 33.	19 42.	4 22.
2. NO	4 44.	31 49.	3 38.	5 56.	25 56.	14 78.
8. DON'T KNOW				1 11.	1 2.	
Q11(19) INTL SOLAR ENERGY SOCIETY-ISES	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	6 67.	39 62.	2 25.		2 4.	5 28.
2. NO	3 33.	24 38.	5 63.	9 100.	43 96.	13 72.
8. DON'T KNOW			1 13.			
Q11(20) SOLAR ENERGY INDUSTRIES ASSOC.-SEIA	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES	2 22.	21 33.	3 38.	2 22.	2 4.	2 11.
2. NO	7 78.	42 67.	4 50.	7 78.	42 93.	15 83.
8. DON'T KNOW			1 13.		1 2.	1 6.

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USE OF SELECTED SOLAR INFORMATION SOURCES - CONTINUED (QUESTION 11)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	APH RES	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG
	$100.^{9}$	$100.^{9}$	$100.^{9}$	$100.^{9}$	$100.^{9}$
Q11(21) QUESTIONNAIRE SOURCE	$100.^{9}$	$100.^{9}$	$100.^{9}$	$100.^{9}$	$100.^{9}$
1. YES	$100.^{9}$	$78.^{7}$	$100.^{9}$	$89.^{8}$	$22.^{2}$
2. NO		$22.^{2}$		$11.^{1}$	$78.^{7}$
8. DON'T KNOW					
	(USDA)	(AEE)	(AEE)	(AEE)	(AEE)
Q11(22) QUESTIONNAIRE SOURCE		$100.^{9}$	$100.^{9}$		$100.^{9}$
1. YES		$11.^{1}$	$22.^{2}$		$33.^{3}$
2. NO		$89.^{8}$	$78.^{7}$		$67.^{6}$
8. DON'T KNOW					
		(IEEE)	(IEEE)		(ASAE)
Q11(23) QUESTIONNAIRE SOURCE					
1. YES					
2. NO					
8. DON'T KNOW					
Q11(24) QUESTIONNAIRE SOURCE					
1. YES					
2. NO					
8. DON'T KNOW					

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

(OCTOBER, 1979)

USE OF SELECTED SOLAR INFORMATION SOURCES - CONTINUED (QUESTION 11)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUc	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
			8 100.	9 100.	45 100.	18 100.
Q11(21) QUESTIONNAIRE SOURCE 21			8 100.	9 100.	45 100.	18 100.
1. YES USDA, including CES			8 100.	9 100.	44 98.	17 94.
2. NO					1 2.	1 6.
8. DON'T KNOW						
Q11(22) QUESTIONNAIRE SOURCE 22				9 100.		
1. YES State Agricultural Office				5 56.		
2. NO				4 44.		
8. DON'T KNOW						

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

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(OCTOBER, 1979)

YEARS IN CURRENT PROFESSION (QUESTION D28)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IAPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
1. 0-2 YEARS		1 11.	1 6.	10 6.	1 13.	1 3.	9 9.				1 11.	4 4.
2. 3-5 YEARS	5 56.	1 11.	6 33.	35 19.	1 13.	11 38.	22 23.	1 11.	3 33.	1 11.	1 11.	16 17.
3. 6-10 YEARS	1 11.	3 33.	4 22.	33 18.	1 13.	9 31.	21 22.	3 33.	2 22.		3 33.	19 20.
4. OVER 10	3 33.	4 44.	7 39.	103 57.	5 63.	8 28.	44 46.	5 56.	4 44.	8 89.	4 44.	56 58.
DON'T KNOW/NA												1 1.

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

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(OCTOBER, 1979)

YEARS IN CURRENT PROFESSION (QUESTION D2B)

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUC	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. 0-2 YEARS	1 11.	1 2.	2 25.		3 7.	
2. 3-5 YEARS	2 22.	8 13.	3 38.	2 22.	9 20.	3 17.
3. 6-10 YEARS		13 21.	1 13.		3 7.	4 22.
4. OVER 10	6 67.	41 65.	2 25.	7 78.	30 67.	11 61.
DON'T KNOW/NA						

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

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T-052

(OCTOBER, 1979)

MEMBERSHIP IN SOLAR-INTERESTED ORGANIZATIONS (QUESTION D3)
MEMBERSHIPS WITH INTEREST IN SOLAR

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT	IPH RES	APH RES	TOTAL IPH RES	ALL RES	CONC COLL MANUF	TOTAL NCONC COLL MANUF	ALL MANUF	IPH PLANT ENG	IPH INDUS ENG	SHAC IND ENG	IPH AGRIC ENG	ALL ENG
	9 100.	9 100.	18 100.	181 100.	8 100.	29 100.	96 100.	9 100.	9 100.	9 100.	9 100.	96 100.
1. YES BELONG, NAME	8 89.	9 100.	17 94.	136 75.	6 75.	20 69.	62 65.	7 78.	7 78.	9 100.	9 100.	81 84.
2. YES BELONG, CAN'T NAME				4 2.								
3. NO, DON'T BELONG	1 11.		1 6.	40 22.	2 25.	9 31.	34 35.	2 22.	2 22.			14 15.
DON'T KNOW/NA				1 1.								1 1.

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

T-052

(OCTOBER, 1979)

MEMBERSHIP IN SOLAR-INTERESTED ORGANIZATIONS (QUESTION D3)
MEMBERSHIPS WITH INTEREST IN SOLAR

INDUSTRIAL AND AGRICULTURAL PROCESS HEAT (CONTINUED)	IPH EDU	ALL EDUc	APH STATE AGRIC OFF	APH CES CO AGENT	ALL CES CO AGENT	ALL CES STATE SPEC
	9 100.	63 100.	8 100.	9 100.	45 100.	18 100.
1. YES BELONG, NAME	8 89.	56 89.	3 38.	5 56.	17 38.	11 61.
2. YES BELONG, CAN'T NAME						
3. NO, DON'T BELONG		5 8.	5 63.	4 44.	28 62.	7 39.
DON'T KNOW/NA	1 11.	2 3.				

Figure F-1. Industrial and Agricultural Process Heat Data Tables (continued)

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15. Supplementary Notes

16. Abstract (Limit: 200 words) This report describes the results of a series of telephonc interviews with groups of users of information on solar industrial and agricultural process heat (IAPH). These results, part of a larger study on many different solar technologies, identify types of information each group needed and the best ways to get information to each group. The report is 1 of 10 discussing study results. The overall study provides baseline data about information needs in the solar community. It covers these technological areas: photovoltaics, passive solar heating and cooling, active solar heating and cooling, biomass energy, solar thermal electric power, solar industrial and agricultural process heat, wind energy, ocean energy, and solar energy storage. An earlier study identified the information user groups in the solar community and the priority (to accelerate solar energy commercialization of getting information to each group. In the current study only high-priority groups were examined. Results from 10 IAPH groups of respondents are analyzed in this report: IPH Researchers; APH Researchers; Representatives of Manufacturers of Concentrating and Nonconcentrating Collectors; Plant, Industrial, and Agricultural Engineers; Educators; Representatives of State Agricultural Offices; and County Extension Agents. The data will be used as input to the determination of information products and services the Solar Energy Research Institute, the Solar Energy Information Data Bank Network, and the entire information outreach community should be preparing and disseminating.

17. Document Analysis

a. Descriptors

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