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**SOLAR DIFFUSION IN CALIFORNIA:
A PILOT STUDY**

CALIFORNIA ENERGY COMMISSION

CONSULTANT REPORT

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Submitted to the California Energy Commission

October 1979

by

Everett M. Rogers
Dorothy Leonard-Barton
Tamar Avi-Itzhak
Eugene Rosa
Ronny Adhikarya

Institute for Communication Research
Stanford University

Contract No. 500-020

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A B S T R A C T

This report meets a growing need for more information about consumer attitudes and motivations to purchase solar energy equipment. The California Energy Commission contracted with the Institute for Communication Research at Stanford University to study solar system owners and their neighbors in the San Francisco Bay Area. The purpose of the study was to determine the level of homeowner awareness about residential solar energy systems, describe characteristics of consumers purchasing solar equipment (e.g. whether they represent identifiable market segments), identify major channels of communication through which solar information is effectively used, determine remaining barriers to solar use, identify needed incentives to accelerate commercialization, and assess public attitudes toward various state and federal government actions to increase the rate of solar energy use statewide. Issues and questions explored in this study are being used in the development of a statewide survey of 700 homeowners in California to determine if these findings apply to residents throughout the state.

PREFACE

The Institute for Communication Research at Stanford University has a long history of involvement with current social issues. Faculty and student research focuses on the interface between science and society in fields as diverse as health, education, communication technology, third world development and the social impacts of electronic media. Members at the Institute conduct "action research" for such federal agencies as D.O.E., H.E.W., N.I.H., and many others.

When Professor Everett M. Rogers joined the faculty at Stanford in 1975, he brought to the Institute more than 20 years experience with the diffusion of innovations. The research reported in this paper grew out of an interest in applying the theories and body of knowledge about the spread of new ideas (documented in some 3,000 empirical studies on the subject) to the diffusion of solar technology. An innovation, which has been defined as "an idea, practice, or object perceived as new by an individual" (Rogers with Shoemaker, 1971) does not usually meet with immediate, unquestioned acceptance from the public. Any new technology must augment or supplant the old, and is at first accepted by a few innovative individuals, whose experience then becomes the basis for increased public adoption.

Solar technology is particularly interesting to the authors, because its spread may partially parallel the diffusion of a number of other innovations we have been studying the past several years, all of which may be roughly classified together as energy-conserving practices (e.g., insulating homes, recycling, etc.). Unlike many of the innumerable previous innovations studied by diffusion scholars, which tended to be of the "bigger and better" variety, these new ideas and behaviors are aimed at scaling down consumption. The emphasis is on small and beautiful rather than big and complex. The residential solar systems covered in this report, as simple as they are, are still at the high technology end of the range of energy-conserving innovations we are studying. The swimming pool,

hot water, and space heating systems studied are all accessible only to quite wealthy people. We have not looked at, in this research, simple active systems such as the "bread boxes" presently being constructed in San Bernardino, California, or at the diverse passive solar systems which enthusiastic solar advocates have constructed in hundreds of homes. The story of the spread of the mostly commercially built, relatively high technology systems we surveyed in this research, therefore, is only a small part of the whole saga of solar.

On each table in the report which follows, we identify the question (or questions) and the questionnaire (there are three) which provided the data summarized in tabular form. The three questionnaires, which are appended (Appendix A) are: (1) a 22-question survey instrument administered to 111 homeowners who had solar equipment in their homes; this is the "Adopters'" questionnaire; (2) a 13-question survey instrument administered to 104 neighbors of homeowners with solar equipment; this is the "Nonadopters'" questionnaire; and (3) a 25-question survey instrument administered to both adopters and nonadopters and called the "Demographics" questionnaire.

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EXECUTIVE SUMMARY

The research reported in this study was undertaken to answer five major research questions:

1. How much and what kinds of information about residential solar systems do Californians have now?
2. What are the characteristics of individuals purchasing solar equipment, and do these individuals represent identifiable market segments?
3. What are the major channels through which information about solar equipment is flowing?
4. What are the principal barriers to, and incentives for, the adoption of solar systems?
5. What are public attitudes towards government regulations regarding the use of solar energy?

In Spring, 1979, graduate students and staff at the Institute for Communication Research, Stanford, California, conducted hour-long, in-home interviews with 111 homeowners who had installed solar equipment to heat their swimming pool, hot tub, domestic hot water or space, and with 104 neighbors of these "solar adopters."

Our sample of adopters and nonadopters exhibited the following characteristics:

- . Adopters in the sample were somewhat wealthier, lived in slightly larger homes, paid higher utility bills, and averaged one more family member than their nonadopter neighbors.
- . The solar systems had all been installed since 1974 and most cost from \$200 to \$3,000; all circulated water through their solar collectors, which averaged about 234 square feet per system.
- . Adopters and nonadopters were compared on many variables which might explain the diffusion of residential solar systems: Sources of information about solar; attitudes towards and experience with solar equipment; attitudes toward, and

acts of, energy conservation; attitudes toward, and acts of, home improvement; demographic descriptions, etc.

Further findings included the following:

- . Most individuals in our sample learned about the potential for solar within the past eight years, especially during 1973-76.

- . Most nonadopters have heard about solar swimming pool, hot water, and space heating systems; 80 percent know of someone who is using solar equipment.

- . The most important sources of information about solar for both adopters and nonadopters are interpersonal: Friends and solar equipment sellers.

- . Nonadopters would potentially utilize more sources of information about solar than adopters have, but the two populations rank order the top few information sources very similarly.

- . While nonadopters say they would have utilized more decision factors in deciding whether or not to purchase solar equipment than did adopters, the two populations' rank-orderings of decision factors were quite similar.

- . The most important decision factors for adopting solar selected by all 215 respondents were: Lower or no energy bills; the initial cost of the equipment; easing the energy shortage; and lessening pollution.

- . For adopters (especially swimming pool owners), the probability of not having to reduce energy consumption in the future was also a major factor in their decision to install solar equipment.

- . Almost all respondents had heard of the (California) state tax credit for solar adopters; adopters (77 percent) were much more familiar with the tax than nonadopters (18 percent). Half the adopters said it was "not at all important" in their purchase decision although 86 percent of the adopters had applied for the tax credit.

- . Only a third of the adopters had obtained bank loans to finance their purchase of solar equipment.

. Adopters expect larger future increases in the cost of energy than non-adopters and are more optimistic about the payback periods of all types of solar equipment.

. Over half of the nonadopters either have decided against buying solar equipment or have never considered such a purchase. Over half the nonadopters either do not know how much a solar hot water system costs, or else over-estimate the expense.

. Two-thirds of the adopters and just over half of the nonadopters favor legislation requiring solar equipment on new home construction, with the most popular options being, first, swimming pool heaters, and, next, water heating.

. Adopters are highly satisfied with their equipment, would install more in a custom-built home, and report no troublesome changes in family routine occasioned by use of solar.

. Both adopters and nonadopters cite high cost as the major deterrent to more widespread adoption of residential solar equipment. Cost was the major problem with solar that nonadopters had heard adopters complain about.

. About two-thirds of the adopters have had to make at least minor repairs to their equipment.

. Adopters are active in marketing solar installations to friends and neighbors, although only two-fifths of the nonadopters have actually seen a solar system in place.

. Adopters invest more money in real estate, make more home improvements, and are capable of making more home repairs themselves than nonadopters.

. Adopters are more active energy-conservers in their homes and hobbies than are nonadopters (although on average they pay higher utility bills).

. Solar water heater owners are more ecology-minded, more active conservers, and engage in more Voluntary Simplicity behaviors to lessen consumption, than do other adopters and nonadopters.

INTRODUCTION

Manufacturers of solar collectors are fond of telling you that 50 years ago, solar flat plate collectors for heating water glistened on the roofs of Pasadena, California and in parts of Florida (see Butti and Perlin, 1977). Cheap and abundant natural gas forced the technology into obsolescence, a slumber from which it has only begun to awaken in the past years. To most Americans, residential solar water heating, for showers or for swimming pools, is an innovation. As in the case of all new technologies, public acceptance of solar collectors trails behind technical feasibility.

By 1978, most Americans had at least heard of solar energy and about one-fifth of the public had read something about it (Milstein, 1978). Because of mass media coverage during 1978 and President Carter's frequent references to solar power,* public awareness is probably at a much higher level now.

As an extensive review of available studies on acceptance of solar energy states, "Public attitudes toward the idea of solar energy can only be described as positive" (Farhar and others, 1979). Solar energy draws support from widely diverse groups which may otherwise be philosophically or politically at odds with each other (Milstein, 1978). Harris polls in 1975 and 1976 found the general public more optimistic about the technical feasibility of solar power than were (presumably more informed) political and business leaders, regulators and environmentalists (Farhar and others, 1979).

Most respondents in the studies reviewed underestimated the initial costs of installing solar equipment, a miscalculation which may have partially inspired the high percent of favorable responses to questions about intent to purchase. In a 1977 survey of homeowners and potential homeowners, about two-thirds of those interviewed said they would choose a new home with solar space and water heating if total costs were equal with conventional systems over a 20-year period

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*For example, August 7, 1979, the President was quoted as saying that "the sun cannot be embargoed."

and about half said they would be willing to retrofit their existing homes if costs were equal over 20 years (Campbell and others, 1977) Another study found support for solar among 85 percent of the respondents (Scott, 1977).

The broadly-based support for the concept of solar energy is not surprising in view of the heavy and almost entirely favorable nationwide publicity solar energy has excited over the past few years. Extensive media coverage has ranged from national television shows (e.g., interviews with solar homeowners and proponents on April 26, 1978) and articles in every newspaper, to flyers put out by solar equipment companies, utilities, or even the Bank of America.

However, nationwide, only about 0.5 percent of the populace has actually installed active solar systems (Farhar and others, 1979). It is estimated that this 0.5 percent represents an approximate doubling during the past year.

Since Americans are favorably disposed towards solar energy, yet few are installing solar systems, a question of major concern to policy-makers arises: What, if any, should be the government's role in the diffusion of solar technology? This broad question actually involves two highly interrelated issues: (1) the diffusion pattern of solar technology, and (2) the potential for government policy in influencing that diffusion.

There are many reasons why people can be highly aware of an innovation and in general favor it without adopting it. One primary reason is that media "blitzes" alone do not usually motivate people to act (except for the effect that advertising may have in the case of purchasing small-cost consumer products).

During World War II, when Americans saw the impressive effects of German propaganda, popular wisdom suggested that the media were incredibly powerful, capable of directly molding public opinion and action. However, a group of social scientists researching voters' decision processes during the 1940 Presidential election discovered that most people do not in fact base their decisions upon information obtained directly from the media, but rather on the opinions

of respected friends and acquaintances. These opinion leaders serve as intermediaries between the media and the decision-maker, encouraging or discouraging the adoption of an idea by their speech and even more importantly, by their actions. Consumers' purchasing behavior is thus highly influenced by the actions of friends and neighbors.

If the new product is highly visible (e.g., window air conditioners), it has even proven possible to document visually the spread of the innovation from house to house because of the power of "word-of-mouth advertising" (Whyte, 1954). Neighbors, therefore, are likely to be highly influential in decisions about solar investments, particularly in well-established neighborhoods.

A second reason for the contrast between high levels of public support and low levels of adoption is that, in the case of major decisions, consumers require more detailed information than can be readily transmitted through mass media. Nationwide, people feel a need for more concrete information about solar energy (Milstein, 1978) and many consumers want to experience a solar-heated environment before forming an opinion (Scott, 1976).

One very logical source of detailed information for potential adopters is those homeowners who have had solar units installed. The experience and attitudes of the "early adopters" of residential solar equipment are vital for several reasons:

1. Present owners will influence the growth of the market for residential solar equipment through the "word-of-mouth advertising," by positive or negative reporting on experience.

2. The public climate for mandated programs will also be affected by the extent to which these solar adopters feel that solar equipment lives up to the many promises made for it and by public perception of the motives which impel adoption.

3. Present real-life experience with solar equipment will guide the design,

pricing, and financing of future systems.

The research reported here explores the attitudes and experience of solar adopters and their neighbors, in order to answer five major questions:

1. How much and what kinds of information about residential solar systems do Californians have now?
2. What are the characteristics of individuals purchasing solar equipment, and do these individuals represent identifiable market segments?
3. What are the major channels through which information about solar equipment is flowing?
4. What are the principal barriers to, and incentives for, the adoption of solar systems?
5. What are public attitudes towards government regulations regarding the use of solar energy?

STUDY DESIGN

In studying the diffusion of any new idea or product, an important question to be answered is: Why do some people adopt the innovation while others, with a similar opportunity, do not? To answer this question for the diffusion of solar equipment, we interviewed two sets of people: (1) solar adopters, that is, homeowners who had retrofitted their homes with solar equipment for heating their swimming pool, their domestic water supply, or their home, and (2) nonadopters, people living in the same neighborhoods and therefore presumably of somewhat similar economic and social status, who had not invested in solar equipment for their homes. From the adopters we expected to learn why and how they had decided to install solar equipment and what their experience with the equipment had been. From the nonadopters, we expected to determine what informational, financial, and social barriers exist to the purchase of solar equipment and reasons why more homeowners are not investing in solar equipment.

This study of 111 adopters (including 8 leasers) and 104 nonadopters is a part of a pilot study, to be followed later by a statewide survey of a representative sample of Californians (to be conducted by Field Research Corporation, in September, 1979). The questions for this statewide survey of approximately 1,000 homeowners will be drawn from the Stanford University pilot study and from the data collected in 10 focus group interviews conducted by Drs. Joseph Margolin and Marlon Misch. These two studies will provide information about the attitudes towards solar of three populations: adopters, nonadopters somewhat exposed to residential solar equipment, and nonadopters without previous experience with solar.

THE METHODOLOGY

Interviewer Training

Sixteen of the interviewers in the pilot study were graduate students; a few were older college graduates. Almost all had had considerable previous experience in research interviewing; all were re-trained to take part in this survey. This training was conducted in three phases. First, the interviewers attended two on-campus training sessions, in which they were instructed about the objectives of the study, about solar equipment, about interviewing techniques and about the questionnaires. Each interviewer was provided with a detailed guide to the interviewing procedures, from how to telephone for an appointment, to how to dress for field interviewing. These sessions were followed by practice interviews, using friends and roommates to play the role of respondents. In the second phase of the training, each interviewer accompanied and observed one of the members of the project staff or an interviewer with very extensive interviewing experience, in an actual field interview. Finally, members of the project staff accompanied each interviewer on his/her first field interview and afterwards critiqued the conduct of the interview. These rather elaborate training procedures ensured a high degree of uniformity in delivery of the questionnaire, armed the interviewers with ready and consistent responses to questions, and therefore greatly enhanced the quality of the data.

Drawing the Sample

Adopters

A quota-based sample of 111 adopters was drawn from names provided by several sources (Table 1) and was restricted geographically to three northern California counties: Santa Clara, San Mateo, and Alameda. The fact that most of the adopters' names were drawn from manufacturers' lists influences many of our findings, as we will note later in the present report. In order to cover a wider spectrum

Table 1. Sources of Respondent Names for Adopter Sample for the Pilot Study.

Source of Names of Solar Adopters	Number of Potential Respondents
1. Names provided by solar manufacturing firms to the State Energy Commission.	127
2. Names obtained from the State Energy Commission for the Institute for Communication Research, Pretest Study (in Spring, 1978) and from respondents in that study.	23
3. Referrals: Names obtained from adopters in the present sample.	36
Total Number of Names	186

of experience than that held by solar company customers, we located some adopters through referrals obtained from our early respondents. A strong and successful effort was also made to represent various types of solar equipment in the sample (Table 6), but it should be noted that the data provided by these individuals do not necessarily reflect the views of all California solar equipment owners, since the sample is not random nor particularly representative. Our main purpose in the pilot study was to develop a questionnaire to be utilized at a later stage with a representative sample of Californians.

Nonadopters

The 10 focus-group interviews conducted by Drs. Margolin and Misch explore the opinions of people who have not necessarily been exposed to solar equipment. In contrast, our sample of 104 nonadopters was drawn from the ranks of those who at least had the opportunity for exposure to this innovation. Some nonadopter respondents in our study had very direct experience with their neighbor's solar equipment. Some were impacted by their neighbor's purchase decision, for instance, because the solar panels were mounted on a highly visible section of the house's roof, or because the nonadopter had to trim a tree in his/her yard to allow sun for the adopters's solar panels.

Rather than interview one nonadopter in each neighborhood in which an adopter was interviewed, we selected at random 25 adopters and interviewed four or five immediate neighbors -- if possible, the closest homeowners on either side, in front and directly in back of each adopter. This sampling technique had several advantages. First, we were able to control to some extent the variation between adopters and nonadopters, so that nonadopters were roughly matched with the adopters in social and economic background and in their house type. Further, by drawing our nonadopter sample in small clusters, we could obtain several differing opinions of the same solar equipment and gauge the influence of the same adopter on several different neighbors. Finally, our data-gathering method had

certain economic benefits as our interviewers could conduct two or more interviews during the same visit to one neighborhood -- a major advantage at the time of our interviewing, when gasoline station lines were at their longest in California history and when gas prices were rising.

Interviewing Procedures

Adopters

All adopters were first sent a letter (Appendix A) requesting their help and explaining that an interviewer would be contacting them to set up an appointment at a mutually convenient time. These letters were followed up by the interviewers, who tried to set up the appointment with the individual identified as the customer by the solar firm and addressed in the letter. Most of the individuals so identified were males. This might seem to be a sample bias. However, in our pre-test conducted by the Institute for Communication Research, at Stanford University in Spring, 1978, interviewers consistently found that women declined to be interviewed alone. They either deferred to their husbands on the subject of solar equipment, or requested that the interview be conducted jointly with both man and wife. Evidently, at least in the San Francisco Bay Area, solar equipment is considered by families to be a technical purchase and its mechanical details are a man's province. Interviews with adopters usually took an hour or more; most were conducted in the home and interviewers were usually invited to see the solar equipment. A few adopters were interviewed at their offices or places of work.

Nonadopters

Appointments with nonadopters were secured in one of two ways. Either (1) the interviewer obtained the neighbor's street address at the time he/she conducted the adopter interview, and then letters were sent to those neighbors, whose names were obtained through a reverse telephone directory, or (2) the

interviewers went door-to-door when they were in the neighborhood to set up appointments. Unfortunately, the responses of the nonadopters were not recorded uniformly enough for a response rate to be figured.

DESCRIPTION OF THE SAMPLE

Geographic Distribution and Response Rate

As Table 2 indicates, adopters were interviewed in 18 communities, as far south on the Peninsula as Los Gatos, and as far north as Berkeley. Out of a total of 120 potential respondents (discounting the 66 names which were discarded for various reasons by the researchers) only nine people contacted actually refused the interview. This extremely high response rate of 92.5 percent is attributable to the general enthusiasm of solar equipment owners. Almost all were eager to show off their equipment; some were so enthusiastic that interviewers had difficulty extracting themselves from the interview.

Demographics

Table 3, 4, and 5 present graphically a comparison between the adopter and nonadopter sample. Because most of the names of customers given to the research team were men's, the adopter sample is disproportionately male, compared to the nonadopter. The two samples differ little in age, however, except that the adopter sample tends to be a bit more concentrated in the 36-50 range. The average age for nonadopters is 47.5, and 45.7 for adopters. Adopters in our sample have, on the average, one more family member than do nonadopters. As Table 4 shows, adopters in this sample also have a higher income (almost reaching the \$35,000 to \$50,000 category) than nonadopters but there is little difference in the educational level if both respondent and spouse are taken into account (adopter 2.69; nonadopter 2.63). Nor do the two populations differ strikingly in occupation. Over fifty percent of the homeowners in both samples are either major professionals (doctors, lawyers) or business executives. There are more retired people in the nonadopter sample, which may account for the

Table 2. Location and Response Rate for Adopter Sample.

Geographic Location	Number of Adopters Contacted ^a	Number of Interviews Completed	Number of Interviews Refused ^b	Interview Not Completed for Other Reasons ^c
Palo Alto	17	13	-	4
Menlo Park	8	6	-	2
Portola Valley	15	15	-	-
Woodside	5	3	-	2
Stanford	5	5	-	-
Atherton	6	3	-	3
Mountain View	2	1	-	1
Los Altos	30	18	-	12
Redwood City	1	1	-	-
San Bruno	3	2	-	1
Sunnyvale	9	6	1	3
Cupertino	6	3	-	3
Los Gatos	12	6	-	6
Saratoga	2	1	-	1
Santa Clara	36	11 ^d	6	25
San Jose	27	15	2	10
Oakland	1	1	-	-
Berkeley	1	1	-	-
Totals	186	111	9	66

^a A letter was sent (see Appendix A) and an interviewer contacted the respondent by telephone to set up an appointment.

^b The adopter declined the interview. Reasons given included: too busy; have been interviewed before for other, non-Stanford survey; not interested.

^c These reasons included: names and addresses too incomplete to be tracked down; respondent was leasing the equipment and there were already several lessors in the sample; respondents were not the homeowners; respondents did not have solar equipment

^d In Santa Clara out of the 11 completed interviews, 8 respondents lease their equipment from the City.

Table 3. Comparison of Adopters with Nonadopters in Sample by Age, Sex and Average Family Size.^a

Characteristic	Respondents			
	Adopters		Nonadopters	
	Frequencies	Percent	Frequencies	Percent
a. Sex				
1. Male	88	79.3	68	65.4
2. Female	23	20.7	36	34.6
Totals	111	100.0%	104	100.0%
b. Age				
1. 20-35	18	16.2	21	20.2
2. 36-50	60	54.1	43	41.3
3. 51-65	30	27.0	32	30.8
4. Over 65	3	2.7	8	7.7
Totals	111	100.0%	104	100.0%
c. Average Family Size				
Mean Number of Members	3.68		2.64	
SD (Standard Deviation)	1.32		1.68	
Range	1-7		1-7	

The data for this report were gathered through three questionnaires: (1) A 22-question survey instrument administered to 111 homeowners who had installed solar equipment in their homes; this questionnaire will be referred to hereafter as "Adopters;" (2) a 13-question survey instrument administered to 104 neighbors of homeowners with solar systems, referred to hereafter as "Nonadopters;" (3) a 25-question survey instrument administered to both the owners of solar system and to their neighbors, referred to hereafter as "Demographics." Copies of all three questionnaires are appended (Appendix A).

^aData from Question: Demographic #21

Table 4. Comparison of Adopters with Nonadopters in Sample by Income, Education, Occupation and Hobbies.^a

Variable	Respondents							
	Adopters		Spouse		Nonadopters		Spouse	
	Frequencies	Percent	Frequencies	Percent	Frequencies	Percent	Frequencies	Percent
a. Income (combined)								
1. \$5000 or less	0	00.0			2	2.0		
2. 5001 to 10,000	0	00.0			3	3.0		
3. 10,001 to 15,000	2	1.8			3	3.0		
4. 15,001 to 25,000	9	8.1			21	20.8		
5. 25,001 to 35,000	25	22.5			19	18.8		
6. 35,001 to 50,000	35	31.5			28	27.7		
7. Over 50,000	40	36.0			25	24.8		
Totals	111	100.0%			104	100.0%		
Mean Income	5.91				5.33			
SD (Standard Deviation)	1.03				1.44			
b. Education								
0. Not applicable	0	00.0	8	7.2	00	00.0	12	11.5
1. Ph.D., M.D., J.D.	23	20.7	11	9.2	25	24.0	13	12.5
2. Graduate work	39	35.1	26	23.4	29	27.9	19	18.3
3. B.A., B.S. (or equivalent)	23	20.7	26	23.4	19	18.3	33	31.7
4. Some college	18	16.2	27	24.3	19	18.3	17	16.3
5. Completed high school	6	5.4	12	10.8	11	10.6	8	7.7
6. Some High School	2	1.8	1	1.0	0	00.0	2	1.9
7. Primary school	0	00.0	0	00.0	1	1.0	0	11.0
Totals	111	100.0%	111	100.0%	104	100.0%	104	100.0%
Mean	2.53		2.80		2.67		2.59	
SD (Standard Deviation)	1.26		1.44		1.38		1.49	

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c. Occupation

0. Not applicable	0	00.0	9	8.1	1	1.0	11	10.6
1. High executives, major professional	31	27.9	12	10.8	34	32.7	21	20.6
2. High managers, proprietors of big businesses	34	30.6	20	18.0	23	22.1	14	13.5
3. Administrators, proprietors of small businesses	25	22.5	18	16.2	13	12.5	13	12.5
4. Clerical, salespersons	7	6.3	9	8.1	6	5.8	5	4.8
5. Skilled manual	5	4.5	1	0.9	1	1.0	0	00.0
6. Semi-skilled	1	0.9	1	0.9	0	00.0	0	00.0
7. Unskilled	1	0.9	0	00.0	1	1.0	1	1.0
8. Homemaker	5	4.5	40	36.0	12	11.5	31	29.8
9. Retired	2	1.8	1	0.9	13	12.5	8	7.7
Totals	111	100.0%	111	100.0%	104	100.0%	104	100.0%

Mean Level of Occupation

2.56

4.30

2.75

3.78

SD (Standard Deviation)

1.70

3.00

2.33

3.13

-15-

d. Hobbies (respondents only)

0. Not applicable	0	00.0	1	1.0
1. No energy needed	60	54.5	30	28.8
2. Little energy consumed	31	28.2	65	63.1
3. More energy consumed	9	8.2	4	3.9
4. Most energy consumed	10	9.1	3	2.9
Subtotals	110	100.0%	103	100.0%
Missing values	1	0.0%	1	0.0%
Totals	111	100.0%	104	100.0%

Mean Level of Energy Consumed

1.71

1.78

SD (Standard Deviation)

0.95

0.66

^a Data from Question: Demographic #22 to 25

difference in income found between the two samples.

A somewhat surprising difference between the two sample is that the adopters' hobbies are ones requiring little or no energy (e.g., running, hiking) while more of the nonadopter hobbies require some use of energy. However, the fact that many of the adopters have swimming pools and therefore have at least one low-energy (if one ignores capital outlay) recreation in their backyards may in part explain these differences.

Housing Characteristics

In keeping with their somewhat higher income and larger family, the adopters in this sample have slightly larger, newer houses than their neighbors, and pay quite a bit more for utilities (Table 5). There is little difference in mobility between the two populations; the nonadopters have lived in their homes somewhat longer, but only one-third of either population considers it possible or likely that they may move within the next three years.

Table 5. Comparison of Adopters with Nonadopters in Sample by Various Housing Characteristics.^a

Characteristic	Respondents					
	Adopters			Nonadopters		
	Mean	SD	Range	Mean	SD	Range
a. Year house built	1959	13.92	1906-1979	1953	9.14	1925-1974
b. Size (square feet)	2,384	1077.83	400-9,500	2,039	680.33	1,000-4,000
c. Number of bedrooms	3.81	1.03	2-7	3.6	0.91	2-6
d. Number of bathrooms	2.67	0.81	1-5	2.25	0.76	1-4
e. Number of years in house	8.85	6.86	1-30	10.7	8.07	1-33
f. Utility bill	\$69.88	\$48.69	\$0-320	\$54.06	\$36.03	\$10-250
g. Likelihood of moving	Frequency	Percent		Frequency	Percent	
1. Not at all	75	67.6		65	63.1	
2. Possible	27	24.3		25	24.3	
3. Likely	0	00.0		2	1.9	
4. Very likely	9	8.1		11	10.6	
Subtotals	111	100.0%		103	100.0%	
Missing Values	0	0		1	0	
Totals	111	100.0%		104	100.0%	
Mean		1.48			1.60	
SD (Standard Deviation)		0.86			0.96	

^aData from Questions: Demographic #14 to #17, #20.

DESCRIPTION OF RESPONDENTS' SOLAR EQUIPMENT

Equipment Characteristics and Distribution

Types of Equipment

Tables 6 through 10 provide a description of the solar equipment possessed by our respondents.* As Table 6 shows, there were a total of 69 solar systems installed for swimming pools, nine for hot tubs, 45 for domestic water heating, and 20 for space systems among all the houses surveyed. Only four people had stopped using their solar systems, and two of these individuals had multiple systems, that is, which ran two different types of equipment. At least two of the discontinuances resulted from dissatisfaction with the system. One respondent commented that he had bought his house because he liked it architecturally so much, but that the space and water heating system was totally ineffectual and that he used only the back-up heating system. One other discontinued system, for water heating, had been built by the homeowner himself and was inadequately designed.

Time of Installation

Because our sample was drawn largely from current manufacturer's lists of customers, there was a bias towards recently installed systems (Table 6,b). None of our respondents had had more than five years experience with the equipment.

Back-up Systems/Collector Fluid

Although all types of solar heating systems are more attractive economically to homeowners who would otherwise be using electricity, most of our adopters had gas back-up systems for their equipment. Over one-fifth of the swimming pool system owners had completely discontinued use of a back-up heating system. Since most of the systems surveyed were for pool or water heating, it is not surprising that almost all circulated water through the collectors (Table 6,c,d).

*Since the respondents in our study were identified through the manufacturers of solar collectors, our sample is heavily biased towards "high-technology," active solar systems. This study does not include passive systems or "bread box" active systems and other simple water heating systems.

Table 6. Description of Adopters' Equipment: State of Equipment, Time of Adoption, Back-up Systems and Collector Fluid.^a

	Types of Equipment							
	Swimming Pool Heaters		Hot Tub Heaters		Water Heater		Space Heater	
	Frequency	Per- cent	Frequency	Per- cent	Frequency	Per- cent	Frequency	Per- cent
1. State of Equipment								
0. Not applicable	40	35.4	96	86.5	58	52.3	86	77.5
1. Considering ^b	0	00.0	3	2.7	4	3.6	3	2.7
2. On house when purchased	3	2.8	3	2.7	2	1.8	2	1.8
3. Purchased equipment ^c	2	1.9	3	2.7	4	3.6	2	1.8
4. Installed	66	59.9	6	5.4	43	38.7	18	16.2
Totals	111	100.0%	111	100.0%	111	100.0%	111	100.0%
5. Equipment Discontinued	3		1		1		1	
2. Time of Adoption								
1974	3	4.2	0	00.0	0	00.0	0	00.0
1975	1	1.1	0	00.0	1	2.2	0	00.0
1976	18	25.0	0	00.0	4	8.6	2	9.5
1977	27	37.5	5	46.2	20	44.0	5	24.0
1978	20	28.0	7	53.8	20	44.0	12	57.0
1979	3	4.2	1	1.0	1	2.2	2	9.5
Subtotals	72	100.0%	13	100.0%	46	100.0%	21	100.0%
Missing Values	2	0	0	0	4	0	2	0
Totals	74	100.0%	13	100.0%	50	100.0%	23	100.0%
3. Back-up System								
0. Not applicable	2	2.9	0	00.0	0	00.0	0	00.0
1. Electricity	0	00.0	4	30.8	13	28.2	7	33.3
2. Gas	53	75.7	8	61.5	33	73.8	13	62.0
3. Discontinued	15	21.4	1	7.8	0	00.0	1	4.7
Subtotals	70	100.0%	13	100.0%	46	100.0%	21	100.0%
Missing Values	4	0	0	0	4	0	2	0
Totals	74	100.0%	13	100.0%	50	100.0%	23	100.0%
4. Collector Fluid								
0. Not applicable	0	00.0	0	00.0	0	00.0	0	00.0
1. Air	0	00.0	0	00.0	0	00.0	3	16.6
2. Water	65	98.5	11	91.7	38	82.6	13	72.2
3. Chemical	1	1.5	1	8.3	8	17.4	2	11.2
Subtotals	66	100.0%	12	100.0%	46	100.0%	18	100.0%
Missing Values	8	0	1	0	4	0	5	0
Totals	74	100.0%	13	100.0%	50	100.0%	23	100.0%

^aData from Question: Adopters' #1. The numbers of solar units in this table do not match those on other tables because each system is treated separately here; the number of systems exceeds the number of owners.

^bConsidering means the homeowner has obtained cost estimates.

^cSystems which have been purchased but not installed are included in this table, with information, when available, on the intended back-up system and collector fluid.

Collectors

On average, the systems surveyed utilized seven or eight solar collectors (Table 7). About half of the respondents reported that their collectors covered between 200 and 500 square feet. Almost one-third of our adopters had very small systems, with less than 100 square feet of collector space.

Tanks

Aside from the fact that most adopters had one or two storage (or preheat) tanks, little uniformity was found among the tank systems surveyed. A detailed description of the tanks is appended (Appendix B-1). Table 8 provides summary descriptors; however, the averaged statistics should not be interpreted to mean that there is a "usual" tank combination. The systems were quite individual; the number and especially the size of tanks utilized appeared to depend upon the existing water heating system.

Multiple Systems

As Table 9 demonstrates, 26 respondents had "multiple systems," that is, they had installed more than one type of solar equipment.* Respondents were very enthusiastic about these multiple systems, which were highly individual in design. Two space systems had large amounts (12.5 tons and 32 tons) of rocks for storing the heat; a unique water heating system was comprised of piping exposed to the south and angled for maximum exposure to the sun.

Distribution of Systems by Respondent Income Levels

In this sample (Table 10) respondents owning solar water heaters varied more widely in income levels than did adopters of space or swimming pool heaters. As one might expect, the owners of pool heating equipment tended to have higher annual incomes than the rest of the respondents. Almost half the pool owners

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*Besides the major types of multiple systems noted in Table 9, there were two reported systems which included solar greenhouses, and two cases in which the pool included a built-in "spa."

Table 7. Size of Collectors for All Types of Equipment.^a

Collection Space in Square Feet	Frequencies	Percent
1. Less than 50	8	7.0
2. 50 to 99	27	25.0
3. 100 to 199	12	11.0
4. 200 to 299	20	18.5
5. 300 to 399	17	15.7
6. 400 to 499	15	13.8
7. 500 or more	9	8.0
Subtotals	108	100.0%
Missing Values	3	0
Totals	111	100.0%
Mean Number of Square Feet	233.7	
Mode	64	
Range	24-800	

^a Data from Question: Adopters #15.

Table 8. Number and Size of Tanks for All Types of Equipment.^a

Total Number of Gallons in Storage Tanks	Number of Tanks				
	1	2	3	4	5 or more
0 - 180	32	21			
181-- 300		1			
301 - 500	2			2	3
501 - 700	4				
701 - 900	4				
901 - 1100	1				
1101 - 1300	3				
1301 - 1500					
1501 - 1700					
More than 1700	3			3	
Unknown size	5				
Total Number of Tanks					84

^aData from Question: Adopters # 1 e,f.

See Appendix B for a more detailed description of the different types of tanks.

Table 9. Description of Multiple Systems (more than one type of equipment).^d

Type of Equipment	Considering ^a	On House When Purchased	Purchased Equipment, Not Installed	Installed Equipment	Discontinued	Totals
Water and Space		1	1	8 ^b	1 ^c	11
Water and Hot Tub	2			3		5
Water and Pool	1			4		5
Pool and Space				1	1	2
Pool and Hot Tub			1	2		3
Water, Space, and Hot Tub	1			2		3
Water, Space, and Pool	3		1	4 ^b		8
Water, Hot Tub, and Pool		1				1
Totals	<u>7</u>	<u>2</u>	<u>3</u>	<u>24</u>	<u>2</u>	<u>38</u>

^aThese adopters have at least one type of equipment installed and are seriously considering expanding their system.

^bIn two cases of multiple systems, one type of equipment was purchased but not yet installed.

^cIn one case of a multiple system, the water heating system has been discontinued, but the space system is still in use.

^dData from Question: Adopters #1.

Table 10. Distribution of Equipment Among Respondents with Differing Income Levels.^a

Annual Income	Pool Heater	Water Heater	Space Heater
\$10,000 to 15,000	0 (0%)	2 (6.9%)	0 (0%)
\$15,001 to 25,000	4 (7.1%)	4 (13.8%)	1 (5.0%)
\$25,001 to 35,000	10 (17.9%)	6 (20.7%)	7 (35.0%)
\$35,001 to 50,000	17 (30.4%)	7 (24.2%)	8 (40.0%)
Over \$50,000	25 (44.6%)	10 (34.4%)	4 (20.0%)
Totals	56 ^b (100.0%)	29 ^b (100.0%)	20 ^b (100.0%)

^aData from Questions: Adopters #1 and Demographics #22.

^bInformation on income was not available for all respondents.

(45 percent) earn over \$50,000 a year, whereas only a third of respondents owning water heating systems earned that much.

Cost

Eight of the respondents in our sample had leased their solar swimming pool heaters from the City of Santa Clara, which has had a very active program since 1976 in promoting solar adoption. Most of these leasers paid about \$200 for initial installation, and thereafter a service fee ranging from \$20 to \$38 monthly, for the six months out of the year the pool is in use (Table 11). Leasers appeared very satisfied with this arrangement, reporting that the city was quick to answer any requests for maintenance work, and that leasing was an ideal way to try solar heating without having to tie up capital.*

Respondents with multiple systems had some difficulty in separating out the initial costs associated with each type of equipment. Moreover, a few of the costs reported on the high end of the range for water heater and swimming pool systems may be inflated because of the tendency to include into the cost of the equipment, structural changes made in the houses at the same time, not all of which were absolutely necessary to the installation of solar equipment (e.g., a pavillion by the pool, the roof of which supports the solar panels).**

Most (62 percent) swimming pool systems surveyed cost their owners less than \$3,000 but there were quite a few (27 percent) more expensive ones. The number of collectors (and therefore the expense) depended upon the size of the pool, of course. A few pool owners reported purchasing additional panels because they wanted to keep the pool warmer than the manufacturers had expected. There seems to be considerable variance in perceptions of what constitutes a comfortable pool temperature and therefore of what size solar system is "adequate."

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*There are about 80 such leasers in Santa Clara; we confined our interviews to eight since the focus of the study is on homeowners who purchased solar equipment.

**For future studies, it may be necessary to separate out costs in much more detail, e.g., the costs incurred in changing swimming pool pumps, the cost of the support structures for solar panels, and the cost of the panels themselves.

Table 11. Distribution of Equipment in Sample by Cost.^a

Type of Equipment	Frequency	Percent
a. Swimming Pool Heater		
1. \$80 to \$350 ^b	8	11.3
2. \$500 to \$1500	19	26.7
3. \$1501 to \$3000	25	35.3
4. \$3001 to \$6000	19	26.7
Subtotals	71	100.0%
Missing Values	3	0
Totals	74	100.0%
b. Hot Tub Heater		
1. \$400 to \$1000	7	53.8
2. \$1001 to \$2000	3	23.1
3. \$2001 to \$3000	3	23.1
Totals	13	100.0%
c. Water Heater^c		
1. \$200 to \$1900	23	49.0
2. \$1901 to \$2900	16	33.8
3. \$2901 to \$8000	8	17.2
Subtotals	47	100.0%
Missing Values	3	0
Totals	50	100.0%
d. Space Heater		
1. \$400 to \$2500	7	36.8
2. \$2900 to 5900	7	36.8
3. \$6000 to \$10,000	5	26.4
Subtotals	19	100.0%
Missing Values	4	0
Totals	23	100.0%

^a Data from Question: Adopters #1.

^b Leasers

^c These figures include the costs of one discontinued system.

Most water heating equipment costs under \$3,000. Possibly because adopters with water heating equipment tended to utilize their back-up systems more actively than did pool owners, we received few comments from solar water heater owners about discrepancies between the water temperatures expected and those delivered by the system.

A few respondents had very elaborate (and expensive) space heating systems, usually installed in conjunction with other equipment.

Not surprisingly there is a relationship between the cost of the equipment and the income level of the homeowner. Of the systems which were located in the upper third of the cost range for that type equipment, 60 percent were found in the homes of those earning more than \$50,000 annually.

The source for the names of respondents in the sample largely determined how many systems surveyed were installed by companies and how many were home-constructed (Table 12). Even among our sample, however, one-fourth of the adopters had installed their own equipment and another seven percent had aided in the installation. This distribution probably reflects the mechanical capacity of many adopters (about which we will have more to say later) as well as their interest in "hands-on" experience with the technology,* and suggests that in a sample less skewed away from self-designed and constructed systems, the percentage of "do-it-yourselfers" may be considerably higher.

The source of names for the sample may also affect the data displayed in Table 13. Some respondents who were not told that the solar company installing their equipment had applied for a building permit assumed that none had been obtained. In the case of company-installed solar systems, the companies are probably more reliable sources of information about building permits than are the homeowners.

*See Leonard-Barton (1978), The Diffusion and Adoption of Solar Equipment Among California Homeowners: Report on a Pretest Study.

Table 12. Distribution of Sample by Who Designed, Built and Installed the Equipment.^a

	Adopters					
	Designed		Built		Installed	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
1. Self or Friends	18	16.5	15	13.7	27	24.7
2. Solar Company	87	79.8	88	80.7	75	68.8
3. Combination of 1 and 2	4	3.7	6	5.6	7	6.5
Subtotals	109	100.0%	109	100.0%	109	100.0%
Missing values	2	0	2	0	2	0
Totals	111	100.0%	111	100.0%	111	100.0%

^aData from Question: Adopters' #13.

Table 13. Distribution of Building Permits in Adopters' Sample.^a

Permits	Frequency	Percent
1. Not obtained	33	29.7
2. Do not know if obtained	25	22.6
3. Obtained by owner	17	15.3
4. Obtained by contractor	36	32.4
Totals	111	100.0%

^a Data from Question: Adopters' #2.

FINDINGS

The Diffusion Process

As Figure 1 suggests, an individual's decision whether or not to purchase solar equipment may proceed through several stages, from first awareness of the potential of solar for residential use, through a decision process, to the purchase itself, and then either continued use of the system or discontinuance. That adopter's actual experience with solar equipment feeds back into the information system affecting other consumers' perceptions of solar and their own decision process.

In the pages which follow, the data has been organized into categories which approximate the stages in the suggested decision model. Adopters' and nonadopters' perceptions are compared where appropriate.

Awareness of Solar

Hundreds of empirical studies of the diffusion process have led to the realization that, in general, mass media channels are relatively more important in creating awareness about a new idea or product, whereas personal contacts are more important in persuading people to try an innovation (Rogers with Shoemaker, 1971). The data in this study further support this generalization. Media were more often cited as the source from which they first learned about the potential of solar for heating by both adopters and nonadopters than any other source (Table 14). Almost one-fifth of the adopters, however, mentioned some "childhood experience" which raised awareness of solar energy. Examples were childhood experiments with sun shining through pieces of glass, or a particularly warm room with a southern exposure in the childhood home.

The fact that nonadopters were more likely than adopters to trace to media their first awareness of the potential for solar heating may be further indirect evidence for how important personal experience with an innovation can be. Perhaps the media-generated impressions were too general to motivate adoption,

Figure 1. The Acceptability of Solar Equipment.

Table 14. Time and Place Respondents First Learned It Was Possible to Heat with Solar Energy.^a

Where Learned	Respondents			
	Adopters		Nonadopters	
	Frequency	Percent	Frequency	Percent
1. Media	38	37.5	56	54.4
2. Place of work	0	00.0	3	2.9
3. Solar Company	11	11.0	4	3.9
4. Childhood experience	20	19.8	10	9.7
5. From friends	15	15.0	14	13.6
6. School	9	8.9	12	11.7
7. College	7	7.0	3	2.9
8. Trip overseas	1	0.9	1	1.0
Subtotals	101	100.0%	103	100.0%
Missing Values	10 ^b	0	1	0
Totals	111	100.0%	104	100.0%
	Adopters		Nonadopters	
Mean Date of Awareness	1963		1966	
Range (years)	1910-1978		1919-1977	

^a Data from Question: Adopters' #16, Nonadopters' #1.

^b Included as missing values were several answers too vague to be informative, e.g., "Forever," "When I was born," or "I don't know."

whereas experiences recalled from childhood were more influential. Of course the difference between groups may also reflect different kinds of people. Adopters may have had a lifelong interest in technology.

It is interesting that on average there is little difference in the length of time adopters and nonadopters report knowing about solar. Half of both populations have become aware of solar energy as a potential heat source during the eight years since 1971. Not surprisingly, the period most often mentioned for when people became aware of solar energy is the time following the first real energy crunch: 1974-1976.

Once the adopters seriously considered buying solar equipment for their homes, in general they implemented the decision quickly (Table 15). Almost three-fourths installed their equipment within the year.

Nonadopters' exposure to solar equipment differs considerably among individuals and by type of equipment (Table 16). Although these respondents live in the immediate vicinity of at least one adopter, one fifth of the nonadopters said they did not know anyone with solar equipment.* The great majority of nonadopters know of at least one home solar system, although only one-fifth know of three or more solar adopters.

Nonadopters evidenced a high level of awareness that solar heating systems were feasible for swimming pools, and water heaters (Table 16) but surprisingly, over one-fifth did not know about solar space heating. Only half had heard solar heating could be used for hot tubs, and few had actually seen one. A majority had seen solar swimming pools (61.5) and solar waters heaters (52.9 percent) in place, but almost three-fourths had never seen a solar space heating system. Most of the solar equipment they had seen was in homes or businesses, rather than in demonstration buildings.

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*One striking example of such unawareness of neighborhood activity was provided by a nonadopter who disclaimed knowledge of any installed systems. From where the interviewer sat, the solar collectors on the neighbor's roof were clearly visible through the floor-to-ceiling family-room windows, and in fact faced the nonadopter's backyard.

Table 15. Time Elapsed Between First Consideration and Installation by Adopters.^a

Time Elapsed	Frequency	Percent
1. Less than 6 months	56	50.5
2. 6 months to 1 year	23	20.7
3. 3 to 4 years	7	6.3
4. 5 to 6 years	2	1.8
5. More than 6 years	1	.9
Totals	111	100.0%

^a Data from Question: Adopters' #12.

Table 16. Level of Nonadopters' Awareness of Residential Solar Systems.^a

Nonadopters' Experience with Solar Equipment		Frequency	Percent	
a. Number of people nonadopters know who are using solar equipment				
1. Do not know of any		21	20.2	
2. Know of one		29	27.9	
3. Know of two		23	22.1	
4. Know of three		14	13.5	
5. Know of four		8	7.7	
6. Know of five		4	3.8	
7. Know of six		2	1.9	
8. Know of eight		2	1.9	
9. Know of ten		1	1.0	
Totals		104	100.0%	
b. Kinds of residential solar equipment nonadopters have heard of				
	Swimming Pool Heater	Hot Tub Heater	Water Heater	Space Heater
	Frequency	Per- cent	Frequency	Per- cent
1. Not heard	5	4.8	54	51.9
2. Heard	99	95.2	50	48.1
	Frequency	Per- cent	Frequency	Per- cent
Totals	104	100.0%	104	100.0%
c. Kinds of residential solar equipment nonadopters have seen.				
1. Not seen	39	37.5	91	87.5
2. Seen	65	62.5	13	12.5
	Frequency	Per- cent	Frequency	Per- cent
Totals	104	100.0%	104	100.0%
d. Whether or not the residential solar equipment seen by nonadopters was installed as a demonstration.				
1. No	54	83.0	9	75.0
2. Yes	11	17.0	3	25.0
	Frequency	Per- cent	Frequency	Per- cent
Subtotals	65	100.0%	12	100.0%
Missing values	0	0	1	0
Totals	65	100.0%	13	100.0%

^a Data from Question: Nonadopters #2, 3

As Table 17 indicates, nonadopters regarded the decision about whether or not to install solar as a slightly more weighty one than did solar adopters. Only one-fourth of the adopters, as compared to over two-fifths of the nonadopters, felt more thought goes into the decision to buy solar equipment than into buying a car.

Search for, and Use of, Information

As previously noted, interpersonal sources of information tend to become more important than mass media when people are actually considering adopting an innovation. Both adopters and nonadopters reflected this general tendency by naming sellers of equipment and friends as the two most useful sources of information about solar equipment out of a list of 14 possible sources.* In fact, the lists of selected information sources are remarkably similar for the two populations. There is some difference in rank-order, most notably that sellers are the most popular information source for adopters and friends are second, whereas the reverse is true among nonadopters. There is one difference in selection of top ranking items, however. Nonadopters evidently favor demonstration buildings as providing useful information; adopters selected energy fairs instead.

Another difference between adopters and nonadopters is that, while both populations emphasized the importance of almost the same few sources when they were asked to narrow their selection to five and rank them, nonadopters cited many more potential sources than the adopters reported having used (see graph in Appendix B-2).

For instance, while only 14 percent of the adopters actually used television as an information source, about one-third of the nonadopters consider it a

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*These 14 information sources were derived in two ways: (1) pretest interviews with solar equipment adopters, and (2) literature on solar equipment. See question #14 on the Adopters' questionnaire, #7 on the Nonadopters'. In general, those information sources suggested in the pretests were also those selected by our respondents in this study. The information sources suggested as likely ones in the writings of "experts" on the subject were in fact hardly considered by our respondents.

Table 17. Amount of Thought Involved in the Purchase Decision.^a

Question	Adopters		Respondents Nonadopters	
	Frequency	Percent	Frequency	Percent
How much thought goes into a decision on buying solar equipment?				
1. As much as buying a major appliance	19	17.3	8	7.8
2. _____ ^b	18	16.4	10	9.7
3. As much as buying a car	46	41.8	41	39.8
4. _____ ^b	15	13.6	28	27.2
5. As much as buying a house	12	10.9	16	15.5
Subtotals	110	100.0%	103	100.0%
Missing values	1	0	1	0
Totals	111	100.0%	104	100.0%

^a Data from Question: Demographic #5.

^b No verbal labels were given to responses #2 and #4 on this five-point scale.

potentially useful source. Only 11 percent of the adopters mentioned using the California State Energy commission toll-free telephone number, but approximately one-third of the nonadopters selected that source as a potentially useful one. Only seven percent of the adopters found consumer groups good sources of information, yet almost half of the nonadopters thought such groups were potentially good sources of information (Table 18).

While these differences obviously reflect the disparity between potential and actual information sources, they may also indicate interest in sources which have been previously underutilized.

The Decision about Solar Installation

As Figure 1 suggests, the decision about any purchase involves a weighing of various factors, including the expected characteristics of the innovation, the incentives to purchase, and the perceived barriers to making the purchase. Respondents in this study were asked to select those factors which they had considered in making their purchase (or in the case of nonadopters, those factors they would consider) from a list of 21 potential factors.* Again, the selection of the two populations differed less in the selection of factors than in the rank ordering of those items (Table 19). Six out of the top seven ranked factors were the same for adopters and nonadopters. The seventh differing factor is of interest, however. Adopters considered the possibility that solar could save them from having to reduce energy consumption in the future to be important. Nonadopters rated the expense of maintaining equipment as a more important decision factor. This difference in selection may reflect the adopter's experience with the equipment; perhaps once the installation is in place solar owners tend to forget that maintenance expenses were ever factors to be considered, whereas to nonadopters that potential expense is an unknown and therefore an important

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*See question #20 on the Adopters' questionnaire; #12 on the Nonadopters'.

Table 18. Sources of Information about Solar Equipment Selected as Most Useful by Adopters and Nonadopters ^a

Adopters (N=111)			Nonadopters (N=104)		
Ranking	Information Source	Mean Score ^b	Ranking	Information Source	Mean Score ^b
1st	Sellers of solar equipment	3.88	1st	Friends	2.65
2nd	Friends	2.70	2nd	Sellers of solar equipment	2.44
3rd	Magazines	2.14	3rd	Magazines	2.33
4th	Textbooks	1.53	4th	Demonstrations	2.09
5th	Seminars on solar	1.47	5th	Textbooks	1.83
6th	Newspapers	1.37	6th	Seminars on solar	1.60
7th	Energy Fairs	1.21	7th	Newspapers	1.54
8th	Alternative Technology Groups	1.05	8th	Alternative Technology Groups	1.43
9th	Utility Companies	1.01	9th	Utility Companies	1.37

^a Adopters were asked to select and rank in order of importance those sources of information which had proven most useful to them. Nonadopter respondents who had considered purchasing solar equipment were asked what sources had been most useful. Respondents who had never even considered solar were asked what sources of information were potentially most useful. Data from Questions: Adopters #14, Nonadopters #7.

^b This score reflects frequency of mention weighted by ranking in importance. Range is 0 to 6, where 0 means not mentioned, 1 means mentioned but not ranked, and 2 through 6 are rankings from low to high.

Table 19. A Comparison of Decision Factors as Ranked by Adopters and Nonadopters.^a

Adopters			Nonadopters ^b		
Ranking	Decision Factor	Mean ^c	Ranking	Decision Factor	Mean ^c
1st	Lower or no energy bills	3.51	1st	Initial cost of equipment	3.72
2nd	Initial cost of equipment	3.09	2nd	Easing the energy shortage	2.34
3rd	Easing the energy shortage	2.94	3rd	Reliability of equipment	2.62
4th	Lessening pollution	1.68	4th	Lower or no energy bills	2.13
5th	Not having to reduce consumption	1.57	5th	Lessening pollution	1.61
6th	Reliability of equipment	1.54	6th	Reliability of solar companies	1.60
7th	Reliability of solar companies	1.33	7th	Expense of maintaining equipment	1.56

^a Data from Questions: Adopters #20, Nonadopters' #12.

^b Since Nonadopters have not actually made the purchase decision, they were asked to select and rank in importance those factors which would enter their decision to buy or not buy solar equipment.

^c Range is from 0 to 6, where 0 means not selected, 1 means selected but not ranked, and 2 through 6 are rankings from low to high.

consideration. A more important possible implication of this difference between adopters and nonadopters is that some people are motivated to buy solar equipment out of fear that future energy shortages will require lifestyle changes, if they do not have solar heating as insurance. This interpretation is supported by the data presented in Table 20. Not having to reduce energy consumption in the future is a much more important decision criterion for swimming pool owners than for adopters of space or water heating systems. Note also that the possibility of lower or no energy bills and the potential for easing the energy shortage are almost reversed in importance for these two subpopulations of adopters.

We will be presenting further evidence that swimming pool owners differ in motivation and consumption patterns from buyers of water heating and, to a lesser degree, from adopters of space heating systems.

As in the case of information sources, nonadopters tended to mention more possible decision factors than did adopters, although there was fairly good agreement between the two populations on what factors were the important ones (see Appendix B-3). The only decision factor more frequently cited (regardless of ranking) by adopters than nonadopters was "Not having to pay monthly energy bills." All other decision criteria were considered potentially influential by more nonadopters than nonadopters.

For instance, only about four percent of the adopters mentioned including in their purchase decision, considerations about obtaining a home loan or getting the equipment covered by homeowner's insurance. The comparable percentages for nonadopters were about 26 percent and 38 percent respectively. The possibility of increased property taxes because of installing solar equipment was mentioned as a consideration by only about one-tenth of the adopters, whereas over two-fifths of the nonadopters thought it was a concern.

There are several possible explanations for this finding. It may be an artifact of the study. That is, perhaps some of the factors suggested to the

Table 20. A Comparison of Decision Factors as Ranked by Adopters with Swimming Pool Systems and by Adopters with Other Systems.^a

Owners of Swimming Pool Solar Heating Systems			Owners of Other Solar Heating Systems		
Ranking	Decision Factor	Mean ^b	Ranking	Decision Factor	Mean ^b
1st	Lower or no energy bills	4.21	1st	Easing the energy shortage	3.43
2nd	Initial cost of equipment	3.02	2nd	Initial cost of equipment	3.17
3rd	Easing the energy shortage	2.47	3rd	Lessening pollution	2.26
4th	Not having to reduce energy consumption	2.04	4th	Lower or no energy bills	2.19
5th	Operating reliability of equipment	1.37	5th	Operating reliability of equipment	1.80

^a Data from Questions: Adopters #1 and #20.

^b Range is from 0 to 6, where 0 means not selected, 1 means selected but not ranked, and 2 through 6 are rankings from low to high.

respondents (namely, those decision factors taken from literature about solar marketing rather than those drawn from the Stanford in-depth pretest interviews) had never been considered by either population. Adopters were constrained in their selection to those factors actually used, whereas nonadopters could pick factors which were of potential importance.

A second possible explanation is that in the process of shopping for their equipment, solar adopters considerably narrowed the range of decision factors, and therefore the smaller number of factors named reflects experience with the real-life decision process.

Thirdly, it is possible that nonadopters are more cautious shoppers than adopters, and therefore more inclined to take all kinds of factors into consideration. Perhaps adopters, being a bit wealthier, are a bit more inclined to risk investment in a technology without thinking about all possible ramifications.

Incentives to Adopt

Almost everyone in our sample was aware of the California State tax credit, an encouraging finding since even four months before the survey some solar manufacturers felt that the general public did not know about the credit. Awareness is not understanding, of course, and as one would expect, the adopters in our sample felt much more familiar with the credit than did nonadopters (Table 21). The great majority of adopters did apply for and get a tax credit, usually for one year. Surprisingly, fully half did not consider the credit to be at all important in their decision to buy solar. A cross-tabulation run between the type of equipment respondents owned and the importance of the tax credit revealed that about two-thirds of the space and water heating system owners considered the credit to be "somewhat" or "very" important. Only just over a third of the swimming pool owners rated the credit similarly. A comparison between income levels and the perceived importance of the tax credit shows no relationship. The relative

Table 21. Awareness and Perceived Importance of California State Tax Credit.^a

Awareness/Importance Variables	Respondents			
	Adopters		Nonadopters	
	Frequency	Percent	Frequency	Percent
a. Are you aware of the California tax credit for the purchase of solar equipment?				
1. No	0	00.0	1	1.0
2. Have only heard of it	3	2.7	19	18.4
3. Somewhat familiar with it	23	20.7	65	63.1
4. Quite familiar with it	<u>85</u>	<u>76.6</u>	<u>18</u>	<u>17.5</u>
Subtotals	111	100.0%	103	100.0%
Missing Values	0	0	1	0
Totals	<u>111</u>	<u>100.0%</u>	<u>104</u>	<u>100.0%</u>
b. How important was (would be) ^b the tax credit in your decision to buy solar equipment?				
1. Not at all important	54	52.0	14	15.5
2. Somewhat important	17	16.3	39	43.5
3. Very important	<u>33</u>	<u>31.7</u>	<u>37</u>	<u>41.0</u>
Subtotals	104	100.0%	90	100.0%
Missing Values	7	0	14	0
Totals	<u>111</u>	<u>100.0%</u>	<u>104</u>	<u>100.0%</u>

^a Data from Questions: Adopters and Nonadopters #4.

^b The nonadopters were asked to state how important the tax credit would be if they were to consider buying solar equipment.

influence of the tax credit in the decision to purchase solar equipment appears to depend more upon the type of equipment purchase (and therefore on motivation and expected payback) than upon the income of the adopters.

Relatively few of the adopters (Table 22) needed bank financing to purchase their equipment.* For these early adopters, then, low-cost loans (available through some banks) were not an incentive. Of the few who did seek financing, none reported any difficulties in obtaining a loan. In this sample of adopters, there was little relationship between income level and financing, although adopters earning \$25,000 or less were slightly more inclined (22 percent) to borrow money to finance the installation of solar equipment than were those earning more than \$25,000 (15.4 percent).

Expectations of rising gas and electricity costs might be expected to serve as an incentive to invest in solar equipment. As Table 23 indicates, nonadopters are only slightly more optimistic than adopters about future expenses. Over half the adopters expect price increases of more than 50 percent over the next five years; less than two-fifths of the nonadopters expect prices to rise at that rate. It should be noted that the adopter's pessimism could be partially the result of post-purchase rationalization, that is, adopters may convince themselves that their purchase was a wise one by inflating their estimates of future energy costs. However, especially in view of the fact that "lower or no energy bills" was the most important decision factor for adopters (Table 19), it is equally likely that owners of solar systems were motivated to make the purchase because of a genuine concern for rising costs. Perceptions of future energy prices, in other words, may actually predict adoption of solar equipment.

Expected Payback

Adopters are similarly more optimistic about getting a return on solar

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*One solar manufacturer refers to his customers as "eco-chics" since most are not buying for economic reasons. This manufacturer noted that virtually none of his customers had needed to take longer than the 90 days offered (without interest) to pay for their systems, and most had paid cash on delivery.

Table 22. Financing of Solar Equipment: Tax Credit and Loans(Adopters Only).^a

Respondent Actions	Frequency	Percent
a. Applying and receiving tax credit for their equipment:		
1. Not applied	14	13.5
2. Applied	91	86.5
Subtotal	105	100.0%
Missing values	6	0
Total	111	100.0%
b. Number of years total requested for tax credit on solar equipment:		
1. One year	56	65.0
2. Two years	16	18.5
3. Three years	13	15.5
4. Ten years	1	1.0
Subtotal	86	100.0
Missing values	5	0
Total	91	100.0%
c. Obtained bank loans:		
1. No	90	64.0
2. Yes	17	36.0
Subtotal	107	100.0%
Missing values	4	0
Total	111	100.0%

^a Data from Questions: Adopters #4 and #5.

Table 23. A Comparison of Adopters' and Nonadopters' Expectations about Future Cost of Gas and Electricity.^a

Question	Respondents			
	Adopters		Nonadopters	
	Frequency	Percent	Frequency	Percent
Over the next five years do you feel that the cost of gas and electricity will:				
1. Decrease	0	00.0	0	00.0
2. Stay about the same	1	0.9	2	2.0
3. Increase, less than 10%	5	4.5	1	1.0
4. Increase 11 to 25%	9	8.1	21	21.2
5. Increase 26 to 50%	37	33.3	38	38.3
6. Increase 51 to 100%	45	40.5	30	30.3
7. Increase more than 100%	14	12.6	7	7.2
Subtotals	111	100.0%	99	100.0%
Missing values	0	0	5	0
Totals	111	100.0%	104	100.0%

^a Data from Question: Demographic #7.

investments than are nonadopters (Table 24). Adopters tend to believe (58 percent) that all types of solar equipment will eventually pay for themselves in utility bill savings; nonadopters are slightly more cautious (43 percent). As the figures in Table 25 for both the mean and the median number of years to expected payback show, the disparity between the adopter and nonadopter populations is especially great for hot tub and swimming pool payback. Nonadopters appear to be less sensitive than adopters to the real difference in economic payback between solar heating for swimming pools and the payback of other systems.

Once again, it is difficult to say whether adopters purchased their equipment because they were more optimistic than their neighbors about payback or whether they have become more optimistic as a result of the purchase; either way, there seems to be need for more information about payback.

Mandated Programs

Some type of legally-required solar equipment is slightly favored by adopters as compared to nonadopters (Table 26). Interviewers found that when respondents were first asked the general question whether or not some type of solar heating system should be legally required in new construction, the immediate, often somewhat emotional answer was "no mandates"! However, when the interviewer showed the respondent a card displaying the possible options, the respondents tended to reconsider and to say that one or more of the mandate options was acceptable.

The most popular mandated program, according to this sample of adopters and nonadopters, would be a legal requirement that swimming pools be heated with solar power (if at all). Among those respondents who favored some kind of mandated program, that option was selected by 85 percent of the adopters and 77 percent of the nonadopters (or about 45 percent of the total sample of 215). Some respondents (including ones who owned pools) remarked that since swimming pools were a luxury, people who owned them could afford to put in solar equipment.

Table 24. A Comparison of Adopters and Nonadopters Expectations About Payback for Solar Equipment.^a

Question	Respondents			
	Adopters		Nonadopters	
	Frequency	Percent	Frequency	Percent
Do you think that (your) solar equipment will eventually pay for itself in savings on utility bills?				
1. Don't know	8	7.7	7	6.8
2. No	8	7.7	13	12.6
3. Yes, some types	28	27.0	39	37.9
4. Yes, all types	60	57.6	44	42.7
Subtotals	104	100.0%	103	100.0%
Missing values	7	0	1	0
Totals	111	100.0%	104	100.0%

^aData from Question: Adopters' #6, Nonadopters' #10.

Table 25. A Comparison of Adopters' and Nonadopters' Judgements of Years Required for Payback on Solar Equipment.^a

Type of Equipment	Respondents							
	Adopters				Nonadopters			
	Swimming Pool Heater	Hot Tub Heater	Water Heater	Space Heater	Swimming Pool Heater	Hot Tub Heater	Water Heater	Space Heater
Mean Number of Years for Payback	5.7	7.5	8.8	12.5	9.4	10.7	10.7	14.0
Median Number of Years for Payback	5.0	6.3	8.5	10.5	7.0	9.8	9.9	10.5
S.D.	3.67	5.36	4.57	7.70	7.80	8.19	7.16	8.82
Range (Number of Years)	1-18	1-20	1-20	1-30	1-25	1-28	1-42	1-50

^a Data from Question: Adopters' #6, Nonadopters #10.

Table 26. Comparison of Adopters' and Nonadopters' Attitudes Towards Mandating Solar Installations.^a

Question	Respondents			
	Adopters		Nonadopters	
	Frequency	Percent	Frequency	Percent
a. Do you believe that some type of solar heating system should be legally required in all new homes constructed				
1. No	42	38.5	49	45.0
2. Yes	67	61.5	53	55.0
Subtotals	109	100.0%	102	100.0%
Missing values	2	0	2	0
Totals	111	100.0%	104	100.0%
b. Required architectural designs which take advantage of heat (passive solar)				
1. No	19	29.0	15	29.0
2. Yes	49	71.0	37	71.0
Subtotals	66	100.0%	52	100.0%
Missing values	1	0	1	0
Totals	67	100.0%	53	100.0%
c. Required solar equipment to heat swimming pools at an additional cost of about \$1,000 to \$2,000				
1. No	10	15.0	12	23.0
2. Yes	55	85.0	41	77.0
Subtotals	65	100.0%	53	100.0%
Missing values	2	0	0	0
Totals	67	100.0%	53	100.0%
d. Required solar equipment installed to heat domestic water systems at an additional cost of \$1,500 to \$2,000				
1. No	29	45.0	26	49.0
2. Yes	35	55.0	27	51.0
Subtotals	64	100.0%	53	100.0%
Missing values	3	0	0	0
Totals	67	100.0%	53	100.0%

^a Data from Question: Adopters #3, Nonadopters #11.

Passive solar designs were favored by 71 percent of those respondents who felt some sort of solar systems should be legally required, or by about two-fifths of the total sample. Mandated water heating systems was the option chosen by just about half of the respondents who favored some kind of mandated program (or just over one-fourth of the total sample).

Among nonadopters who have not already definitely made up their minds about whether to purchase solar equipment, the present tax credit is the most preferred incentive (Table 27). Nonadopters who have not rejected the possibility of buying solar equipment (70 out of 104 or 67 percent) would generally prefer to buy and maintain their own equipment (Table 27); and of these respondents, a majority would rather pay cash than finance through a loan. The very small number of respondents who would like to rent equipment, are evenly divided on the question of whether they would prefer to rent from a utility or private company.

Potential Disincentives

As one would expect (given that they have made the investment) adopters are more sanguine than nonadopters about the chances that the addition of solar equipment will raise the value of a home (Table 28). However, out of the entire sample interviewed, only four people thought the installation of solar systems would lower a house selling price. Over half of the adopters and almost half of the nonadopters consider solar equipment to be a good risk.

Despite that optimistic response about investing in solar, most of our respondents (adopters and nonadopters) perceived cost as the major disincentive to adoption (Table 29). Over a third of the nonadopters also mentioned a fear of unknown technology as the primary barrier. Paradoxically, more adopters than nonadopters put some emphasis on potential buyers' uncertainty about the reality of an energy crisis. Either nonadopters do not feel this consideration to be a major one in the purchase of solar, or else they do not believe that potential

Table 27. Nonadopters' Preferred Incentives to Install Solar Systems.^a

Question	Frequency	Percent
a. Nonadopters who may install or have not considered:		
There are a number of alternative means by which the government could provide financial assistance to people purchasing solar equipment. Which one of the following alternatives would you consider best?		
1. A 55% tax credit which the individual could start claiming the year the equipment was installed	38	56.7
2. A direct government rebate of 25% of the total price to purchase within 3 months of purchase	11	16.4
3. A low interest loan of 6% over 15 years (\$21 monthly), as compared to \$30/month on a standard 12% loan	11	16.4
4. Prefer no government assistance	7	10.5
Totals	67	100.0%
b. Nonadopters who definitely plan to install, may install, or have not considered installing solar equipment:		
Assuming that you are considering installing a solar water heating system in your home, which would cost a total of \$2,500 installed, would you prefer to:		
1. Buy and maintain your own equipment	57	80.3
2. Rent the equipment (with service included)	14	19.7
Totals	71	100.0%
Nonadopters who prefer buying:		
1. Pay cash	37	65.0
2. Finance through a loan.	20	35.0
Totals	57	100.0%
Nonadopters who prefer renting; would you prefer to rent from a		
1. Utility company	7	50.0
2. Private company	7	50.0
Totals	14	100.0%

^a Data from Question: Nonadopters' #6.

Table 28. Anticipated Effect of Solar Equipment on Value of House.^a

Anticipated Effect	Respondents			
	Adopters		Nonadopters	
	Frequency	Percent	Frequency	Percent
1. Would lower the price	2	1.8	2	2.0
2. Would not affect the price	24	21.8	17	17.2
3. Would raise values but not as much as the price of the equipment	23	20.9	34	34.3
4. Would raise values, more than the price of the equipment	61	55.5	46	46.5
Subtotals	110	100.0%	99	100.0%
Missing values	1	0	5	0
Totals	111	100.0%	104	100.0%

^a Data from Question: Adopters' #19, Nonadopters' #9.

Table 29. Perceived Reasons for Not Buying Solar Equipment.^a

Reasons	Respondents			
	Adopters		Nonadopters	
Question:	Frequency	Percent	Frequency	Percent
In your opinion why aren't more people buying solar equipment for their homes?				
1. Uncertain about reality of energy crisis	16	14.7	1	1.0
2. Costs perceived as too high	66	60.6	52	52.5
3. Technology not mature	13	11.9	11	11.0
4. Feel detracts from house value	1	0.9	0	00.0
5. Fear of the unknown	13	11.9	35	35.5
Subtotals	109	100.0%	99	100.0%
Missing values	2	0	5	0
Totals	111	100.0%	104	100.0%

^a Data From Question: Adopters' #21, Nonadopters #13.

buyers are any more skeptical than actual buyers about energy shortages. As we will see later in this report, solar owners as a whole do not appear to believe in energy shortages any more strongly than nonadopters.

Perceived Motives for Solar Installation

Asked to assign a general, non-economic motive to the purchase of solar equipment (Table 30) most respondents thought the adoption decision was inspired by a desire to lessen energy shortages rather than to combat pollution. Purely economic reasons were not listed in the original question, yet 20 people felt strongly enough that there were no non-economic motives involved, to suggest an economic motivation under the open category, "other." When the motives cited in Table 30 were cross-tabulated by type of equipment, we found that swimming pool owners were much more likely to give economic reasons than were other respondents. Fifteen of the 20 respondents who wrote in cost as a primary purchase motive, owned swimming pool heaters.

Experience with Solar

For a number of reasons, the actual experience which adopters have with their installed equipment will, as Figure 1 suggests, greatly influence future demand. First, present owners of solar equipment, if satisfied, may retrofit their homes with multiple systems (and in fact many adopters declared their intention to do so); also in today's highly mobile society, many homeowners will have the choice of duplicating present solar systems in future homes, or having solar systems included in custom-built homes. The influence of present adopters' experience on their friends and neighbors is even more important, however, since as marketers have long been aware, "word-of-mouth advertising" is extremely influential in the diffusion of innovation.

As Table 31 shows, almost all of the adopters are quite satisfied with their

Table 30. Adopters' and Nonadopters' Perception of Motive for Installing Solar Equipment.^a

Question	Respondents			
	Adopters		Nonadopters	
	Frequency	Percent	Frequency	Percent
"Installing solar equipment is a statement of _____"				
1. Commitment to help the world get through a serious energy problem.	46	42.0	58	56.3
2. Intention to simplify one's lifestyle.	3	2.8	4	3.9
3. Interest in innovative technology.	11	10.3	5	4.9
4. Independence from utility companies.	11	10.3	10	9.7
5. Commitment to protect your environment	5	4.6	11	10.7
6. Ability to spend money wisely (economic reasons) ^b	13	11.8	7	6.8
7. Other	20	18.2	8	7.8
Subtotals	109	100.0%	103	100.0%
Missing values	2	0	1	0
Totals	111	100.0%	104	100.0%

^a Data from Question: Demographic #4.

^b This category was not included in the original wording of the question, but was written in under "other" by 20 people.

Table 31. Level of Adopter Satisfaction with Solar Equipment
(N= 110 ^a).^b

Variable	Frequency	Percent
1. Would purchase solar equipment again if "had it to do over."	105	95.4
2. If moved, would retrofit house with solar equipment	105	95.4
3. If custom built new home, would install solar equipment	105	95.4

^a One missing value.

^b Data from Questions: Adopters' #7 to #9.

equipment and would be willing to invest all over again, given the opportunity.* Even if this satisfaction derives to some extent from post-purchase rationalization, the short-term effect will be to encourage solar adoption. The present adopters may themselves constitute a future market, as Table 32 shows. Although the majority of these adopters do not have immediate intentions to move, they are still a young enough population that many of them probably will own another house.

This enthusiasm for solar equipment appears to have been unaffected by the fact that the solar systems have not been problem-free for a majority of solar systems owners (Table 33). Almost two-thirds of the adopters had at least minor repairs made to their equipment; relatively few reported major difficulties, however. In most cases, the solar companies assumed technical and financial responsibility for making the necessary repairs or adjustments (Table 34). While 19 out of 111 adopters incurred some costs (many of these were self-installed systems), most of the expenses amounted to less than \$100. Only three adopters incurred major expenses in repairing their equipment; in one of these cases there was extensive damage to the roof from leaking. The solar company paid half of the cost of the re-roofing. Another major expense was incurred because the system was quite old (installed about 1958) and the present owner had to rebuild the system.

Most of the adopters reported (Table 35) either having no need to make

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*This same finding in a 1978 study in Florida was accompanied by the discovery that many systems were not in fact in good working order; see Yarosh and Litka, (1978). While we did not have engineers check the systems, almost all were claimed to be in good order by their owners. Through a phenomena known to psychologists as "cognitive dissonance reduction" adopters of innovation are likely to report a high level of satisfaction with their decision. The usually unconscious reasoning seems to be "I bought it, so it must be good and I must be satisfied with it." This post-purchase rationalization gives adopters a high degree of tolerance for system flaws -- a tolerance which purchasers of a home already equipped with solar equipment may not have. In fact, the respondent most vocally dissatisfied with the solar equipment had bought the house because he liked the architecture; he felt the solar system was totally inadequate and disliked it very much.

Table 32. Types of Solar Equipment Adopters Would Install in Different House.^a

Type of House		Types of Equipment							
		Swimming Pool Heater		Hot Tub Heater		Water Heater		Space Heater	
		Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Another Existing House (Retrofit)									
1. No		26	75.0	71	68.5	40	38.0	33	32.7
2. Yes		79	25.0	33	31.5	65	62.0	68	67.3
Subtotals		105	100.0%	104	100.0%	105	100.0	101	100.0%
Missing values		6	0	7	0	6	0	10	0
Totals		111	100.0%	111	100.0%	111	100.0%	111	100.0%
New House (Custom built)									
1. No		29	27.8	62	60.7	17	16.5	29	28.5
2. Yes		75	72.2	40	39.3	86	83.5	73	71.5
Subtotals		104	100.0%	102	100.0%	103	100.0%	102	100.0%
Missing values		7	0	9	0	8	0	9	0
Totals		111	100.0%	111	100.0%	111	100.0%	111	100.0%

^a Data from Question: Adopters #7 to #9.

Table 33. Reported Problems with Solar Equipment.^a

Problems	Frequency	Percent
1. No problems	39	35.1
2. Problems	71	64.9
Subtotals	110	100.0%
Missing values	1	0
Totals	111	100.0%
1. Valve had to be replaced	10	14.0
2. Leaking tank or panel or pipe	17	24.0
3. Water froze in both pipes and panels	17	24.0
4. Hose, filter or pump had to be replaced	9	12.5
5. Pipes needed insulation	2	3.0
6. Water froze in panels	3	4.0
7. System was designed incorrectly	9	12.5
8. Minor maintenance required (no real problems)	4	6.0
Totals	71	100.0%

^a Data from Question: Adopters #10.

Table 34. Description of How Repairs to Solar Equipment were Made and Financed:^a

Variables	Frequency	Percent
a. How problems with the equipment were solved:		
1. Not solved	3	4.3
2. Replaced	23	32.3
3. Repaired	40	56.3
4. Both repaired and replaced	5	7.0
Totals	71 ^b	100.0%
b. Who repaired or replaced the faulty equipment?		
1. Friends	0	00.0
2. Self/spouse	14	20.5
3. Solar company	46	68.0
4. Self and solar company	8	11.5
Totals	68 ^b	100.0%
c. How the costs involved were covered		
1. Warrantees ^c	43	63.2
2. Insurance	0	00.0
3. Self	25	36.7
Totals	68 ^b	100.0%
d. Percent of repair costs paid by owners:		
1. 5%	1	3.5
2. 33%	1	3.5
3. 40%	1	3.5
4. 50%	6	21.5
5. 100%	19	68.0
Totals	28 ^b	100.0%
e. Amount of money paid by owners		
1. \$4 to \$100	18	63.5
2. \$101 to \$300	5	18.5
3. \$301 to \$400	2	7.5
4. \$401 to \$485	3	10.5
Totals	28 ^b	100.0%
Mean	\$137	
SD(Standard Deviation)	14.0	

^a Data from Question: Adopters #10.

^b Only 71 Adopters reported problems; not all of these answered questions about the repairs.

^c Includes warrantees offering less than 100 percent coverage.

Table 35. Effect of Solar Equipment on Daily Routine.^a

Variable	Frequency	Percent
a. Whether or not use of solar equipment affects daily routine		
1. Does not affect.	49	44.5
2. Does affect	61	55.5
Subtotals	110	100.0%
Missing values	1	0
Totals	111	100.0%
b. Changes in routine caused by use of solar equipment		
1. Longer swimming season	37	62.8
2. Altered time for showers	9	15.2
3. Altered time for laundering	1	1.7
4. Altered time for washing dishes	11	18.6
5. More than one of the above	1	1.7
Subtotals	59	100.0%
Missing values	2	0
Totals	61	100.0%

^a Data from Question: Adopters #11.

changes in their daily routine because of the solar equipment or they report altering that routine for the better, e.g., they can swim daily more days out of the year than before they put in solar heating. An interesting finding not evident in the figures of Table 35 is that adopters were not consistent about the changes in routine they reported as necessary. Those who said the use of solar water heating required a change in the schedule of hot water use tended to contradict each other as to what the alteration involved; some said they had to wait until the end of the day to use hot water and others maintained that the system only yielded enough hot water in the mornings (when, presumably the water had been heated by the backup system).

Adopters as Opinion Leaders

Adopters have shown their equipment to a surprising number of people, (Table 36) although perhaps memory has somewhat inflated the figures. A few of the homeowners interviewed had allowed their houses to be shown as part of a community effort to stimulate interest in solar through a guided tour of solar-equipped homes. Also, many of the adopters were active in the community and extremely proud of their equipment, so it is quite believable that they have shown more than 25 people their installations. Most have also recommended that others buy solar. About half of the adopters know of at least one homeowner who purchased solar equipment after seeing the adopter's installation. Some of the respondents had allowed the solar company to use them as references, and had shown their home to potential customers who subsequently bought a solar system.

Neighbors generally have made little comment about adopter's installations, at least to the equipment owners (Table 36,d), but the approximately one-third of the adopters who have received neighborly comments reported compliments rather than complaints. As previously noted, many neighbors are totally unaware of the nearby solar collectors. This finding may be due in part to the fact that these first adopters are well-off; a lot large enough to house a pool is likely to be

Table 36. Role of Adopters in Diffusing Adoption of Solar Equipment to Friends and Neighbors.^a

Variable	Frequency	Percent
a. Number of people to whom adopters have shown their equipment		
1. None	5	4.5
2. 1 to 5	8	7.2
3. 6 to 10	15	13.5
4. 11 to 15	16	14.4
5. 16 to 20	8	7.2
6. 21 to 25	6	5.4
7. More than 25	53	47.7
Totals	111	100.0%
b. Number of people to whom adopters have recommended buying solar equipment		
1. None	13	11.8
2. 1 to 5	13	11.8
3. 6 to 10	15	13.6
4. 11 to 15	17	15.6
5. 16 to 20	3	2.8
6. 21 to 25	5	4.6
7. More than 25	44	39.8
Subtotals	110	100.0%
Missing values	1	0
Totals	111	100.0%
c. Number of people to whom adopters showed or recommended solar, who purchased solar equipment themselves		
1. None	36	37.6
2. 1 to 5	49	51.4
3. 6 to 10	6	6.0
4. 11 to 15	1	1.0
5. 16 to 20	0	00.0
6. 21 to 25	0	00.0
7. More than 25	4	4.0
Subtotals	96	100.0%
Missing values	15	0
Totals	111	100.0%
d. Reaction of neighbors to adopters' solar equipment		
1. Neighbors complain	2	1.9
2. Neighbors make no comment	69	63.9
3. Neighbors compliment	37	34.3
Subtotals	108	100.0%
Missing values	3	0
Totals	111	100.0%

^a Data from Question: Adopters #17.

sizeable and therefore there may be quite a bit of distance between neighbors. The impact of solar collectors in neighborhoods with houses closely packed in may be quite different.*

Nonadopter neighbors report almost as high a level of satisfaction among solar owners as do the adopters (Table 37,a). The major complaint nonadopters recall hearing about solar systems is that they are too costly. Over half the nonadopters in our sample reported that adopters found the systems too expensive, a surprising figure considering the high percentage of adopters who expect their equipment to pay for itself. Perhaps information about the high initial costs of solar systems is easily conveyed; expectations about payback are not so readily transmitted. Of those nonadopters who know of people owning solar equipment, over half have seen the equipment, and over a third initiated the visit to see the equipment themselves. Neighbors report more reluctance on the part of adopters to recommend purchase than do adopters. Only 10 nonadopters out of the entire 104 had been shown equipment and had also had the purchase recommended to them.

Nonadopters as Potential Adopters

Nonadopters appear to have no firm idea of how much a top quality water heating system would cost (Table 38). Assuming that such a system actually costs between \$2,000 and \$3,000,** we see that only about one-third of the nonadopters chose prices within that range. Over half of the nonadopter respondents either have no idea of the costs involved or considerably over-estimate the expense involved. Over one-fourth of the nonadopters have never considered it and rejected the idea. Half of those who decided against installation felt it was too costly. Asked what if anything would persuade them to buy, this same group tended

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*See Mazur (1979) for a discussion of how unsightly the numerous solar systems are in Israel, where the equipment is regarded as a lower or lower-middle class purchase

**At the time of the survey, this was a "reasonable" cost estimate provided by manufacturers of solar equipment.

Table 37. Nonadopters' Perceptions of Adopters' Experience with Solar Equipment. ^a

Variable	Frequency	Percent
a. Nonadopters' opinions as to whether solar users are satisfied		
1. Dissatisfied	6	8.3
2. Satisfied	67	91.7
Totals ^b	73	100.0%
b. Difficulties nonadopters have heard adopters have experienced with solar equipment		
1. Too costly	55	70.4
2. Technology not mature	8	10.2
3. Poor quality	9	11.4
4. Poor design	5	6.4
5. Both 2 and 3	1	1.6
Totals ^b	78	100.0%
c. Extent to which nonadopters have seen installed equipment		
1. Not seen	31	39.2
2. Seen at adopters' initiative	21	26.5
3. Seen at nonadopters' initiative	27	34.3
Totals ^b	79	100.0%
d. Extent to which adopters have recommended purchase of solar equipment to nonadopters		
1. No, have not recommended	41	80.3
2. Yes, have recommended	10	19.7
Totals ^b	51	100.0%

^a Data from Question: Nonadopters #3.

^b Not all 104 Nonadopter respondents answered these questions.

Table 38. Nonadopters' Attitudes Toward Adoption.^a

Attitudes		Frequency	Percent
a. How much a solar water heating system costs.			
1.	\$500 to \$1499	14	13.7
2.	\$1500 to \$2499	20	19.6
3.	\$2500 to \$3499	15	14.7
4.	\$3500 to \$4499	13	12.7
5.	More than \$5000	20	19.6
6.	Don't know	20	19.6
	Subtotals	102	100.0%
	Missing values	2	0
	Totals	104	100.0%
b. What is your present attitude toward installing solar equipment in your home?			
1.	Have considered, will not install	30	28.8
2.	Have not considered	29	27.9
3.	May install	40	38.5
4.	Definitely plan to install (have obtained cost estimates and/or equipment)	5	4.8
	Totals	104	100.0%
c. Nonadopters who considered but will not install:			
I. Why did you decide against installation?			
1.	Too costly	13	43.3
2.	Technology is not mature	2	6.6
3.	Moving to a new home	5	16.7
4.	May install in custom built house	1	3.3
5.	Retrofitting very difficult	1	3.3
6.	Most economical for pools, don't have one	2	6.6
7.	Not aesthetic	1	3.3
	Subtotal	25	83.3
	Missing value	5	16.7
	Total	30	100.0%

II. What, if anything, would persuade you to install solar equipment?

1. Lower cost	9	38.0
2. More aesthetic	0	00.0
3. Better technology	3	12.5
4. If energy situation gets worse	6	25.0
5. May consider passive	0	00.0
6. If could realize savings	1	4.0
7. If given for experimental purposes	2	8.0
8. If moving to a new home	3	12.5
Totals	24	100.0%

d. Nonadopters who may install: why have you not made definite plans to install?

I. Awaiting further information about solar equipment.

1. No	28	70.0
2. Yes	12	30.0
Totals	40	100.0%

II. Awaiting more money.

1. No	28	70.0
2. Yes	12	30.0
Totals	40	100.0%

III. Waiting to see if there are further shortages in energy.

1. No	36	99.0
2. Yes	4	1.0
Totals	40	100.0%

IV. Waiting to see if the equipment works for others.

1. No	29	72.5
2. Yes	11	27.5
Totals	40	100.0%

V. Waiting for price to come down.

1. No	18	45.0
2. Yes	22	55.0
Totals	40	100.0%

^aData from Question: Nonadopters #6.

to cite economics directly (lower cost, 38 percent) or indirectly (a worsening of the energy situation, 25 percent). Among nonadopters who may install but have not yet, the most popular reason given for the delay in purchase was "waiting for the price to come down." This kind of statement reflects the expectation (born of recent U.S. consumers' experience with calculators, computers, micro-wave ovens and other new technologies) that as production increases in volume, prices will lower. Solar manufacturers warn, however, that there are relatively few economies of scale involved in the production and installation of residential solar equipment since the basic materials are expensive and labor costs are escalating. If the manufacturers are correct, experience with the pricing of solar equipment will probably run contrary to the expectations of a large segment of the population.

Over two-thirds of the nonadopters said they desired further information about solar (Table 39). The most needed types of information were (1) general and (2) details about cost.

Adopter/Nonadopter Profiles

One of the primary objectives of the present research is to determine what types of behaviors and attitudes are associated with adoption of solar residential equipment. Presumably, the way people use discretionary income on their homes, their abilities and skills in making home improvements, their attitudes towards and acts of conservation -- all of these characteristics potentially may distinguish between adopters and their neighbors. We will now examine comparatively a number of home and conservation-related variables as one basis for distinguishing between subpopulations in the sample.

Financial Investments/Home Improvements

Probably because they are somewhat wealthier, more adopters than nonadopters put money into all kinds of investments. The difference between the two populations is most striking in the case of real estate (Table 40). Whereas fewer than

Table 39. Information Desired by Nonadopters about Solar Equipment.^a

Variables		Distribution of Responses							
a. More Information Desired		Frequency	Percent						
1. No		30	28.8						
2. Yes		74	71.2						
Totals		104	100.0%						
b. Types of information desired:									
General Information		Cost		Installation		Maintenance			
	Frequency	Per- cent	Frequency	Per- cent	Frequency	Per- cent	Frequency	Per- cent	
1. No	1	2.0	1	2.0	1	2.6	1	2.5	
2. Yes	54	98.0	50	98.0	38	97.4	39	97.5	
Totals		55	100.0%	51	100.0%	39	100.0%	40	100.0%

^a Data from Question: Nonadopters #8.

Table 40. Comparison of Financial Investments Made by Adopters and Nonadopters.^a

Investment	Respondents			
	Adopters		Nonadopters	
	Frequencies	Percent	Frequencies	Percent
a. Stocks, bonds, securities				
1. No	47	42.3	48	46.2
2. Yes	64	57.7	56	53.8
Totals	111	100.0%	104	100.0%
b. Real estate				
1. No	60	54.1	72	69.2
2. Yes	51	45.9	32	30.8
Totals	111	100.0%	104	100.0%
c. Improvement to increase resale value of home				
1. No	48	43.2	52	50.0
2. Yes	63	56.8	52	50.0
Totals	111	100.0%	104	100.0%
d. Cumulative Score of Financial Investments				
	Adopters		Nonadopters	
Mean Score	1.78		1.46	
S.D. (Standard Deviation)	0.94		0.94	

^a Data from Question: Demographic #10.

one-third of the nonadopters invest in real estate, 46 percent, or almost half of the adopters do. In keeping with the difference in income between the groups is also the pattern of budgeting for home improvements (Table 41). One-fourth of the adopters spend more than \$2,000 annually on their homes, whereas only 11 percent nonadopters do. The adopter sample distribution on this question tends to bifurcate, however, with many adopters spending \$500 or less annually. The reason for this bimodal distribution is that swimming pool owners, who have in general a higher income than other adopters, also tend to allocate more money for home improvements than do other adopters.

Since on average, adopters budget more for home improvements it is not surprising that they have on average made more improvements to their home in the past five years than have nonadopters (Table 42). Addition of solar equipment appears to be one among numerous major investments wealthier people made in their homes.

Ability to Make Repairs

Adopters evidence more ability to make repairs around their homes than do nonadopters (Table 43). Thus, adopters not only invest more in their homes but do more of the work themselves.

Energy Conserving Attitudes and Behavior

Adopters and nonadopters differ little in their verbal appraisal of the energy situation as it applies to their lives (Table 44), although adopters evidence slightly stronger belief that we are facing a long-term energy shortage and that the energy crisis was not a "put on" than do nonadopters.

In actual conserving behavior, there appears to be a difference between solar adopters and nonadopters. Adopters report making their homes more energy-efficient (Table 45) than nonadopters. Taken alone, this finding might seem to indicate merely that adopters have extended their interest in general home improvements

Table 41. Comparison of Dollars Budgeted Annually for Home Improvements by Adopters and Nonadopters.^a

Amount Budgeted	Respondents			
	Adopters		Nonadopters	
	Frequency	Percent	Frequency	Percent
0. Not applicable (new home)	5	4.7	10	9.7
1. \$10 to \$500	24	22.6	31	30.1
2. \$501 to \$1000	21	19.8	26	25.2
3. \$1001 to \$1500	17	16.0	14	13.6
4. \$1501 to \$2000	13	12.3	11	10.7
5. More than \$2000	26	24.5	11	10.7
Subtotals	<u>106</u>	<u>100.0%</u>	<u>103</u>	<u>100.0%</u>
Missing values	5	0	1	0
Totals	<u>111</u>	<u>100.0%</u>	<u>104</u>	<u>100.0%</u>
Mean Amount Budgeted 1.17				
S.D. (Standard Deviation) 1.16				

^a Data from Question: Demographic #9.

Table 42. Comparison of Home Repairs Adopters and Nonadopters are Capable of Making Themselves.^a

I. Type of Home Improvement	Respondents			
	Adopters		Nonadopters ^a	
	Frequency	Percent	Frequency	Percent
a. Replacing Roof				
1. No	73	65.8	63	61.2
2. Yes	38	34.2	40	38.8
Totals	111	100.0%	103	100.0%
b. Paving or Adding a Patio				
1. No	73	65.8	81	78.6
2. Yes	38	34.2	22	21.4
Totals	111	100.0%	103	100.0%
c. Installing a Sauna, Hot Tub, or Swimming Pool				
1. No	72	64.9	94	91.3
2. Yes	39	35.1	9	8.7
Totals	111	100.0%	103	100.0%
d. Adding One or More Rooms				
1. No	93	83.8	89	86.4
2. Yes	18	16.2	14	13.6
Totals	111	100.0%	103	100.0%
e. Completely remodeling One or More Rooms				
1. No	65	58.6	67	65.0
2. Yes	46	41.4	36	35.0
Totals	111	100.0%	103	100.0%
II. Average Number of Home Improvements				
Mean Number of Improvements	1.64		1.16	
S.D. (Standard Deviation)	1.32		1.16	
Range	0-5		0-5	

^a One missing value; data from Question: Demographic #8.

Table 43. Comparison of Home Repairs Made by Adopters and Nonadopters.^a

Type of Repair Adopters Can Make	Respondents			
	Adopters		Nonadopters	
	Frequencies	Percent	Frequencies	Percent
a. Automobile Tuneups				
1. No	72	64.9	64	61.5
2. Yes	39	35.1	40	38.5
Totals	111	100.0%	104	100.0%
b. Repairs on Major Appliances				
1. No	57	51.4	72	69.2
2. Yes	54	48.6	32	30.8
Totals	111	100.0%	104	100.0%
c. Repairs on Minor Appliances				
1. No	30	27.0	32	30.8
2. Yes	81	73.0	72	69.2
Totals	111	100.0%	104	100.0%
d. Plumbing				
1. No	24	20.7	28	26.9
2. Yes	87	79.3	76	73.1
Totals	111	100.0%	104	100.0%
e. Repairs to Electrical Wiring in the House				
1. No	45	40.5	57	54.8
2. Yes	66	59.5	47	45.2
Totals	111	100.0%	104	100.0%
f. Cumulative Score of Home Repairs				
Mean Number of Repairs	2.94		2.57	
S.D. (Standard Deviation)	1.73		1.72	
Range	0-5		0-5	

^aData from Question: Demographic #11.

Table 44. Comparison of Adopters' and Nonadopters' Attitudes Towards the Energy Situation.^a

		Respondents			
		Adopters		Nonadopters	
		Frequency	Percent	Frequency	Percent
a. Regardless of the cause, we are facing a long-term energy shortage (natural gas, gasoline & electricity).					
1.	Totally agree _b	85	76.6	71	68.3
2.	_____ _b	11	9.9	24	23.1
3.	Undecided, neutral _b	6	5.4	7	6.7
4.	_____ _b	6	5.4	1	1.0
5.	Totally disagree	3	2.7	1	1.0
Totals		111	100.0%	104	100.0%
b. The energy crisis was a "Put on" in order to raise the price of fuel.					
1.	Totally agree _b	11	10.0	13	12.6
2.	_____ _b	23	20.9	25	24.3
3.	Undecided, neutral _b	20	18.2	19	18.4
4.	_____ _b	19	17.3	24	23.3
5.	Totally disagree	37	33.6	22	21.4
Subtotals		110	100.0%	103	100.0
Missing values		1	0	1	0
Totals		111	100.0%	104	100.0%
c. There are so many conflicting stories about energy that I do not know if it is really necessary for my family to conserve or not.					
1.	Totally agree _b	10	9.2	5	4.8
2.	_____ _b	3	2.8	4	3.8
3.	Undecided, neutral _b	10	9.2	6	5.8
4.	_____ _b	19	17.4	21	20.7
5.	Totally disagree	67	61.5	67	64.9
Subtotals		109	100.0%	103	100.0%
Missing values		2	0	1	0
Totals		111	100.0%	104	100.0%
Cumulative Score of Attitudes Towards Energy		Mean Score	12.2	12.4	
		S.D. (Standard Deviation)	3.2	2.2	

^a Data from Question: Demographic #1 to #3.

^b No verbal labels were given to responses #2 and #4 on this five-point scale.

Table 45. Energy Conserving Home Improvements Made By Adopters and Nonadopters.^a

Home Improvement	Respondents			
	Adopters		Nonadopters	
	Frequency	Percent	Frequency	Percent
a. Weatherstripping or caulking windows and doors to eliminate drafts:				
0. Not applicable (new home)	2	1.8	1	1.0
1. Have done	64	58.2	50	48.1
2. Considered, plan to do	18	16.4	16	15.4
3. Considered, may do	12	10.9	20	19.2
4. Considered, will not do	5	4.5	5	4.8
5. Have not considered	9	8.2	12	11.5
Subtotals	111	100.0%	104	100.0%
Missing Values	0	0	0	0
Totals	111	100.0%	104	100.0%
b. Adding insulation to exterior walls of the house:				
0. Not applicable (new home)	5	3.7	5	4.8
1. Have done	46	42.2	19	18.3
2. Considered, plan to do	5	4.6	4	3.8
3. Considered, may do	16	15.6	17	16.3
4. Considered, will not do	21	19.3	25	24.0
5. Have not considered	16	14.7	34	32.7
Subtotals	109	100.0%	104	100.0%
Missing Values	2	0	0	0
Totals	111	100.0%	104	100.0%
c. Adding insulation to the ceiling of the house:				
0. Not applicable (new home)	4	3.7	9	8.7
1. Have done	66	61.1	53	51.0
2. Considered, plan to do	10	9.3	11	10.6
3. Considered, may do	7	6.5	11	10.6
4. Considered, will not do	9	8.3	5	4.8
5. Have not considered	12	11.1	15	14.3
Subtotals	108	100.0%	104	100.0%
Missing Values	3	0	0	0
Totals	111	100.0%	104	100.0%
d. Installing timer on heating system or furnace:				
0. Not applicable (new home)	5	4.6	4	3.8
1. Have done	32	29.6	11	10.6
2. Considered, plan to do	11	10.2	7	6.7
3. Considered, may do	20	18.5	20	19.2
4. Considered, will not do	8	7.4	6	5.8
5. Have not considered	32	29.6	56	53.8
Subtotals	108	100.0%	104	100.0%
Missing Values	3	0	0	0
Totals	111	100.0%	104	100.0%
Cumulative Score of Energy Conserving Improvements				
Mean Score	14.1		11.4	
S.D. (Standard Deviation)	4.44		4.2	
Range	0-20		0-20	

^a Data from Question: Demographic #12.

to include ones such as insulation, which conserve energy, and that such energy-conserving home improvements are not necessarily motivated by the desire to cut down energy use. However, as Table 46 indicates, adopters also report making more changes in family routine in order to conserve energy than do nonadopters. Therefore it would seem that adoption of solar equipment fits in with a pattern of energy-efficient practices and with other types of energy-efficient innovations in the home.*

Table 47 shows how the subpopulations in our sample differ on a number of conservation-related variables. The most striking finding demonstrated in this table is that solar water heating owners are much more conservation-minded and engage in more conserving acts than do the other respondents in our survey population.

Voluntary Simplicity Scores**

In recent years, a great deal of interest has been occasioned by the apparent popularity among some U.S. citizens of a philosophy of life based on a set of at least five basis values:

- Material simplicity
- Human Scale
- Self-determination
- Ecological awareness
- Personal growth (Elgin and Mitchell, 1976)

Some social observers have seen in the espousing of these and similar values the emergence of a social movement which could have profound implications for America (Lovins, 1977). Nationwide Harris polls are cited in evidence that although the

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*For further evidence of this trend, see Leonard-Barton and Rogers, 1979.

**We define Voluntary Simplicity as the degree to which an individual consciously chose a way of life intended to maximize the individual's control over his/her own life.

Table 46. A Comparison of Energy Conserving Behavior Among Adopters and Nonadopters.^a

Behavior	Respondents			
	Adopters		Nonadopters	
	Frequency	Percent	Frequency	Percent
a. Turn off the furnace pilot lights during summer months.				
1. Never	40	38.0	38	38.3
2. Occasionally	8	7.8	9	9.2
3. Usually	13	12.3	20	20.2
4. Always	44	41.9	32	32.3
Subtotals	105	100.0%	99	100.0%
Missing values	6	0	5	0
Totals	111	100.0%	104	100.0%
b. Turn the furnace thermostat down to 65° daytime, lower at night.				
1. Never	14	13.1	9	8.9
2. Occasionally	19	17.6	8	7.9
3. Usually	25	23.1	33	32.6
4. Always	50	46.2	51	50.6
Subtotals	108	100.0%	101	100.0%
Missing values	3	0	3	0
Totals	111	100.0%	104	100.0%
c. Set the air-conditioning thermostat at 78° in summer.				
1. Never	6	5.9	11	13.9
2. Occasionally	2	2.0	3	3.8
3. Usually	9	8.9	6	7.6
4. Always	13	12.9	7	8.9
5. No air-conditioning	71	70.3	52	65.8
Subtotals	101	100.0%	79	100.0%
Missing values	10	0	25	0
Totals	111	100.0%	104	100.0%
d. Cumulative Score of Energy Conserving Behavior				
	Adopters		Nonadopters	
Mean Score	6.30		5.97	
S.D. (Standard Deviation)	2.70		2.19	
Range	0-12		0-12	

^a Data from Question: Demographic #12.

Table 47. A Comparison Between Subpopulations on Conservation-related Variables.^a

Variable	Swimming Pool Owners	Water Heater Owners	Space Heater Owners	Average for All Adopters	Average for All Nonadopters	Range
1. Ecology-mindedness	4.05	7.28	6.10	5.15	4.69	0-20
2. Energy Conserving Behaviors: Both Routine and Invest	20.2	21.7	19.8	20.5	18.1	0-32
a. Changes in Routine Only	6.04	7.08	6.28	6.30	5.97	0-12
b. Investments in House Only	13.59	15.04	13.72	14.10	11.43	0-20
3. Attitudes Towards the Energy Crisis	12.0	12.9	12.8	12.6	12.4	0-15
4. Ability to Make Home Repairs	3.0	2.9	2.8	2.9	2.6	0-5

^a Data from Questions: Adopters #20, Nonadopters #12, Demographics #1-4,11,12.

numbers of people who carry these values to their most extreme behavioral extension (by cutting back on consumption of all types) are few, VS sympathizers are many (See Harris, 1977).

We are somewhat skeptical of attempts to predict peoples' behavior by asking in public polls what they value (see Rogers and Leonard-Barton, 1979b). However, we do believe that there are identifiable patterns of behavior, and that it is possible to predict likely future behavior from present action. We have therefore developed and tested on a number of populations, an index of behaviors which are characteristic of individuals who are attempting to live a whole-hearted life of VS, who want to consume little and produce much.

This index, applied to the subpopulations in the present sample, reveals interesting characteristics. As Table 48 shows, the items on the index do not discriminate well between adopters and nonadopters as a whole. However, Table 49 demonstrates clearly that there is a real difference between pool owners and non-pool owners for both adopter and nonadopter populations. Adopters of solar water heating or space systems score by far the highest on the index. That is, the purchase of solar water heating fits in with other energy conserving and "scaling-down" behaviors. People who are interested in recycling, bicycling, in gardening, etc., are prime targets for diffusion of those types of solar systems which will most affect lifestyles and nationwide energy use: water and space heating systems.

Role of the State

Both nonadopters and adopters believe that the state has a role to play in promoting solar energy, and are in fair agreement as to what that role should be (Table 50). A majority in both subpopulations ranked the provision of economic incentives as the most important role government should play; the second most important act for the state was seen to be investing in solar research. The

Table 48. A Comparison of Adopters' and Nonadopters' Scores on the Voluntary Simplicity Index.^a

VS Index Item	Adopters		Nonadopters	
	Frequencies	Percent	Frequencies	Percent
1. Recycle at least 75% of the newspapers used at home.	80	72.1	73	70.2
2. Have made a gift instead of purchasing one. ^b	69	62.2	60	57.7
3. Family has a meatless main meal one or more days a week (meat includes fish).	47	42.3	61	58.7
4. A family member or friend changes the oil in the family car.	49	44.1	50	48.1
5. Recycle at least 75% of the glass jars/bottles used in the home.	49	44.1	50	48.1
6. Make financial contributions to ecologically-oriented organizations such as Greenpeace, Sierra Club, etc. ^b	54	48.6	46	44.2
7. Recycle at least 75% of the cans used at home.	49	44.1	49	47.1
8. Have used a bicycle within the last month for exercise or recreation.	54	48.6	43	41.7
9. Have a compost pile.	48	43.2	39	37.5
10. Have bought a major piece of furniture second-hand or made one. ^b	48	43.2	37	35.6
11. Have used a bicycle within the last month for an errand.	36	32.4	37	35.6
12. Grow 15% or more of the vegetables you and your family consume during a summer season. ^b	39	35.1	31	29.8
13. Have exchanged goods or services with others in lieu of payment with money, e.g., repairing equipment in exchange for other skilled work. ^b	32	28.8	19	18.3

14. Buy a major item of furniture or clothing at a garage sale (over \$15). ^b	24	21.6	26	25.0
15. Have used a bicycle within the last month for a social visit.	21	18.9	21	20.4
16. Have taken a class to increase your self-reliance; for example, in carpentry, car tune-up and repair, or plumbing. ^b	15	13.5	25	24.0
17. Buy clothing at a second-hand store. ^b	14	12.6	20	19.2
18. Belong to a cooperative.	21	18.9	13	12.5
19. Have used a bicycle within the last month for transportation to work.	20	18.0	15	14.6

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^a Data from Question: Demographics #13.

^b The time frame for these items is "within the past year."

Table 49. Respondent Scores on Voluntary Simplicity Index.^a

Population	Frequency	Mean Score ^b
Total Sample	215	6.89
Adopters	111	6.90
Own Solar Systems for Swimming Pools	57	5.47
Own Solar Systems for Water Heating	29	9.17
Own Solar Systems for Space Heating	20	7.80
Nonadopters	104	6.88
Own Swimming Pools	7	5.43
Do Not Own Swimming Pools ^c	49	7.08
Range 0-19		

^a Data from Question: Demographic #13.

^b These means represent the average for each population scored on the composite Voluntary Simplicity index, which is built from standardized factor scores.

^c Information as to whether the nonadopters have pools or not is available for only 56% of the respondents. This question was not included in the survey, but an effort was made to obtain the information by telephone since pool owners clearly differ from other homeowners. While not all 104 nonadopters could be reached, enough were contacted to show that the same pattern of Voluntary Simplicity scores found among adopters held in the nonadopter sample for pool and non-pool owners. Also, the followup telephone interviews showed that pool owners were in the minority among the nonadopters.

Table 50. The Role of the State in Promoting Solar Equipment.

Variable	Adopters		Nonadopters	
	Frequency	Percent	Frequency	Percent
Whether or not the state government should assume a major role in promoting solar.				
No	9	8.3	12	11.8
Yes	99	91.7	90	88.2
Subtotals	108	100.0%	102	100.0%
Missing values	3		2	
Totals	111		104	
a. Economic incentives (low-interest loans, tax credit, etc.)				
1st	68	72.3%	47	60.3
2nd	15	15.9	18	23.1
3rd	7	7.5	6	7.7
4th	4	4.3	5	6.4
5th	0	0.0	2	2.5
Subtotals	94	100.0%	78	100.0%
Not applicable	5		12	
Totals	99		90	
b. Investment in solar research				
1st	13	19.5	22	34.9
2nd	27	40.8	21	33.4
3rd	14	21.2	11	17.5
4th	10	15.5	5	7.9
5th	2	3.0	4	6.3
Subtotals	66	100.0%	63	100.0%
Not applicable	33		27	
Totals	99		90	
c. Standardization of equipment				
1st	6	8.6	11	16.4
2nd	20	28.6	19	28.4
3rd	23	32.8	22	32.9
4th	17	24.2	12	17.9
5th	4	5.8	3	4.4
Subtotals	70	100.0%	67	100.0%
Not applicable	29		23	
Totals	99		90	

d. Consumer information distribution

1st	7	8.7	5	6.8
2nd	23	28.4	19	26.3
3rd	30	37.0	27	37.8
4th	16	19.7	21	29.1
5th	5	6.2	0	0.0
	<u>81</u>	<u>100.0</u>	<u>72</u>	<u>100.0</u>
Subtotals	81	100.0	72	100.0
Not applicable	18		18	
	<u>99</u>		<u>90</u>	
Totals	99		90	

e. Requiring utility companies to lease solar equipment to homeowners

1st	0	0.0	1	4.1
2nd	10	26.3	2	8.3
3rd	6	15.8	7	29.2
4th	6	15.8	4	16.7
5th	16	42.1	10	41.7
	<u>38</u>	<u>100.0%</u>	<u>24</u>	<u>100.0%</u>
Subtotals	38	100.0%	24	100.0%
Not applicable	61		66	
	<u>99</u>		<u>90</u>	
Totals	99		90	

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standardization of quality and distribution of consumer information were regarded as almost equally important, but adopters laid more stress on the consumer information, and nonadopters were slightly more inclined to see the standardization of quality as more important.

DISCUSSION AND POLICY IMPLICATIONS

The following discussion is organized according to the five research questions posed at the beginning of this report.

1. How much and what kinds of information about residential solar systems do Californians have now?

Among our sample, almost everyone had heard of using solar equipment in the home for some purpose. On average, respondents first became aware of solar energy as a heating source in the 1960's. However, that mean score includes a number of respondents who date their first awareness back to the early 1900's. Half of the adopters and of the nonadopters have become aware of solar heating equipment since 1971; the most influential period of years appears to have been those following the first "energy crunch" in 1973-1976.

The residential solar systems with which nonadopters in our sample are most familiar, are swimming pool heaters and hot water heating systems. One-fifth of these highly-educated, high-income nonadopters have never even heard of equipping homes with solar space heating systems; moreover, most of them have never seen such equipment.

It is more surprising that one-fifth of the nonadopter population sampled do not personally know anyone with solar equipment of any type, although they live only a few houses (at most) away from a solar adopter.

Most of the nonadopters say they would like to receive more information about solar equipment, and when asked to indicate in more detail what kind of information they need, our respondents tended to check all the categories offered.

Therefore, it appears from the data in this pilot study that the general populace still needs much information on the subject of solar equipment.

Since the two most-favored sources of information (friends and sellers of solar equipment) are likely to be biased, potential adopters need sources of information which they perceive as objective, e.g., a kind of consumer's guide.

2. What are the characteristics of individuals purchasing solar equipment, and do these individuals represent identifiable market segments?

We think our sample may be representative of California solar adopters who have adopted active residential solar equipment at the present time. Our adopters are wealthy (with an average annual income over \$35,000) and are well-educated (adopters had an average formal education beyond a college degree). That is not to say that all wealthy, highly-educated people will buy solar equipment. Although the nonadopters in our sample were almost equally wealthy, and averaged even more formal education than the adopters, over half of them had either decided against purchasing solar or had never considered making such a purchase.

As we emphasized previously in this report, our sample of respondents only included adopters of relatively "high-technology" active solar equipment. The characteristics of our adopters would probably be much less elite if we had studied the adopters of "low-technology" active solar equipment (as has been studied by the Solar Energy Research Institute in the San Luis Valley of Colorado) or certain types of passive solar equipment.

Looking at our sample of solar adopters as a whole, there appear to be two major motives for purchasing solar equipment: (1) economic, and (2) ecological. However, if one divides the sample according to the type of equipment purchased, it becomes clear that there are two different market segments:

1. Swimming pool owners, who are among the wealthier in our sample, are principally interested in the economics of solar, and in not having to reduce their energy use in the future. They tend to regard solar energy as insurance against the necessity of having to change their lifestyle in the future.

2. Water heater owners, in contrast, vary more in income, and are decidedly more active conservers of energy. They also are more inclined than pool owners to consider the contribution of solar equipment to lessening pollution as an important decision criterion.

For both of these market segments, installing solar equipment fits into a pattern of investing in home improvements. Solar adopters are more capable of making home repairs and therefore of installing and/or maintaining solar equipment themselves than are nonadopters.

One prime target for future diffusion of solar water heating systems would seem to be ecology-minded individuals who would purchase solar equipment as much for the common good as for personal gain. For such people, economic considerations are not paramount. They may buy solar equipment even if expected payback periods are long.

Another group of people, like our swimming pool owners, will buy solar equipment as a hedge against having to reduce their energy consumption in the future. They are motivated by both economic considerations and fear of future shortages.

Finally, do-it-yourselfers are evidently a natural market segment for solar. Working around the house is a kind of recreation for them. They derive psychic satisfaction as well as financial benefit from making their homes more energy-efficient. Solar equipment is one more home improvement.

While more home-constructed systems may mean less control over aesthetics and less standardization of equipment, it may be possible to promote more solar equipment "kits" and to provide incentives and rewards as well as detailed information for the do-it-yourselfer. Workshops and seminars by local governments and by ecological organizations might provide needed information to the individuals who want to build and/or design their own systems.

3. What are the major channels through which information about solar equipment is flowing?

Adopters and nonadopters differ in their opinions as to what sources of information about solar are useful mainly in that nonadopters cite many more sources than do adopters. Such information sources as consumer groups or the

California Energy Commission toll-free telephone number, for example, have been seldom utilized by adopters but are regarded as potentially useful by the non-adopters.

For both populations, however, the most important sources of information about solar equipment are interpersonal: Friends, and sellers of solar equipment. Since interpersonal communication from peers about an innovation is generally more important than mass media in persuading potential adopters to give the new idea "a try," the early adopter's "word-of-mouth" advertising is a powerful force in the marketplace. Moreover, early adopters like those in our sample are in a good position to give status to the purchase of the kind of solar equipment surveyed, since these early adopters are mostly highly educated professionals with incomes in the \$30,000 to \$50,000-a-year category.

We found these adopters to be highly satisfied with their equipment. They would buy again, and if circumstances warranted, would invest in even more solar equipment than they now possess. They do not find that reliance on solar equipment adversely affects their daily lives. They are therefore enthusiastic word-of-mouth advertisers for solar equipment. More than one-half of the adopters have shown their equipment to over 25 people, and at least one person has subsequently made a similar purchase himself/herself. However, most (two-thirds) of the solar equipment owners have had some problems with their equipment. Most of the problems have been minor leaks, or the freezing of their solar panels, etc., and less than 10 percent of the adopters in our sample had to pay more than \$100 themselves for repairs.

However, it is important to note that because the adopters surveyed had made the sizeable investment in solar equipment recently, their enthusiasm may partially result from post-purchase rationalization; they are unlikely to admit that they made a bad investment. As houses are passed along to new buyers, who do not bear the responsibility for the decision to install solar equipment, the

minor breakdowns experienced by two-thirds of our adopters may become major annoyances to the new owners. In our sample only four systems were "inherited" from former owners, but one of these systems was regarded as totally inadequate by the present owners who had discontinued using it.

The very interpersonal communication system which presently actively promotes solar could heavily discourage the further diffusion of solar if, as some manufacturers fear, inferior equipment comes on the market and adopters complain about it. Moreover, the post-purchase honeymoon which solar now enjoys may possibly result in part from the limited number of years (five or fewer) our solar adopters have had experience with their equipment.

The channel of information perceived as third most useful to our respondents (both adopters and nonadopters) is magazines. Respondents referred to detailed "how-to" articles in magazines like Sunset or Popular Mechanics which cater to readers who spend a lot of time, effort and money on home improvements. Besides providing detailed information on construction and maintenance, such magazines may be good channels for information about federal incentives (or, in the case of Sunset, which confines itself principally to Western readers) about state incentives and programs.

4. What are the principle barriers to, and incentives for, the adoption of solar systems?

Cost is a primary deterrent to adoption of solar, according to the respondents in our survey. Both adopters and nonadopters see expense as the primary reason why more people are not buying solar equipment, and nonadopters cited "initial cost" as the most important decision factor in considering the purchase of solar equipment.*

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*Again, the perceived high cost of solar equipment is partly a function of the type of solar systems that we studied: "High-technology," active solar equipment.

Nonadopters consider the purchase of solar equipment to be a weightier decision, expect longer payback periods for all types of solar equipment than do adopters, and about one-half of the entire sample (N=215) do not believe that they could recover the initial costs of solar equipment when they sell their home.

Many other potential barriers to adoption were not considered to be important ones by our respondents -- either adopters or nonadopters. Relatively few people felt that, for example, concern about cloudy days, the safety of the equipment, aesthetics, the possibility of difficulty in obtaining loans, the risk that neighboring structure could be built to cut off the sunlight, or that there would be difficulty in getting homeowners' insurance, were important considerations in deciding about solar equipment.

The current California state income tax credit was not an important incentive for half the adopters in our sample, yet was utilized by 86 percent. The credit may become more important as less wealthy individuals consider purchasing solar equipment, but it will only affect one segment of the population: The fairly well-to-do, who do not build and install the equipment themselves. Some of our adopters had designed and built their equipment; the tax credit was unimportant because they were not eligible under the current state regulations.

Nevertheless, the current credit was preferred by nonadopters over alternative incentives such as low-cost loans or cash rebates. Asked what if anything would persuade them to adopt solar equipment, half of the 26 nonadopters who had considered the purchase but decided against it, replied "lower costs." Evidently even the tax credit is not sufficient incentive for such nonadopters.

5. What are public attitudes toward government regulations regarding the use of solar energy?

Legislation mandating the installation of some type of solar equipment in

new homes is acceptable to a majority in our sample, with predictably greater enthusiasm among adopters than nonadopters. However, experience in the interviewing process revealed that responses to questions of mandating solar depended partly upon how the question was posed. In principle, many respondents disliked the idea of more state regulation; however, when offered specific mandating options, they tended (62 percent) to support one or more. Requiring solar systems for heated swimming pools was the most favored option; mandating water heating systems was next most popular. Requiring construction of houses for maximum passive solar utility was the option least favored, probably because, as some respondents observed, that type of legislation would be the most difficult to specify and enforce.

Since the majority of voters in the state do not own solar equipment, it is worth noting that only just over half the nonadopters favored mandating solar. Some of those who objected to such legislation felt very strongly about the subject, stating that individual freedom had been impinged upon enough. Some said that although they personally supported solar, mandated programs were an unwarranted extension of state power.

Moreover, requiring utility companies to lease solar equipment to homeowners was the most unpopular option for state involvement in the promotion of solar, especially among the nonadopters. It is clear from the answers that our respondents made to several different questions that they feel the state's most appropriate role is to provide financial incentives, even though such incentives may not be enough to motivate the purchase of solar equipment. Half of the entire sample of homeowners selected the stimulation of solar research as one of the top three (out of five) appropriate actions for the state to take.

While it must again be emphasized that these data are not based on a representative sample, it seems that our respondents tend to regard the government role as a fairly traditional one, namely the providing of funds.

In summary, it would appear from this pilot study that most adopters of active systems are "spreading the word" to their peers, and that the future diffusion of residential solar systems depends greatly upon their continued enthusiasm. Since our research was confined to residents of just three California counties, it is unwise to generalize to the whole state population. The state-wide survey will allow us to determine what most Californians think about the issues explored in this study and the questions raised by our findings.

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STANFORD UNIVERSITY

STANFORD, CALIFORNIA 94305

INSTITUTE FOR COMMUNICATION RESEARCH

Cypress Hall
Telephone: (415) 4 33

Dear

We are writing to ask you a favor. The Institute for Communication Research at Stanford University, in cooperation with the California State Energy Commission, is conducting a study about the purchase, installation and use of solar equipment. As one of a growing number of Californians who have taken the initiative to install solar devices in your home, you have special experience and knowledge. Because of this experience, your name was included in a scientifically drawn sample of approximately 100 homeowners in the greater San Francisco Bay Area.

We are asking you to consent to an interview in your home, to help us find out about your opinions and experience with solar energy. The results of the study will be used to assist the State Energy Commission in designing statewide solar energy programs.

Within the next several days, a student or faculty interviewer from Stanford will be contacting you by telephone to arrange for a mutually convenient time. For your protection the interviewer will be carrying identification when he or she comes to your home.

We know that you are very busy, but the time you give will be extremely important to the success of the study. We cannot offer you payment for your participation, but our experience with many similar surveys tells us that you will likely find the study interesting.

Any information we receive from you will be treated in strictest confidence of course, and your anonymity will be protected.

If you have any questions about the purpose or use of the information we will be asking you for, please contact the Project Coordinator, Dr. Dorothy Leonard-Barton at 497-1820 or 497-2753.

THANK YOU for your help.

Sincerely,

Everett M. Rogers
Janet M. Peck Professor of
International Communication

INSTITUTE FOR COMMUNICATION RESEARCH

Cypress Hall
Telephone: (415) 497-2753

We are writing to ask you a favor. The Institute for Communication Research at Stanford University, in cooperation with the California State Energy Commission, is conducting a study in your neighborhood about the use of solar energy. You are one of the approximately 200 homeowners in the greater San Francisco Bay Area whom we are contacting.

We are asking you to consent to an interview in your home, about your views on solar energy. Since your name was selected in a scientifically drawn sample, your opinions will represent those of thousands of other people, and are extremely important to us. The results of the study will be used to assist the State Energy Commission in designing statewide programs related to the use of solar equipment in the home.

Within the next several days, a student or faculty interviewer from Stanford will be contacting you by telephone to arrange for a mutually convenient time. For your protection, the interviewer will be carrying identification when he or she comes to your home.

We know that you are very busy, but the time you give will be extremely important to the success of the study. We cannot offer you payment for your participation, but our experience with many similar surveys tells us that you will likely find the study interesting.

Any information we receive from you will be treated in strictest confidence, of course, and your anonymity will be protected.

If you have any questions about the purpose or use of the information we will be asking you for, please contact the Project Director, Dr. Dorothy Leonard-Barton, or the Project Coordinator, Ronny Adhikarya, at 497-1820.

Thank you for your help.

Sincerely,

Everett M. Rogers
Janet M. Peck Professor of
International Communications

Appendix A-3

DIFFUSION OF SOLAR ENERGY

Institute for Communication Research

Stanford University

Everett M. Rogers, Principal Investigator

497-2753

ADOPTER'S QUESTIONNAIRE

Date of Interview: _____

Respondent's I.D.: _____

Interviewer: _____

1 2 3

1. a. What kinds of solar equipment have you purchased, installed, or plan to install and when did you install it?

IF NO SOLAR EQUIPMENT IS YET INSTALLED, USE NON-ADOPTER'S QUESTIONNAIRE.

	CONSI- DERING (have cost esti- mates) 1	ON HOUSE AT TIME OF PURCHASE 2	PURCHASED EQUIPMENT 3	INSTALLED EQUIPMENT 4	WHEN (month, year) 5	DIS- CON- TIN- UED (Write D) 5
Swimming pool heater						
Hot tub or spa heater						
Water heater (house)						
Space heater (house)						
Others (specify) _____						

4 5 6 7 8
10 11 12 13 14
16 17 18 19 20
22 23 24 25 26
28 29 30 31 32

- b. How much did your solar equipment cost (before tax credit)?
- c. If you have a back-up energy system for your solar equipment, what type is it (gas, electricity, or other)?
- d. What material is being circulated through the collector, i.e., water, air, or a chemical?

*INTERVIEWER: MARK THE SPACE A FOR AIR, W FOR WATER, OR C FOR CHEMICAL.

- e. How many storage tanks are on the system?
- f. How many gallons of water does each tank hold?

INTERVIEWER: NOTE THE GALLONS FOR EACH, SEPARATED BY COMMAS, E.G., 40,80,120.

	COST (before tax credit)	BACK-UP SYSTEM E=electric G=gas O=other	COL- LEC- TOR FLUID*	# OF TANKS	SIZE OF TANKS
Swimming pool heater					
Hot tub or spa heater					
Water heater (house)					
Space heater (house)					
Others (specify) _____					

34 35 36 37 38 39 40 41 42 43 44 4
46 47 48 49 50 51 52 53 54 55 56 5
58 59 60 61 62 63 64 65 66 67 68 6
70 71 72 73 74 75 1 2 3 4 5 6
7 8 9 10 11 12 13 14 15 16 17 1

2. Was a building permit obtained for the installation of the solar equipment?

19

1 No

2 Do not know

3 Yes,
obtained by
homeowner

4 Yes,
obtained by
contractor
(solar company
or installer)

IF YES:

Were there any problems in obtaining the permit?

1 No

2 Yes

20

IF YES:

What were the problems?

21

3. Do you believe that some type of solar heating system should be legally required in all new home construction?

1 No

2 Yes

22

IF YES:

What type of equipment should be required? (CHECK ALL THOSE THAT APPLY.)

       Required architectural designs which take advantage of the heat from sunlight (passive solar).

23

       Required solar equipment installed to heat swimming pools at an additional cost of about \$1,100-\$2,000 per pool.

24

       Required solar equipment installed to heat domestic water systems (in the house), at an additional cost of \$1,500-\$2,000 per house.

25

       Other (please specify)

26

I.D. _____

4. Are you aware of the California tax credit regarding the purchase of solar equipment for the home?

1 No   Yes

27

IF YES:

- a. How familiar are you with the way the tax credit works?

2 Not at all (have only heard of it)

3 Somewhat (am unfamiliar/confused about the details)

4 Quite familiar (could explain how it works to others)

- b. How important was the tax credit in your decision to buy solar equipment for your home?

1 Not at all 2 Somewhat 3 Very

28

- c. Did you apply for and receive the tax credit for your equipment?

1 No 2 Yes

29

IF YES:

- d. How many years total will or did you request tax credit on the solar equipment which you have installed (EQUIPMENT ALREADY IN PLACE).

           years

30 31

5. Did you obtain a bank loan to finance the solar equipment?

1 No   Yes

32

IF YES:

Did you have any difficulties with financing?

2 No 3 Yes

33

IF YES:

Could you describe those difficulties for me?

34

I.D.

6. THIS QUESTION APPLIES ONLY TO SOLAR INSTALLATIONS WITH BACK-UP SYSTEMS:

-105-

- a. Do you think that your solar equipment will eventually pay for itself in savings on utility bills?

1 No   2 Don't know   3 Yes, all types   4 Yes, some types

35

IF NO OR DON'T KNOW, GO TO QUESTION b.

IF YES, OR YES, FOR SOME:

How many years will that payback take?
(Indicate the number of years for each
type which you believe will pay for
itself in savings.)

YEARS

Swimming pool heater

_____

36

37

Hot tub or spa heater

_____

38

39

Water heater (house)

_____

40

41

Space heater (house)

_____

42

43

Other (specify)

_____

44

45

IF NO OR DON'T KNOW:

- b. How much additional monthly cost (assuming your equipment will NEVER pay for itself), are you willing to pay for the use of the solar equipment? Please give answer in the form of percent above present monthly utility bills.

	None	Up to 10%	11 - 20%	21 - 30%	Over 30%
Swimming pool heater					
Hot tub or spa					
Water heater					
Space heater					
Other (specify)					

46

47

48

49

50

I.D. _____

7. If you had it to do all over again, would you still purchase solar equipment?

51

1 No 2 Yes

8. If you move to a different house that is not equipped with a solar installation, do you think you will add solar equipment?

52

1 No 2 Yes

IF YES:

What kinds of equipment would you install? (CHECK ALL WHICH APPLY.)

<u> </u> Swimming pool heater	<u> </u> 53
<u> </u> Hot tub or spa heater	<u> </u> 54
<u> </u> Water heater (house)	<u> </u> 55
<u> </u> Space heater (house)	<u> </u> 56
<u> </u> Other (specify)	<u> </u> 57

_____
_____

I.D. _____

7. If you had it to do all over again, would you still purchase solar equipment?

1 No 2 Yes

51

8. If you move to a different house that is not equipped with a solar installation, do you think you will add solar equipment?

1 No 2 Yes

52

IF YES:

What kinds of equipment would you install? (CHECK ALL WHICH APPLY.)

<u> </u> Swimming pool heater	<u> </u> 53
<u> </u> Hot tub or spa heater	<u> </u> 54
<u> </u> Water heater (house)	<u> </u> 55
<u> </u> Space heater (house)	<u> </u> 56
<u> </u> Other (specify)	<u> </u> 57

_____
_____

I.D. _____

58

What types of solar equipment would you have built in?

_____Swimming pool heater	_____59
_____Hot tub or spa heater	_____60
_____Water heater (house)	_____61
_____Space heater (house)	_____62
_____Other (specify)	_____63

64

IF YES:

What were the problems? (e.g., breakdowns, leaks)

65

How were the problems solved?

_____ not solved (equipment left in disrepair) _____ 66
1
_____ equipment replaced
2
_____ equipment repaired
3
_____ other (please specify) _____
4

I.D. _____

10. continued...

IF REPAIRED OR REPLACED:

By whom?

- friends
  1
         self/spouse
  2
         solar company
  3
         other (please specify)
  4
_____

67

How were the costs involved covered?

- warrantees
         insurance
         self
         other (specify)
_____

68

69

70

71

What percent of the total costs involved did you pay yourself?

         %

72 73

How much money was that? \$ _____

74 75 76 77

I.D.

78 79 80

I.D. _____

11. Does using solar equipment in your home affect your daily habits (e.g., timing of hot water use, use of swimming pool later in the season, etc.)

1 No 2 Yes

1

IF YES:

Please describe the changes in routine the solar equipment causes. (WRITE RESPONSES IN DETAIL.)

2

---

12. How much time elapsed between when you first seriously considered using solar equipment in your home and when you had it installed?

3

1 less than 6 months
2 6 months to 1 year
3 1-2 years
4 3-4 years
5 5-6 years
6 more than 6 years

13. Some people design, build or install solar equipment themselves. Please tell us, for your fully installed equipment, which tasks you performed yourself, or with friends. (NOTE: THIS QUESTION APPLIES ONLY TO THE EQUIPMENT IN PLACE: IF RESPONDENT HAS DONE ANY WORK ON ANY OF THE INSTALLED EQUIPMENT, MARK THE APPROPRIATE SPACE.)

	By self or with friends	Solar firm did	
Design	<u>1</u>	<u>2</u>	<u>4</u>
Built equipment	<u>1</u>	<u>2</u>	<u>5</u>
Installed	<u>1</u>	<u>2</u>	<u>6</u>

I.D. _____

14. GET OUT "INFORMATION CARDS"

Here is a stack of cards, each listing one possible source of information about solar energy. I would like you to separate these cards into two piles: one with sources of information which you learned about solar energy from, and the other with sources of information you did not use.

WHEN RESPONDENT HAS SORTED CARDS, TAKE AWAY CARDS HE/SHE "DID NOT USE."

Now would you please show me which five of these information sources you used were the most useful to you, and rank order them, so that the most useful source is on top, the second most useful second, and so on.

WHEN RESPONDENT HAS FINISHED RANKING, TAKE RANKED CARDS AND DOUBLE CHECK TO MAKE SURE YOU KNOW WHICH CARD IS #1 AND WHICH IS #5. THEN HAND RESPONDENT ATTITUDES QUESTIONNAIRE.

Thank you very much. Now I'd appreciate your filling out PART ONE of this questionnaire on your attitudes about energy issues.

WHILE RESPONDENT FILLS OUT QUESTIONNAIRE, FILL IN HIS CARD RANKINGS BELOW: MARK THE TOP FIVE (1-5) WITH NUMBERS; PLACE AN "X" BESIDE ALL OTHER INFORMATION SOURCES WHICH WERE USED.

RANK

___ a. Sellers of solar equipment	___ 7
___ b. Utility companies	___ 8
___ c. Alternative technology groups	___ 9
___ d. Friends or neighbors	___ 10
___ e. Consumer groups	___ 11
___ f. Demonstration buildings	___ 12
___ g. Textbooks	___ 13
___ h. Magazines	___ 14
___ i. Newspapers	___ 15
___ j. State Energy Commission Toll-Free Telephone Number	___ 16
___ k. Radio	___ 17
___ l. T.V.	___ 18
___ m. Seminars/workshops	___ 19
___ n. Energy fairs	___ 20
___ o. Other (specify)	___ 21

I.D. _____

15. How many square feet of collectors (TOTAL) do you have?

_____ square feet

22 23 24

INTERVIEWER: MOST SOLAR PANELS ARE 4 x 8, OR 32 SQUARE FEET EACH; IF THE RESPONDENT DOES NOT KNOW THE SQUARE FOOTAGE, ASK THE NUMBER OF PANELS AND COMPUTE.

16. Where or from whom did you first learn that it is possible to heat with solar energy?

25

_____
_____

When was that? (YEAR) _____

26 27

17. a. To how many people have you shown your solar equipment?

b. To how many people have you recommended buying solar equipment?

c. How many of these people (EITHER CATEGORY) have bought solar equipment for their homes?

NUMBER OF PEOPLE

	None	1-5	6-10	11-15	16-20	21-25	More than 25
SHOWN TO							
RECOMMENDED TO							
BOUGHT AFTER YOU SHOWED/RECOMMENDED							

28

29

30

18. Would you say your neighbors give you more compliments or complaints about your solar equipment, or do they not comment about it?

1 More compliments 2 More complaints 3 No comment

31

I.D. _____

19. Do you expect that the addition of solar equipment will raise, lower or not affect the resale value of your house?

1 Not affect   2 Lower   Raise

32

IF RAISE:

As much as the price of the equipment?

3 No   4 Yes

20. TAKE OUT "DECISION" CARDS

I would like to ask you again to sort some cards into two piles. Please include in one pile the factors that entered your decision to buy solar equipment, and put the factors that you did not consider into the other pile.

WHEN RESPONDENT HAS SORTED CARDS, TAKE AWAY THE PILE HE/SHE "DID NOT USE."

Thank you. Now I would like you to place the five factors that are most important to your decision in order of their importance, with the most important on top, the second most important second, etc.

WHEN RESPONDENT HAS FINISHED RANKING, TAKE RANKED CARDS, AND DOUBLE CHECK TO MAKE SURE THE MOST IMPORTANT IS ON TOP. THEN TELL RESPONDENT TO PROCEED WITH PART TWO OF THE QUESTIONNAIRE.

Thank you very much. Now if you would fill out PART TWO of this questionnaire, we will be all through.

WHILE RESPONDENT FILLS OUT QUESTIONNAIRE, FILL IN HIS/HER CARD RANKINGS BELOW: (MARK THE TOP FIVE, 1-5, WITH NUMBERS; PLACE AN "X" BESIDE ALL OTHER SOURCES WHICH WERE USED).

<u> </u> a.. Initial cost of solar equipment	<u>33</u>
<u> </u> b. Possible increase in resale value of house	<u>34</u>
<u> </u> c. Cost and difficulty of getting solar equipment covered by homeowner's insurance	<u>35</u>
<u> </u> d. Possible increase in property tax assessment due to installation of solar equipment	<u>36</u>
<u> </u> e. Not having to pay monthly energy bills	<u>37</u>

I.D. _____

20. continued...

___ f.	Not being forced to reduce energy consumption in the future	___ 38
___ g.	Possibility of running out of solar energy on long stretches of cloudy days	___ 39
___ h.	Effects of solar panels on attractiveness of house	___ 40
___ i.	Safety of solar equipment	___ 41
___ j.	Operating reliability of solar equipment	___ 42
___ k.	Possible damage to solar panels from dirt, vandalism, storms, or corrosion	___ 43
___ l.	Reliability of solar firms and suppliers	___ 44
___ m.	Expense of maintaining solar equipment	___ 45
___ n.	Lessening harmful effects on the environment (e.g., less pollution)	___ 46
___ o.	The contribution of solar to easing the energy shortage	___ 47
___ p.	The possibility that neighboring structures might be built which cut off sunlight to the solar panels	___ 48
___ q.	Risk that solar equipment now on the market will soon be obsolete, and better equipment will then be available	___ 49
___ r.	Risk that the price of solar equipment would drop after yours was installed	___ 50
___ s.	Problems of obtaining a home loan to finance the solar equipment	___ 51
___ t.	Warranty coverage for the solar equipment	___ 52
___ u.	The possibility that the installer may go out of business.	___ 53

21. In your opinion, why aren't more people buying solar equipment for their homes?

54

22. What or who ^{convinced} motivated you to install your solar system? (PROBE FOR MOST IMPORTANT INFLUENCE ON DECISION: e.g., A PERSONAL CONTACT, EXPERIENCE WITH SHORTAGES, ETC. RECORD ANSWER NEXT PAGE, "ADDITIONAL NOTES.")

Respondent I.D.

EW

Interviewer I.D.

55	56	57
58	59	

MAP OF NEIGHBORHOOD

NAMES & ADDRESSES OF NEIGHBORS

ADDITIONAL NOTES

DIFFUSION OF SOLAR ENERGY
Institute for Communication Research
Stanford University
Everett M. Rogers, Principal Investigator
497-2753

NON-ADOPTER'S QUESTIONNAIRE

Respondent I.D.

1 2 3

Name of Interviewer _____

Date of Interview _____

1. Where or from whom did you first learn that it is possible to heat with solar energy?

4

_____
_____
_____

How many years ago was that? _____ years

5 6

2.

	Swimming pool heater	Hot tub or spa heater	Water heater	Space heater	Other (specify)
a. What kinds of solar equipment for the home have you heard of? (CHECK ALL NAMED.)					
b. Which of the following kinds of solar equipment have you seen in a home or being used (e.g., in a friend's house, in a demonstration building).					
c. Was the solar equipment you saw installed for demonstration purposes? (Refer to the equipment named in b.) (NO = 1; YES = 2)					

7 8 9 10 11

12 13 14 15 16

17 18 19 20 21

3. How many people do you know personally (friends, neighbors, relatives) who are using solar equipment in their homes?

_____ people

22 23

IF ANSWER IS ZERO, GO TO QUESTION 4., NEXT PAGE.

- a. Are most of them, in your opinion:

_____ Satisfied with the solar equipment.

1

_____ Dissatisfied with the solar equipment.

2

24

- b. Have you heard of any difficulties these people have had with their equipment?

_____ No _____ Yes

1

IF YES:

What? _____

25

- c. Have you seen their equipment and how it works?

_____ No _____ Yes

1

IF YES:

At whose initiative?

_____ Theirs

2

_____ Yours

3

26

Have they recommended that you buy solar equipment?

_____ No _____ Yes

1

2

27

- d. Do you know the name(s) and address(es) of these solar equipment owners?

_____
_____
_____

I.D. _____

4. Are you aware of the California tax credit for the purchase of solar equipment for the home?

1 No   Yes

28

IF YES:

- a. How familiar are you with the way the tax credit works?

     Not at all (have heard of it only)
2

     Somewhat (am unfamiliar/confused about the details)
3

     Quite familiar (could explain how it works to others)
4

- b. How important would the tax credit be in your decision to buy solar equipment for your home?

1 Not at all 2 Somewhat 3 Very

29

5. Approximately how much do you think a good quality solar water heating system (manufactured and installed by a solar company) would cost for your house?

1 \$500 - \$1,499

2 \$1,500 - \$2,499

3 \$2,500 - \$3,499

4 \$3,500 - \$4,499

5 More than \$5,000

6 Don't know

30

6. What is your present attitude toward installing solar equipment in your home?

1 Have considered, and will not install (GO TO A)

4 Definitely plan to install (i.e., have obtained cost estimates and/or equipment) (GO TO D)

2 Have not considered (GO TO C AND D)

3 May install (GO TO B, C AND D)

31

I.D. _____

6. continued...

A. IF HAVE CONSIDERED BUT WILL NOT INSTALL:

a. Why did you decide against installation?

32

b. What, if anything, would persuade you to install solar equipment?

33

B. IF MAY INSTALL: (CHECK ALL WHICH APPLY)

Why have you not made definite plans to install?

       Awaiting further information about solar equipment 34

       Awaiting more money 35

       Waiting to see if there are further shortages in energy 36

       Waiting to see if the equipment works for others 37

       Waiting for the price to come down 38

       Other (specify) 39

I.D. _____

6. continued...

C. IF MAY INSTALL OR HAVE NOT CONSIDERED:

There are a number of alternative means by which the government could provide financial assistance to people purchasing solar equipment. Which one of the following alternatives would you consider to be best? (SHOW GOVERNMENT ASSISTANCE CARD.)

1 A 55% tax credit which the individual could start claiming the year the equipment was installed.

2 A direct government rebate of 25% of the total price to purchasers within 3 months of purchase.

3 A low-interest loan of 6% over 15 years (\$21 monthly), as compared to \$30/month on a standard 12% loan.

4 Prefer no government assistance.

40

D. IF DEFINITELY PLAN, MAY OR HAVE NOT CONSIDERED:

Assume that you are considering installing a solar water heating system in your home which would cost a total of \$2,500, installed. Would you prefer to:

1 Buy and maintain your own equipment
or

2 Rent the equipment (with service included)

41

IF BUY:

Would you prefer to:

1 Pay cash

2 Finance through a loan

42

IF RENT:

Would you prefer to rent from a:

1 Utility company

2 Private company

43

I.D. _____

NOTE TO INTERVIEWER: IF RESPONDENT HAS NOT CONSIDERED PURCHASING SOLAR EQUIPMENT, USE PARAGRAPH A FOR QUESTION 7. OTHERWISE, USE PARAGRAPH B.

7. GET OUT "INFORMATION" CARDS

- A. Here is a stack of cards, each listing one possible source of information about solar energy. I would like you to separate these cards into two piles: those sources you would go to for information and those you would not go to.

WHEN RESPONDENT HAS SORTED CARDS, TAKE AWAY CARDS HE/SHE "WOULD NOT GO TO."

Now would you please select the five of these information sources which are potentially the most useful to you and rank order them according to their importance to you as potential sources of information.

- B. Here is a stack of cards, each listing one possible source of information about solar energy. I would like you to separate these cards into two piles: one with sources of information which you learned about solar energy from, and the other with sources of information you did not use.

WHEN RESPONDENT HAS SORTED CARDS, TAKE AWAY CARDS HE/SHE "DID NOT USE."

Now would you please show me which five of these information sources you used were the most useful to you, and rank order them, so that the most useful source is on top, the second most useful second, and so on.

THE REMAINDER OF QUESTION 7 APPLIES TO ALL RESPONDENTS.

WHEN RESPONDENT HAS FINISHED RANKING, TAKE RANKED CARDS AND DOUBLE CHECK TO MAKE SURE YOU KNOW WHICH CARD IS #1 AND WHICH IS #5. THEN HAND RESPONDENT ATTITUDES QUESTIONNAIRE.

Thank you very much. Now I'd appreciate your filling out PART ONE of this questionnaire on your attitudes about energy issues.

WHILE RESPONDENT FILLS OUT QUESTIONNAIRE, FILL IN HIS CARD RANKINGS BELOW: MARK THE TOP FIVE (1-5) WITH NUMBERS; PLACE AN "X" BESIDE ALL OTHER INFORMATION SOURCES WHICH WERE USED.

I.D. _____

7. continued...

RANK

a. <u> </u> Sellers of solar equipment	<u> </u> 44
b. <u> </u> Utility companies	<u> </u> 45
c. <u> </u> Alternative technology groups	<u> </u> 46
d. <u> </u> Friends or neighbors	<u> </u> 47
e. <u> </u> Consumer groups	<u> </u> 48
f. <u> </u> Demonstration buildings	<u> </u> 49
g. <u> </u> Textbooks	<u> </u> 50
h. <u> </u> Magazines	<u> </u> 51
i. <u> </u> Newspapers	<u> </u> 52
j. <u> </u> State Energy Commission Toll-Free Telephone Number	<u> </u> 53
k. <u> </u> Radio	<u> </u> 54
l. <u> </u> Television	<u> </u> 55
m. <u> </u> Seminars/workshops	<u> </u> 56
n. <u> </u> Energy fairs	<u> </u> 57
o. <u> </u> Other (specify)	<u> </u> 58

_____

_____

8. Would you like to get more information regarding solar equipment?

       59

       No   Yes

       1   2

IF YES:

Information about

<u> </u> General (how to use it, what it does, etc.)	<u> </u> 60
<u> </u> Cost	<u> </u> 61
<u> </u> Installation	<u> </u> 62
<u> </u> Maintenance	<u> </u> 63
<u> </u> Other (specify) _____	<u> </u> 64

I.D. _____

9. Do you think that the addition of solar equipment would raise, lower or not affect the resale value of your house?

65

1 Not affect   2 Lower   Raise

IF RAISE:

As much as the price of the equipment?

    No   4 Yes
3

10. a. Do you think that solar equipment will eventually pay for itself in savings on utility bills?

1 No   2 Don't know   3 Yes, all types   4 Yes, some types

66

IF NO OR DON'T KNOW, GO TO QUESTION b, NEXT PAGE.

IF YES OR YES, FOR SOME:

How many years will that payback take?
(Indicate the number of years for each
type which you believe will pay for it-
self in savings.)

	YEARS	
Swimming pool heater	<u> </u>	<u>67</u> <u>68</u>
Hot tub or spa heater	<u> </u>	<u>69</u> <u>70</u>
Water heater (house)	<u> </u>	<u>71</u> <u>72</u>
Space heater (house)	<u> </u>	<u>73</u> <u>74</u>
Other (specify)	<u> </u>	<u>75</u> <u>76</u>

I.D.

10. continued...

IF NO OR DON'T KNOW:

- b. How much additional monthly cost (assuming the equipment would never pay for itself in savings) would you be willing to pay for the use of solar equipment? Please give answer in the form of percent above present monthly utility bills.

	None 1	Up to 10% 2	11 - 20% 3	21 - 30% 4	Over 30% 5
Swimming pool heater					
Hot tub or spa heater					
Water heater					
Space heater					
Other (specify) _____					

____ 1
____ 2
____ 3
____ 4
____ 5

11. Do you believe that some type of solar heating systems should be legally required in all new home construction?

No Yes
____ 2

____ 6

IF YES:

What type of equipment should be required? (CHECK ALL THOSE THAT APPLY.)

____ Required architectural designs which take advantage of the heat from sunlight (passive solar).

____ 7

____ Required solar equipment installed to heat swimming pools, at an additional cost of about \$1,100-\$2,000.

____ 8

____ Required solar equipment installed to heat domestic water systems at an additional cost of about \$1,500-\$2,000 per house.

____ 9

____ Other (please specify)

____ 10

I.D. _____

12. TAKE OUT "DECISION" CARDS

I would like to ask you again to sort some cards into two piles. Please include in one pile the factors that would enter your decision to buy solar equipment, and put the factors that would not be considered into the other pile.

WHEN RESPONDENT HAS SORTED CARDS, TAKE AWAY THE PILE HE/SHE "DID NOT USE."

Thank you. Now I would like you to place the five factors that are most important to your decision in order of their importance, with the most important on top, the second most important second, etc.

WHEN RESPONDENT HAS FINISHED RANKING, TAKE RANKED CARDS, AND DOUBLE CHECK TO MAKE SURE THE MOST IMPORTANT IS ON TOP. THEN TELL RESPONDENT TO PROCEED WITH PART TWO OF THE QUESTIONNAIRE.

Thank you very much. Now if you would fill out PART TWO of the questionnaire, we will be just about through.

WHILE RESPONDENT FILLS OUT QUESTIONNAIRE, FILL IN HIS/HER CARD RANKINGS BELOW: MARK THE TOP 5 (1-5) WITH NUMBERS; PLACE AN "X" BESIDE ALL OTHER SOURCES WHICH WERE USED.

RANK

___a. Initial cost of solar equipment	___11
___b. Possible increase in resale value of house	___12
___c. Cost and difficulty of getting solar equipment covered by homeowner's insurance	___13
___d. Possible increase in property tax assessment due to installation of solar equipment	___14
___e. Not having to pay monthly energy bills	___15
___f. Not being forced to reduce energy consumption in the future	___16
___g. Possibility of running out of solar energy on long stretches of cloudy days	___17
___h. Effects of solar panels on attractiveness of house	___18
___i. Safety of solar equipment	___19
___j. Operating reliability of solar equipment	___20

I.D. _____

12. continued...

- ____ k. Possible damage to solar panels from dirt, vandalism, storms, or corrosion ____ 21
- ____ l. Reliability of solar firms and suppliers ____ 22
- ____ m. Expense of maintaining solar equipment ____ 23
- ____ n. Lessening harmful effects on the environment (less pollution) ____ 24
- ____ o. The contribution of solar to easing the energy shortage ____ 25
- ____ p. The possibility that neighboring structures might be built which cut off sunlight to the solar panels ____ 26
- ____ q. Risk that solar equipment now on the market will soon be obsolete, and better equipment will then be available ____ 27
- ____ r. Risk that the price of solar equipment would drop after yours was installed ____ 28
- ____ s. Problems of obtaining a home loan to finance the solar equipment ____ 29
- ____ t. Warranty coverage for the solar equipment ____ 30
- ____ u. Possibility that installer may go out of business ____ 31

13. In your opinion, why aren't more people buying solar equipment for their homes?

____ 32

INTERVIEWER: MAKE ADDITIONAL NOTES ABOUT THE INTERVIEW ON PAGE 12.

Respondent I.D.

____ 33 ____ 34 ____ 35

Interviewer I.D.

____ 36 ____ 37

ADDITIONAL NOTES:

Appendix A-5

DIFFUSION OF SOLAR ENERGY

INSTITUTE FOR COMMUNICATION RESEARCH

STANFORD UNIVERSITY

Everett M. Rogers, Principal Investigator

497-2753

Demographics

PART I

PLEASE INDICATE YOUR OPINION ABOUT THE FOLLOWING TWO STATEMENTS BY CHECKING THE APPROPRIATE SPACE.

1. Regardless of the cause, we are facing a long-term energy shortage (natural gas, gasoline and electricity).

4

: ————— : ————— : ————— : ————— : —————
 1 2 3 4 5
 Totally Undecided
 Agree or Neutral Totally
 Disagree

2. The energy crisis was a "put on" in order to raise the price of fuel.

5

: ————— : ————— : ————— : ————— : —————
 1 2 3 4 5
 Totally Undecided
 Agree or Neutral Totally
 Disagree

3. There are so many conflicting stories about energy that I do not know if it is really necessary for my family to conserve or not.

6

: ————— : ————— : ————— : ————— : —————
 1 2 3 4 5
 Totally Undecided
 Agree of Neutral Totally
 Disagree

4. Please check the phrase below which best completes the following sentence:

"Installing solar equipment is a statement of _____."

7

1 a. commitment to help the world get through a serious energy problem.

2 b. intention to simplify one's lifestyle.

3 c. interest in innovative technology.

4 d. independence from utility companies.

5 e. commitment to protect your environment against pollution.

6 f. other (specify) _____

5. How much thought goes into a decision on buying solar equipment?

:	:	:	:	:	:	8
1	2	3	4	5		
As much as buying a major appli- ance		As much as buying a car		As much as buying a house		

6. Should the state government assume a major role in promoting solar equipment?

No	Yes
1	2

IF YES:

a. What should that role be? Place a check to the left of each option selected, then rank the items in order of their importance.

	<u>RANK</u>	
☐ Economic incentives (low-interest loans, tax credits, etc.)	_____	10
☐ Investment in solar research	_____	11
☐ Standardization of quality	_____	12
☐ Consumer information distribution	_____	13
☐ Requiring utility companies to lease solar equipment to homeowners	_____	14
☐ Other (specify)	_____	15
_____		
_____		

I.D. _____

7. Over the next five years, do you feel that the cost of gas and electricity will: (CHECK ONE)

16

1	2	
Decrease	Stay about the same	Increase

IF INCREASE:

How much would the total increase be by the fifth year?

3	4	5	6	7
10% or less	11-25%	26-50%	51-100%	More than 100%

8. Please check any of the following home improvements you have made in the last 5 years.

____ roofing

17

____ paving or the addition of a patio

18

____ installing a sauna, hot tub, or swimming pool

19

____ adding one or more rooms to a house

20

____ completely remodeling one or more rooms

21

9. Approximately how much money do you budget annually for home improvements?

22

1	2	3	4	5
\$0-\$500	\$501-\$1,000	\$1,001-\$1,500	\$1,501-\$2,000	More than \$2,000

I.D. _____

10. Which, if any, of the following investments have you made during the past two years? (CHECK ALL WHICH APPLY)

_____stocks, bonds, securities

23

_____real estate

24

_____home improvements to increase resale value of home

25

_____other; (please specify)_____

26

11. Please check the boxes below for repairs that you make yourself (or that someone else in the household makes).

_____automobile tuneups

27

_____repairs on major appliances (television, refrigerator, washing machine, for example)

28

_____repairs on minor appliances (toaster, lamps, blender, for example)

29

_____plumbing repairs (e.g., replace faucets; install garbage disposal)

30

_____repairs to the electrical wiring in the house

31

12. Please indicate which word best describes your family's routine by checking the appropriate blank.

32

- a. Turn off the furnace pilot lights during summer months.

: _____ : _____ : _____ : _____ :
 1 2 3 4
 Never Occasionally Usually Always

- b. Turn the furnace thermostat down to 65° daytime, lower at night.

33

: _____ : _____ : _____ : _____ :
 1 2 3 4
 Never Occasionally Usually Always

- c. Set the air-conditioning thermostat above 78° in summer months.

34

: _____ : _____ : _____ : _____ :
 1 2 3 4
 Never Occasionally Usually Always

I.D. _____

12. continued...

Next, we would like to know about some home improvements which would need to be made no more than once a year. Could you tell me please which of these you have considered doing, and whether you have done them, plan to do them, or do not plan to do them.

d. Weatherstripping or caulking windows and doors to eliminate drafts.

:	:	:	:	:	:
1	2	3	4	5	
Have done	Considered, plan to do	Considered, may do	Considered, will not do	Have not considered	

35

e. Adding insulation to exterior walls of the house.

:	:	:	:	:	:
1	2	3	4	5	
Have done	Considered, plan to do	Considered, may do	Considered, will not do	Have not considered	

36

f. Adding insulation to the ceiling of the house.

:	:	:	:	:	:
1	2	3	4	5	
Have done	Considered, plan to do	Considered, may do	Considered, will not do	Have not considered	

37

g. Installing timer on heating system or furnace.

:	:	:	:	:	:
1	2	3	4	5	
Have done	Considered, plan to do	Considered, may do	Considered, will not do	Have not considered	

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*PLEASE STOP HERE: INTERVIEWER WILL TELL YOU WHEN TO PROCEED:

I.D. _____

13. Please tell me which of the following apply to you OR your spouse within the past 12 months. (CHECK THOSE ITEMS THAT APPLY.)

- ☐ Shop for clothes or household items as a leisure activity. 39
- ☐ Watch at least one hour of TV per day. 40
- ☐ Have made a gift instead of purchasing one. 41
- ☐ Have bought a major piece of furniture second-hand or made one. 42
- ☐ Family has a meatless main meal one or more days a week (meat includes fish). 43
- ☐ Have a compost pile. 44
- ☐ Have and use a dishwasher. 45
- ☐ A family member or friend changes the oil in the family car. 46
- ☐ Recycle at least 75% of the newspapers used at home. 47
- ☐ Recycle at least 75% of the glass jars/bottles used in my home. 48
- ☐ Recycle at least 75% of the cans used in my home. 49
- ☐ Buy clothing at a second-hand store. 50
- ☐ Buy a major item of furniture or clothing at a garage sale (over \$15). 51
- ☐ Grow 15% or more of the vegetables you and your family consume during a summer season. 52
- ☐ Belong to a cooperative organization such as a food co-op or car-repair co-op, in which you are required to provide some of the labor. 53
- ☐ Have taken a class to increase your self-reliance; for example, in carpentry, car tune-up and repair, or plumbing. 54
- ☐ Make financial contributions to ecologically-oriented organizations such as Greenpeace, Sierra Club, etc. 55
- ☐ Have gone backpacking, hiking or bicycling as one of the last three major family vacations. 56
- ☐ Have exchanged goods or services with others in lieu of payment with money, e.g., repairing equipment in exchange for other skilled work. 57

I.D. _____

13. continued...

Have used a bicycle within the last month:

_____ for a social visit	_____ 58
_____ for an errand	_____ 59
_____ for exercise or recreation	_____ 60
_____ for transportation to work	_____ 61

14. When was your house built? (YEAR) _____

_____ 62 _____ 63

15. How large is your house?

Square feet _____

Number of bedrooms _____

Number of bathrooms _____

_____ 64	_____ 65	_____ 66	_____ 67
_____ 68			
_____ 69			

16. How long have you lived at this address? _____ years

_____ 70 _____ 71

17. How likely is it that you will move within the next three years? (CHECK THE APPROPRIATE SPACE.)

_____ Not at all likely

_____ 1

_____ Possible

_____ 2

_____ Likely

_____ 3

_____ Very likely

_____ 4

_____ 72

18. What is your occupation? _____

_____ 73

19. What is your spouse's/housemate's occupation?

_____

_____ 74

I.D. _____

20. How much did you pay last month for gas and electricity? (DO NOT INCLUDE WATER.)

\$ _____

RESPONDENT I.D.

75 76 77

1 2 3

21. We would like to know a little about your household; the number of people who live here, and their ages. Please start with yourself, and indicate the other permanent members of the household.

	SEX	AGE			
YOU YOURSELF	_____	_____	_____	4	_____
SPOUSE/HOUSEMATE	_____	_____	_____	5	_____
CHILDREN*	_____	_____	_____	6	_____
	_____	_____	_____	7	_____
	_____	_____	_____	8	_____
	_____	_____	_____	9	_____
	_____	_____	_____	10	_____
	_____	_____	_____	11	_____
	_____	_____	_____	12	_____
	_____	_____	_____	13	_____
	_____	_____	_____	14	_____
	_____	_____	_____	15	_____
	_____	_____	_____	16	_____
	_____	_____	_____	17	_____
	_____	_____	_____	18	_____
	_____	_____	_____	19	_____
	_____	_____	_____	20	_____
	_____	_____	_____	21	_____
	_____	_____	_____	22	_____
	_____	_____	_____	23	_____
	_____	_____	_____	24	_____
	_____	_____	_____	25	_____
	_____	_____	_____	26	_____
OTHER ADULTS	_____	_____	_____	27	_____
living in the house	_____	_____	_____	28	_____
	_____	_____	_____	29	_____
	_____	_____	_____	30	_____
	_____	_____	_____	31	_____
	_____	_____	_____	32	_____
	_____	_____	_____	33	_____

*INCLUDE ALL CHILDREN LIVING AT HOME, REGARDLESS OF AGE.

22. Which category best represents your total household annual income before taxes (please include your spouse's/housemate's income). (WE NEED THESE STATISTICS TO ANALYZE OUR COMBINED DATA; YOUR INDIVIDUAL ANSWER WILL BE KEPT CONFIDENTIAL.)

<u>1</u> \$5,000 or less	<u>5</u> \$25,001 - \$35,000	<u>34</u>
<u>2</u> \$5,001 - \$10,000	<u>6</u> \$35,001 - \$50,000	
<u>3</u> \$10,001 - \$15,000	<u>7</u> Over \$50,000	
<u>4</u> \$15,001 - \$25,000		

I.D. _____

23. Please check the highest level of education you have reached.

35

- Ph.D., M.D., or J.D.
  1
     Graduate work
  2
     B.A., B.S., or equivalent
  3
     Some college
  4
     Completed high school
  5
     Some high school
  6
     Primary school
  7

24. Please check the highest level of education reached by your spouse/housemate.

36

- Ph.D., M.D., or J.D.
  1
     Graduate work
  2
     B.A., B.S., or equivalent
  3
     Some college
  4
     Completed high school
  5
     Some high school
  6
     Primary school
  7

25. What are your favorite hobbies or leisure time activities?

37

_____
_____
_____
_____

THANK YOU VERY MUCH FOR YOUR HELP

I.D. _____

INTERVIEWER I.D.

38

39

Appendix B-1a

Number and Sizes of Tanks on Swimming Pool Heating Systems
(Both Alone and in Combination with Other Solar Equipment)

Frequency	Number of Tanks	Sizes of Tanks	Number of Different Types of Solar Equip- ment Supported by the Tanks
1	1	40	1
1	1	80	1
1	1	100	2
1	5	80 (each)	2
1	1	82	2
1	1	50	2
1	1	80	2
1	1	unknown	3
1	1	1200	3
1	1	750	3
1	1	80	3
1	1	100,40,80,120	3

Appendix B-1b

Number and Sizes of Tanks on Hot Tub Heating Systems (Both Alone and in Combination with Other Solar Equipment)

Frequency	Number of Tanks	Sizes of Tanks	Number of Different Types of Solar Equipment Supported by the Tanks
1	1	82	1
1	1	unknown	1
1	2	100,40	2
1	1	100	2
1	1	82	2
1	2	40,82	2
1	1	500	3
1	4	1500 (each	3
1	2	40,90	3

Appendix B-1c

Number and Sizes of Tanks on Water Heating Systems (Both Alone and in Combination with Other Solar Equipment)

Frequency	Number of Tanks	Size of Tanks	Number of Different Types of Solar Equipment Supported by the Tanks
2	1	40	1
3	1	50	1
3	1	80	1
1	1	82	1
1	1	83	1
1	1	85	1
2	1	100	1
1	1	150	1
2	2	80,40	1
1	2	80,55	1
1	2	82,40	1
1	2	82,50	1
1	2	120,30	1
1	1	80	2
3	1	82	2
1	1	90	2
1	1	100	2
1	1	120	2
1	1	750	2
1	1	unkown	2
1	1	1800	2
1	2	100,40	2
1	2	120,40	2
1	2	82,40	2
1	5	80 (each)	2
1	6	5x82,40	2
2	1	unknown	3
1	1	80	3
1	1	500	3
1	1	750	3
1	1	1200	3
1	2	40,90	3
1	4	100,80,40,20	3
1	4	1500	3

Appendix B-2

Sources of Information Most Frequently Cited as Useful by Adopters Compared to Nonadopters.

Appendix B-2

Sources of Information Cited Most Frequently as Useful by Adopters Compared to Nonadopters (continued).

Appendix B-3

Decision Factors Most Frequently Cited as Important by Adopters as Compared to Nonadopters.

Appendix B-3

Decision Factors Most Frequently Cited as Important by Adopters as Compared to Nonadopters (continued).