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CONVINCING THE HOME BUILDER TO BUILD SOLAR HOMES

AN EVALUATION OF THE PASSIVE SOLAR WORKSHOPS FOR BUILDERS

By

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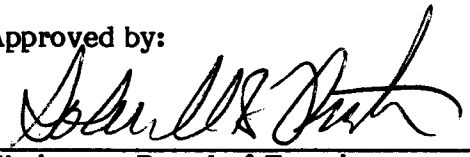

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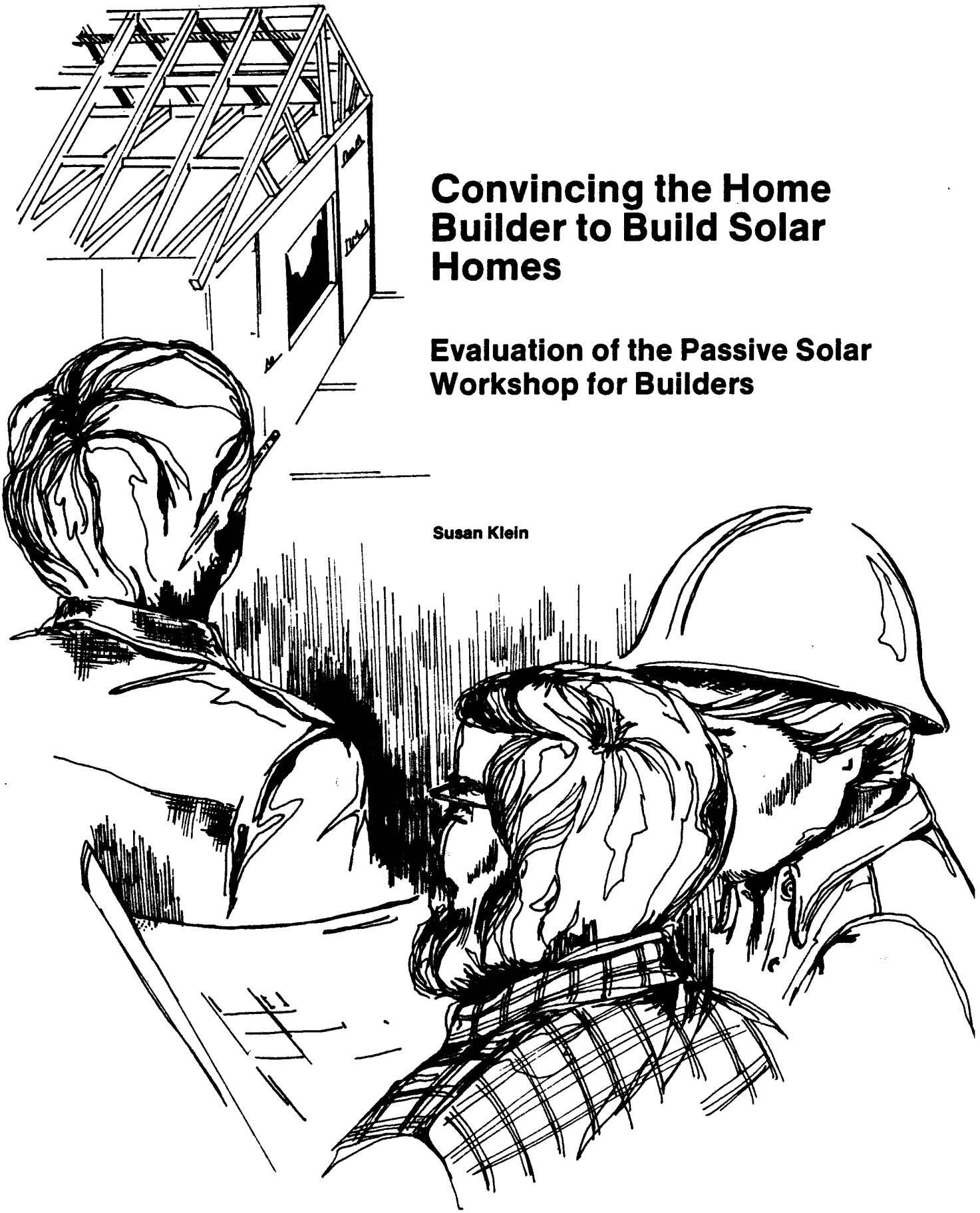

Convincing the Home Builder to Build Solar Homes

Evaluation of the Passive Solar Workshop for Builders

Susan Klein

FOREWORD

The pilot series of the Solar Design Workshop for Builders was sponsored and prepared by the Solar Energy Research Institute (SERI), Regional Solar Energy Centers, and selected state energy offices and home builder organizations. The Building Application and Policy Branch at SERI evaluated the workshops to measure their effectiveness and to provide a basis for continued and expanded government-funded and private programs for builders.

The Solar Workshop Project began at SERI in December 1978 under the guidance of Michael DeAngelis and Douglas Nordham. Many others conscientiously worked to implement this project, in particular, John Kimball of the Arizona Solar Energy Commission, Bob Loux of the Nevada Department of Energy, Chuck Miller of the Desert Research Institute, Herb Wade of the Missouri Department of Natural Resources, Stephen Brown and Judy Bean of the Northeast Solar Energy Center, Michael Gorman of the New York Department of Energy, Michael Bell of the National Association of Homebuilders, and Kal Turkia and Don Abrams of the Southern Solar Energy Center.

The author, Susan Klein, would like to acknowledge the thoughtful assistance and guidance provided this paper by Douglas Nordham and Michael DeAngelis of SERI, and the members of her graduate committee at the University of Montana, John McQuiston, Ph.D.; John Means, Ph.D.; and Richard Sheridan, Ph.D.

SUMMARY

OBJECTIVES

The primary objective of this report is to evaluate the effectiveness and impact that a pilot series of workshops had on educating home builders in passive solar design and in promoting favorable attitudes toward solar concepts.

DISCUSSION

In 1979-80, a pilot series of passive solar workshops for home builders sponsored by the Solar Energy Research Institute, the Regional Solar Energy Centers, and local home builders organizations was offered throughout the United States. The workshops demonstrated the technical and economic feasibility of integrating solar design into a conventional home without substantial costs or marketing risks.

Currently, builders and others associated with the building industry lack full information regarding the advantages of using solar energy for space and hot water heating. In terms of market awareness, solar design is considered to be in the initial stage of commercialization. This report was developed to address the needs of the builders who are the innovators of solar design in residential buildings. It is based on information provided in nearly 1100 pre- and post-training forms returned by the solar workshop participants.

This report includes discussions on:

- builders as innovators of solar design (a profile),
- attitudes that encourage or inhibit the use of solar design by builders,
- an examination of the decision-making behaviors of builders experimenting with solar design.

Using the workshop participants' responses and comments, this report provides a basis for developing future training programs for builders aimed at promoting the commercialization of solar design. To facilitate program planning, several training formats have been prepared to accomodate builder needs depending on the volume of homes they construct each year and their amount of previous solar experience.

Attendance at the workshops was voluntary. The participants may be viewed as representative of builders experimenting with solar design. A workshop profile showed that 67% of the participants had less than 10 years professional experience, two-thirds were small-volume home builders (1-25 homes per year), 36% had previously designed or installed a solar energy system, and 56% were very likely to build a passive solar home within six months of the workshop.

A major question this report sought to answer was what type of information do builders need to follow through on their plans to use solar energy in the future; and if a builder had previous experience with solar systems, what information did he (she) need to continue using it on a full-scale basis? A breakdown of the

barriers and incentives that influenced the builder's decision and an analysis of their evaluation of the workshop provided a basis for answering this question.

It was found that the decision to use solar energy consisted of many steps and could be compared to a decision-making model prepared by Rogers and Shoemaker. In summary, the model states that beginning with initial awareness of a new product or design feature, such as solar energy systems, an individual may develop an interest and choose to pursue or abandon that interest depending on the type of information available regarding its advantages and applicability. A trial period on a small-scale basis will help an individual determine whether or not to use the product on a full-scale basis. Many positive and negative factors (incentives and barriers) affect the direction and rate at which this decision-making process occurs.

Builders attending the one-day workshop were provided a broad overview of solar design concepts, including technical design tools, marketing information, tax incentives, building code information, and case studies presented by experienced solar builders. The workshop also provided a forum for builders to discuss their experiences with each other. Results indicated that information provided by peers regarding the operability and marketability of solar design was found to be an important factor influencing a builder's decision.

Barriers to passive solar construction and other factors that influenced a decision varied among the builders depending on the number of homes they constructed each year and amount of solar experience they had. Generally, before the workshop, the most important barrier cited was "expense to build." After the

workshop, participants cited "lack of information on where to begin and who to talk to" as the most important barrier. Lack of performance information, building code conflicts, lack of financing options, and lack of warranties, were also cited as barriers inhibiting a builders decision.

Builders also listed motivating factors, such as rapidly increasing gas and electric prices and a "necessity to develop alternative energy sources and conserve gas and electricity" among their reasons for deciding to use solar design. Other incentives included availability of tax credits and consumer demands.

After evaluating the factors that influenced a builder's decision to use solar design on an individual basis, the next step was to determine the impact training programs such as the solar workshops could have in promoting solar design in the building industry.

Briefly, the participants attending the workshops collectively had built 16,413 homes built in 1979-80. This represents 1.4% of the 1,194,000 total housing starts in 1979. Market research has shown that education programs as well as economic and institutional incentives should be provided to encourage the initial 20% to 30% of the consumer market to use a new product (e.g., solar design). The research concludes that once initial adoption has been achieved, increasing returns in adoption will result through momentum generated by the early adopters. Other research has indicated that the influence and example exhibited by a concentrated group of early users can be very instrumental in promoting the distribution and use of that product.

Applying the above marketing research, training sessions could influence a large number of builders. However, to be most effective, target audiences with the greatest influence in the home building industry need to be identified and trained in solar design. In addition, the decision-making hierarchy among the various categories of home builders by volume of homes constructed needs to be addressed. For example, one prime target audience could be the large-volume home builder (more than 100 homes per year). It was found that if 33.3% of the homes constructed by large-volume builders were solar homes, then 20% of all new homes would use solar energy. This would involve convincing 2.7% of all home builders. Information on the large, corporate builder regarding the institutions and attitudes that could affect their decision to adopt solar would need to be identified and integrated into the training session. An overview of these factors are included in the text.

CONCLUSION

What effect did the one-day workshop have in convincing builders to build solar homes? Evaluation showed that the workshop was effective in causing incremental positive changes among the builders. It provided an opportunity for those builders with no previous exposure to solar energy systems or design to "pursue their interest" and move closer to a decision to use it in the future. For those builders who were seriously planning to use solar design in the next construction season, the workshop provided the information they needed to get started. It provided an opportunity for them to witness the positive experiences of other builders and elicit contacts for further information.

Workshops of this nature do not provide the time necessary to thoroughly train and convince builders to adopt solar design on a full-scale basis. Short workshops do have a high potential for influencing the solar market if adequate follow-up is built into the initial workshop objectives. To ensure that builders have access to solar design information following the training session, it is suggested that:

- the workshop be designed to facilitate discussions among the builders that will encourage future contact,
- advanced training sessions be offered and be easily accessable, or
- follow-up information be sent to the participants regarding local solar construction, information, resources, workshop dates, publications, etc.

In conclusion, a one-day workshop is not considered the most effective or only method of promoting solar design in the residential building industry. Its potential impact and application as a commercializing tool can be maximized when other factors such as market behavior and the decision-making patterns of the building industry are considered.

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SECTION 1.0

INTRODUCTION

On 20 June 1979, President Carter established a national energy policy which initiated the first step in creating an overall federal solar energy program. At this time the President committed the nation to meeting 20% of its energy needs with solar and renewable energy resources by the year 2000.

This transition from dependence on conventional fossil fuels to development of new energy sources was precipitated by an increase in the price of foreign oil. Many perceive this transition, due to the energy crisis, as a time of disruption and change in standard of living. There is no easy remedy, but new ways must be found to make long-term decisions regarding America's energy future. In light of this, solar energy is emerging as one viable alternative to conventional fuels. The benefits of this renewable resource are being recognized, and obstacles and risks are being minimized.

Passive solar design is a system of design features that can be integrated into the conventional design structure of a building through measures of conservation, site orientation, glazing on south facing windows, and adequate thermal storage. Passive design differs from active solar design in that there are no mechanical parts. The use of solar energy through passive solar designs for buildings is technically and economically ready for commercialization in the marketplace. However, at many levels, attitudinal and institutional barriers stand in the way. Major

barriers to the advancement of the solar industry include social convention and traditions, fear of change and its associated risks, and lack of understanding about the use of solar energy.

A common misconception is that reduced reliance on fossil fuels coupled with an increased use of solar energy implies a decreased standard of living. In actuality, a well-designed and properly installed solar system and energy-efficient home can provide increased comforts, aesthetics, and more efficient use of resources. Education, experience, market incentives, and economic necessity are gradually bringing the advantages of solar energy to the forefront.

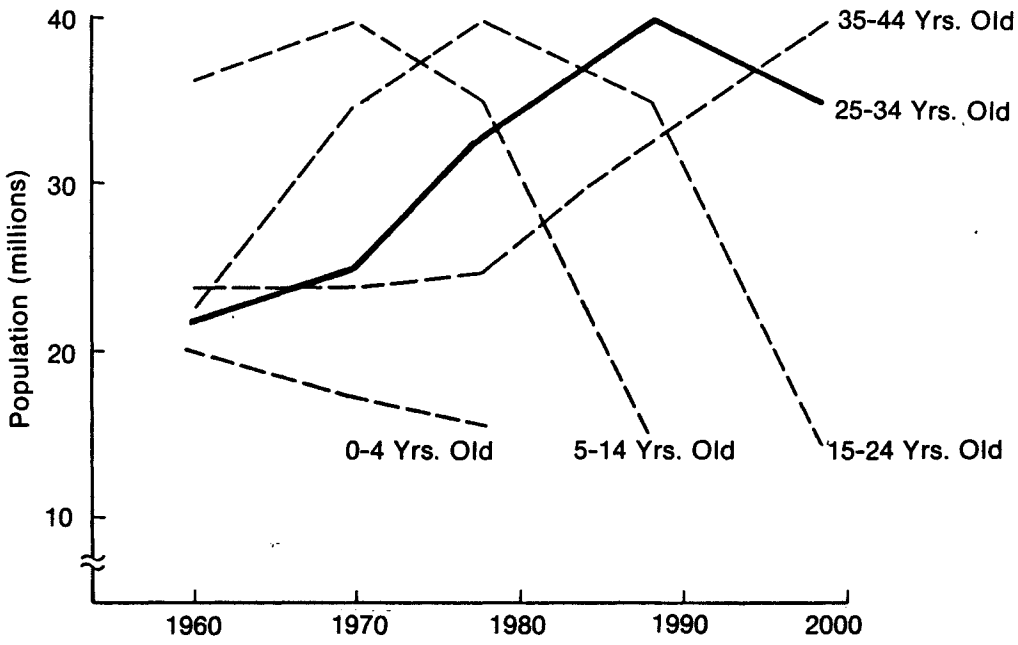
This study examines the residential building industry and particularly design decisions for heating and cooling systems. Approximately one-fourth of our nation's energy use currently is used for heating and cooling buildings. Evidence shows that passive systems can provide between 40% and 80% of the energy needed to heat and cool these buildings (Rappaport 1979). In 1979, passive solar design was used in an estimated 1000 new buildings and this number is increasing each year (Rebibo 1979). In making the transition to solar energy it is crucial that key decision makers in the building industry are adequately educated in the use of passive solar design and construction.

Studies have shown that builders are interested but not yet fully committed to using solar energy (Selling the Solar Home Report 1978). Limited by the dictates of institutional changes, builders await further evidence of acceptance by consumers, financial markets and lending institutions, utility companies, and regulatory agencies.

This project was developed to address the needs of the innovators—defined as those builders who are the early experimenters with solar design—to encourage them towards a more active commitment to solar energy. Providing an accurate assessment of the marketplace, present technology, economic incentives, and current innovative building practices is the first step in procuring a national transition to solar energy in home building.

In 1978, the number of new housing starts reached 2 million. In March 1980, reflecting economic trends of inflation and increased interest rates, the number of new housing starts was down 57% from the previous year (U.S. Department of Commerce 1980). Inflation and high interest rates are largely responsible for the fluxes in the housing industry. However, a slow period in market sales may force builders to analyze market conditions over the long run. This analysis includes investigating current and projected demands that will influence the market in the future. In particular, change in market conditions will be influenced considerably by the sharp growth of prime age home buyers (25- to 35-year-olds), as shown in Fig. 1-1, and rapid increases in gas and electric prices. The energy crisis, coupled with a home-buying age group of an additional 41 million over the next 10 years (Heinly 1980) can have a substantial impact in determining what will be built in the future and how it will be built.

Considering that future homes will be dependent on the availability of energy resources, it is advantageous for builders and their clients to look at all the options available in heating and cooling systems' design and equipment.



Source: Statistical Abstract, of the United States, 1979.

Figure 1-1. Population Projections of Prime Group of Potential Home Buyers

In the past, it was cheaper to heat with oil or gas than to insulate, and oversized conventional system design was the most profitable and practical choice. For 30 years, in accord with copious oil and natural gas supplies, builders relied upon previous experience to guide them in predicting future markets. Since the oil embargo of 1973, reliance on past experience as an indicator of future market conditions is no longer an adequate marketing tool. As an example, in 1973, Saudi crude oil was $5.18 a barrel. In 1979, it had unpredictably increased to $24.00 a barrel (Degolyer and McNaughton 1979).

This study addresses the question of who is making the first transition step in the process of commercializing passive solar energy, and describes the subsequent steps involved in making the decision to change from conventional design to adoption of a new design style.

SECTION 2.0

PROJECT DESCRIPTION

In 1979, a series of pilot workshops for builders and developers was held throughout the United States. The project was designed and prepared by the Solar Energy Research Institute and the four Regional Solar Energy Centers in conjunction with regional and local builders organizations. The primary objective of the project was to educate members of the building industry about passive solar design and energy efficiency in new residential construction.

Builders and designers were selected as the target group of key decision makers in the process of commercializing solar design in new construction. Based on census information, one projection states that 40% of the homes standing in 1989 will be built in that decade (Heinly 1980). With approximately 77% of all home-builders constructing on speculation (as either their first or second most important building operation)* it is primarily the builder who is responsible for making the decisions regarding the type of energy system and appliances to be placed in the majority of homes built.

A 1979 study of 3430 Canadian builders showed that, for the most part, builders are unaware of the total energy consumption accounted for in the residential

*In a national study conducted by NAHB in 1976, 59.2% of the 1351 builders surveyed indicated that speculative building was their most important operation, while 17.8% said it was their second most important operation (Ahluwalia et al. 1979).

sector. In summary, the report stated that: "Their knowledge of the energy usage and potential energy savings associated with residential equipment was disappointing, particularly among builders representing small firms" (Quelch and Thirkell 1979). Lack of knowledge can lead to misguided decisions as well as inefficient energy use. It is believed that with the appropriate information, builders can have a significant affect on the promotion of energy savings and solar design in the residential sector.

2.1 THE WORKSHOP FORMAT AND WORKBOOK

Of the two major components of this project, one was the development and implementation of the workshop. Included in this component were choosing a prime site location and developing a strong organizational network and workshop program for addressing builder's needs in a particular region. The second component of the project was the formulation of a workbook to accompany the workshop presentation.

2.1.1 Implementation of the Workshop

Developing a Strong Organizational Network

The combined efforts of the building industry, local builders and developers, and local and state organizations were instrumental in developing an effective

workshop format and regional specific program. The strength of the various builder related organizations was utilized so that momentum in the solar building industry would continue as a result of this project's initiative. (See Appendix A for list of organizations involved.)

Choosing a Site Location

Pilot states were chosen for the program on the basis of geographic location to include a variety of national and institutional characteristics. Most importantly, the impact and concentration of builders and developers were considered in conjunction with the degree of state involvement and strength of the home builders association in that area. Based on these criteria, workshops were held in the states of California, Nevada, Arizona, Missouri, New York, and seven major cities in the Southeast. In this report, data collected from the various site locations have been compiled by region, as defined by the four Regional Solar Energy Centers: Western Sun, Mid-America, South, and Northeast. (See Appendix B for the states included in each region and information regarding the Regional Solar Energy Centers.)

The Workshop Format

The one-day workshop format was designed to provide a technical and conceptual overview of passive solar design in new residential buildings. This format included

an introduction to passive solar techniques as well as a discussion of the potential issues facing the builder using passive solar designs.

The workshop format varied from region to region based on the different needs defined by the experience and expertise of local builders' organizations and resources, climatic influences, and availability of optimal building materials. Each workshop addressed the following topics:

- energy resources and problems: an overview,
- passive solar design and techniques,
- building codes and solar access laws,
- case studies by experienced and reputable solar builders,
- federal and state incentives including solar tax credits, and
- marketing techniques.

For complete details, see Section 4.3.

2.1.2 The Workbook

The second component of the project was the development of a builder's workbook. The workbook was designed to complement and augment the contents of the workshop presentation. In this way builders had immediate access to a reference manual on passive solar design and other information presented at the workshop. The workbook also included a bibliography and a list of local and regional

resources available to builders in the solar energy field. A different workbook was prepared for each region in which the workshops were held.

2.2 METHODOLOGY

Approximately 1000 persons participated in the pilot series of workshops on passive solar design in 1979-80. Pre- and and post-training forms were distributed to the participants at the workshops. The forms were developed by SERI personnel to determine:

- a builder/participant profile;
- builders' previous experience with solar design;
- an insight into the perceived circumstances which promote or discourage the use of solar design by the prime decision makers in the home-building industry; and
- measure the effectiveness of the workshops in convincing builders to use solar design. (A copy of the pre- and post-training forms appear in Appendix C.)

The results in this paper are based on a total of 1099 pre- and post-training forms returned by participants in the Western Sun, Mid-America, and Southern Solar Energy Center regions. Although pilot workshops were held in the northeast, evaluation forms were not returned, thus precluding an analysis of this region. Analysis of the responses was facilitated by use of the SPSS (Statistical Package for the Social Sciences) computer program.

In some cases a complete analysis of the responses was limited. This section briefly describes the limitations incurred.

- Although all the workshops were well attended, the number of evaluation forms returned varied by region. Western Sun returned a total of 547 pre- and post- training forms, Mid-America returned 411, and the Southern center returned 141 forms. Pre- and post-training evaluation forms were also distributed at builder workshops in the Western Sun and Mid-America regions that closely followed the pilot series format. These forms were included in the analysis.
- Facilitators of the workshop encountered some problems in correlating the pre- and post-training forms of the respondents. In order to measure the change in intent to build and perceptions about solar design before and after the workshop, the participants were asked to sign their name or initials and return both the pre- and post-training forms. Both forms were not returned in all cases which affected the evaluation and lowered the frequency of responses in some categories. (See Appendix D for number of pre- and post-training forms returned by each region.)
- The pre- and post-training forms were collected radomly and reasons for participants not returning the forms are unknown. Approximately 20% of the participants did not return a form.

SECTION 3.0

ANALYSIS OF RESULTS

3.1 CONCEPTUAL ANALYSIS

Attendance at the workshop was voluntary. The results in this report are not intended to be a representative sampling of all builders in the United States. Rather, the results describe a group of builders considered to be the early users or innovators of solar design in new residential construction as evident by their participation in the workshop. Currently, passive solar design is considered to be a new and innovative "product." Information regarding its applicability and usage is not thoroughly understood nor accepted by the majority of home builders or home buyers. Participants attending the pilot series of workshops were clearly interested in learning more about passive solar design and applying it. To better understand the characteristics of the participants as innovators, particularly the builders, a theoretical model on the market diffusion process is described below.

According to the literature on the market diffusion process, early users of an innovation or new product do not reflect the norms of persons who will later choose to adopt. In accord with one market diffusion model, users of an innovation are categorized as one of five ideal types (Rogers and Shoemaker 1971, p. 182). These types and their estimated portion of the population are shown in Fig. 3-1. A list of attributes that characterize each type is summarized in the following outline.

The stages and rate of adoption of an innovation appear as a bell-shaped curve. Rate of adoption varies considerably depending on the product.
Workshop participants were considered to be in the innovator and early adopter stages.

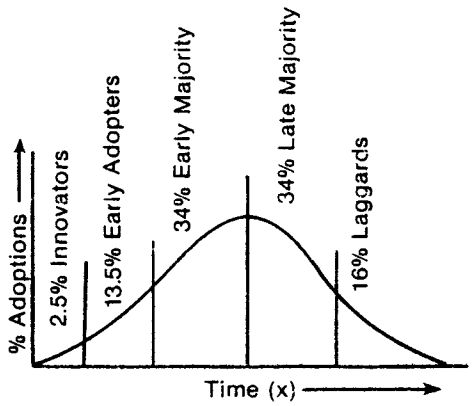


Figure 3-1. The Stages and Rate of Adoption Curve

- o INNOVATORS: - risk takers
  2.5% - financially secure
  - able to apply and understand technology
  - venturesome
  - cosmopolites
- o EARLY ADOPTERS: - opinion leaders and role models
  13.5% - respectable
  - able to successfully apply new ideas
  - localites
- o EARLY MAJORITY: - pensive and rational before adopting new idea
  34% - choose to adopt before the majority
  - deliberate
- o LATE MAJORITY: - cautious
  34% - may choose to adopt due to economic and social pressure
  - skeptical
- o LAGGARDS: - traditional
  16% - refers to previous experience in making decisions.

The evaluation of the pilot series of workshops is primarily aimed at understanding the educational needs and characteristics of the early adopter in the solar energy field. Because information regarding passive solar design is not as readily available as conventional design the results of this study should be helpful in organizing future workshops for builders. As fuel costs increase, solar technologies improve, and the adoption rate increases, it is likely that new workshop formats and topics will evolve.

3.2 OCCUPATIONAL PROFILE

The process of commercializing solar energy on a national scale involves institutional change as well as widespread awareness and acceptance among diverse groups who influence the housing industry (e.g., consumers; institutions that finance, supply and manufacture materials; and government agencies that regulate building codes and standards).

Although the workshops were developed specifically for builders and designers of new residential housing, the variety of occupational backgrounds of other participants demonstrates the need for information on solar energy among other groups as well. Builders and designers constituted 73% of the participants. This group included developers, planners, contractors and sub-contractors, architects, designers, draftsmen, and engineers. The other 27% included financiers and appraisers, suppliers and manufacturers, building code inspectors and government officials, educators and consultants, and the general public. This study specifically addresses those who were builders and designers (see Table 3-1).

3.2.1 Years of Professional Experience

The Majority of Builders Had Less Than 10 Years Experience

The majority of participants (67.2%) tended to have 10 years or less of experience in their respective occupations while 38.1% of the builders had five or less years

Table 3-1. OCCUPATION OF WORKSHOP PARTICIPANTS

	Percentage of Participants			
	Western Sun n = 272	Mid-America n = 224	Southern n = 72	Total n = 545
Builders (Developers' general contractors, subcontractors)	50.7	59.4	56.6	56.1
Designers (Architects, draftsmen, engineers)	22.1	14.3	3.5	16.9
Materials and Supplies (Manufacturers, marketing, sales, suppliers)	8.1	4.9	14.1	7.3
General Public (Owner builders, students, other)	8.8	5.4	2.8	6.6
Financers (Appraisers, bankers, real estate, savings and loan)	5.1	4.5	3.5	5.0
Educators (Consultants, teachers, university professors)	1.8	9.8	0	5.0
Government Representatives (building code inspectors and utility company representatives)	3.1	3.3	1.8	19.8
TOTAL	100.0	100.0	100.0	100.0

Note: To avoid double counting, percentages are based on responses from either the pre-or post-training form, depending on which one had more responses in the set.

of experience.* (In this report "builder" refers to builders and designers and "build" refers to build and design.)

One of the reasons for the large percentage of less experienced builders attending the workshops might be that the new builder is less likely to have established conventional building patterns and is more receptive to developing an awareness of innovative and more diverse design tools in their field. This study indicated that more than twice as many builders with less than 10 years experience had used solar energy design as those with more building experience. See Table 3-2.

3.2.2 Home Builder Size

The Majority of Attendees were Small Home Builders

Results from a marketing study completed in June 1980 indicate that new features in homes are usually adopted first by the small custom builder (Booz, Allen, and Hamilton 1980) and are later adopted progressively by the larger volume builders. In the pilot workshop series, passive solar design was presented as a new design feature that could be integrated into the conventional design structure through conservation measures, site orientation, south-facing windows, and adequate thermal storage. The majority of the builders (74.7%) attending the workshop were small

*According to a 1976 survey conducted by the National Association of Home Builders, the average home builder in the United States had 8.7 years experience. Other results in the study showed that: 33.4% of all home builders had 1-4 years experience, 22.3% had 5-9 years, 12.2% had 10-14 years, 10% had 15-19 years, and 22% had more that 20 years experience (Ahluwalia 1979). See Appendix E for national statistics on number of years in business by size of home builder.

Table 3-2. PROFESSIONAL WORK EXPERIENCE

Builders and Designers

	Years of Experience				
	1-5 Years	6-10 Years	11-15 Years	more than 15 Years	Total (%)
Percentage attending workshop (%)	38.1	29.4	10.6	21.9	100.0
The percentage of those attendees with this experience who have designed or used solar	39.2	37.2	18.2	18.9	31.9[a]

[a]Percentages represent responses in each category and do not total 100%.

volume builders (1-25 homes per year) (see Table 3-3). Further analysis indicated that many of these builders had already used passive solar systems or were seriously planning to use them in the near future (see Sec. 3.2.1). These results reflect the adoption pattern of new features in homes by small volume builders as stated in the marketing study by Booz, Allen, and Hamilton. (See Appendix E for national and regional statistics on home-builder size.)

Home-Builder Size: Regional Analysis

Home-builder size accounting for most new starts varied from region to region. In the midwest, small- and medium-sized firms account for most of the new home sales. Firms of all sizes are actively competing for the strong new housing market in the south (Adams 1979), however, an increasing number of giant firms (sales volume more than $15 million) are dominating the growing housing industry in the western region.* In California, particularly, many of the new homes are built by large firms. As a part of the pilot series, a passive solar workshop was held in San Francisco specifically for large volume builders. For this reason a greater percentage of large volume builders (22.6%) were in the Western Sun region as compared to the total percentage of large volume builders attending the workshops (12.9%).

*A national study completed by the Bureau of Building and Marketing Research indicated that 21% of the new homes erected in 1979 were built by major home builders (sales volume exceeding $15 million). The study also showed that the west and south accounted for the greatest increase in new major home builders (McNeilly 1980, p. 90).

Table 3-3. HOME-BUILDER SIZE OF WORKSHOP PARTICIPANTS

Number of Homes Built	Percentage of Builders by Region (%)			
	Total n = 258	Western Sun n = 122	Mid-America n = 106	Southern n = 30
Very Small (1-5 homes)	39.6	34.9	46.8	34.6
Small (6-25 homes)	35.1	23.6	40.2	61.6
Medium (26-100 homes)	12.4	18.9	7.6	3.8
Large (more than 100)	12.9	22.6	5.4	0
TOTAL %	100.0	100.0	100.0	100.0

3.3 EVOLUTION OF THE INDIVIDUAL THROUGH THE ADOPTION PROCESS

The literature on the market diffusion process states that "An individuals' decision about an innovation is not an instantaneous act, rather it is a process that occurs over a period of time and consists of a series of actions" (Rogers and Shoemaker 1971, p. 100). One of the questions on the evaluation form asked the builders to indicate the stage or degree to which they had used solar design. The responses closely parallel the decision-making stages in the adoption process as described by Rogers and Shoemaker (1971). Table 3-4 compares the workshop evaluation form responses and the stages in the adoption process.

3.3.1 Stages in the Adoption Process: Builders and Designers

75% of the Builder-Participants Were in The Advanced Stages of Adoption Process

Results indicated that 75% of the builders and designers had either designed, installed, or used a solar system in the past, or were seriously planning to use solar design in the near future. For 20% of the builders, the workshop was their first exposure to solar design methods, while 4.3% had considered using solar design but had no plans to use it in the near future.

Table 3-4. Individual Movement through the Adoption Process and Amount of Solar Experience

Adoption Process		Solar Experience
Awareness Stage: The individual learns of the existence of a new idea but lacks information about it.		No experience with solar design
Interest Stage: The individual develops interest in the innovation and seeks additional information about it.		Considered solar design, but have no plans to use in the near future.
Evaluation Stage: The individual makes mental application of the new area to his present and anticipated future situation and decides whether to try it. The individual's behavioral intent is based on attitudes.		Seriously considered and plan to use solar design in the near future.
Trial Stage: The individual actually tries the new idea on a small scale in order to determine its utility in his own situation.		Have designed, installed or used solar design systems.
Adoption Stage: The individual uses the new idea continuously.		

Southern Builders Attending the Workshop Have Had Less Experience With Solar Design

Builders and designers in the Western Sun and Mid-America regions tended to have more experience with solar design than those in the Southern region: 37.4% of the builders in Western Sun and 36.6% in Mid-America had previous experience, whereas only half as many (18.3%) had used solar design in the Southern region. A greater percentage of builders in the Southern region than in the other two regions had considered using solar design, but had no plans for actually using it in the near future (see Table 3-5).

Regardless of Home-Builder Size, Builder-Participants Were Anxious to Use Solar Design

Results showed that the larger volume builder had less experience with solar design than the small volume builder. The medium volume builder, although representing only 11% of all builders surveyed, was most likely to have used solar design.

For the most part, builders were planning on using solar design in the near future and were attending the workshops to find out what they needed to know to get started. (Before the workshop 49.9% of the builders stated that "lack of information on where to begin or who to talk to" was one of the top three barriers to passive solar construction. (See Sec. 3-6 and Table 3-6).

Table 3-5. AMOUNT OF SOLAR EXPERIENCE[a]

Builders and Designers

	Awareness Stage	Interest Stage	Evaluation Stage	Trial Stage	
	No experience with solar systems (%)	Considered solar design but have no plans in the near future (%)	Seriously considered, and plan to use solar design in the near future (%)	Have designed, installed, or used solar systems (%)	Total (%)
Total n = 398	20.0	5.0	39.3	35.7	100.0
Western Sun n = 187	22.4	4.3	35.8	37.5	100.0
Mid-America n = 164	15.8	4.3	43.3	36.6	100.0
Southern n = 71	29.6	14.1	38.0	18.3	100.0

[a]See Appendix F for response of all participants.

Table 3-6. SIZE OF HOME BUILDER AND SOLAR EXPERIENCE[a]

Builders and Designers

Size of Home Builder (Percentage of Total)	Amount of Solar Experience (%)				
	No experience	Considered but have no plans in the near future	Seriously considered and plan to use in the near future	Have designed, installed, or used	Total
Very Small (44.4%) 1-5 homes	8.5	1.7	45.7	44.1	100.0
Small (33.1%) 6-25 homes	22.7	2.3	40.9	34.1	100.0
Medium (11.3%) 26-100 homes	26.7	0	13.3	60.0	100.0
Large (11.3%) 100 homes	33.3	0	40.0	26.7	100.0

[a]Read table across

3.3.2. Workshop Impact in Motivating Builders to Use Passive Solar Design

Builders and Designers Felt More Likely to Build or Design with Solar Design After The Workshop Than Before

Research shows that innovation of new products spreads outward, in a concentric pattern, among innovators (Midgley 1977). If they decide to build with solar design, the builders attending the workshop can promote solar design in home building by setting the pace among their peers. As indicated earlier, builders are at different stages in the adoption process.* At each stage, it is important that the builder is exposed to information that encourages a favorable attitude toward solar design, thereby encouraging the builders to continue through the decision-making or "adoption" process. Based on the responses, the workshop was successful in encouraging favorable attitudes towards solar design as evident in the builder's change in intention to build with solar design.

Participants were asked before and after the workshop how likely they were to build or design a passive solar home on a 5-point scale from very likely to very unlikely to build. The majority of builders and designers stated that they were likely to build or design a passive solar home in the next construction season. Before the workshop, 55.8% of the builders were likely to very likely to build with solar in the next six months, and 71.3% were planning to build in the next 18 months. (Note: builders were asked to indicate likelihood to build for both the next construction season, 6 months, and the following season, 18 months.) See

*Stages in the adoption process are Awareness, Interest, Evaluation, Trial, and Adoption.

Appendix F for table showing pre- and post-training response to likehood of building a passive solar home in 6 and 18 months.

Builders and Designers Were More Likely to Build or Design With Solar Design in 18 Months Than in 6 Months Before and After The Workshop

The change in likelihood or intent to build a solar home was much more favorable over an 18-month period than it was for the more immediate 6-month period. In Table 3-7 the percentages represent those builders who had changed their decision or intent to build from before to after the workshop. The percentages measure a change in either a more favorable or less favorable direction.

In the 6-month period, of the builders who were likely or unsure about building a solar home before the workshop, change in intent to build went both ways. Of the unsure group 18.7% changed in a more favorable direction and 18.7% changed to unlikely or very unlikely to build. For those builders who were unlikely to build a solar home before the workshop, 32.5% moved one step in a favorable direction after the workshop.

In the 18-month period builders intent to build a solar home changed more significantly in a favorable direction. Of the builders who were unsure before the workshop, 38.2% changed to likely or very likely to build a solar home after the workshop. Of the unsure group, 12.8% changed to unlikely or very unlikely to build. Of the builders who were unlikely to build, 42.9% changed their intent to build to unsure, likely, or very likely to build, a favorable change.

Table 3-7. CHANGE IN LIKELIHOOD TO BUILD A SOLAR HOME: FROM BEFORE TO AFTER THE WORKSHOP[a]

(Builders and Designers)

	Post-Training; Percentage of Change					
Pre-Training	Very Likely	Likely	Unsure	Unlikely	Very Unlikely	Total
6 mo. (N = 284)						
Very Likely	93.6	6.4	0	0	0	100.0
Likely	18.0	66.0	12.0	4.0	0	100.0
Unsure	4.0	14.7	62.7	16.0	2.7	100.0
Unlikely	7.5	0	32.5	57.5	2.5	100.0
Very unlikely	4.9	0	2.4	29.3	63.4	100.0
18 mo. (n = 261)						
Very likely	89.0	11.0	0	0	0	100.0
Likely	15.4	73.8	6.2	4.6	0	100.0
Unsure	5.5	32.7	49.1	7.3	5.5	100.0
Unlikely	4.8	4.8	33.3	57.1	0	100.0
Very unlikely	0	0	0	35.0	65.0	100.0

[a]Figures underlined represent those participants who did not change their response from before to after the workshop. Figures to the left of the underlined number represent those who changed from their original position to a more favorable position. Figures to the right of the underlined number represent those who moved to a less favorable position after the workshop.

Responses to another question on the training form indicated that the builders lacked information about where to start or who to talk to about solar home building. The stronger intent to build a solar home in 18 months rather than in 6 months, and the change in intent to build in the 6-month period may indicate that although builders have been exposed to information that encourages a favorable attitude towards solar design, they lacked the information necessary to implement it in their practice. If this is true, a one-day workshop without immediate and continuous follow-up would probably not be sufficient to promote the use of solar design.

Those With More Solar Design Experience More Likely to Build or Design With Solar Than Those Who Have Had No Previous Solar Experience.

As indicated earlier, the decision to adopt an innovation is not an instantaneous act, it is a process that consists of a series of stages. The degree to which builder participants have adopted solar design has already been discussed. Based on their previous experience, how likely is it that they will continue using passive solar design? Will builders progress through the adoption stages until they reach the final stage using solar design continuously and on a full-scale basis? Many factors are involved that may positively or negatively influence the individual in making the transition from one stage to another. Knowledge about the innovation, previous attitudes and experience, and an understanding of the inherent advantages or disadvantages help to determine the decision to adopt. At any point in the process the individual may be exposed to unfavorable conditions and reverse his/her decision to adopt (Rogers and Shoemaker 1971, p. 110). Those who have used solar design in the past have apparently had favorable experiences which

have generated a desire to continue using it in the future. Before the workshop, of the 33.8% of the builders who had used solar design, 63.6% felt very likely to build a passive solar home within 6 months. After the workshop, this number increased to 64.7%. Of the 19% who had had no experience with solar design only 5.4% were willing to make an immediate commitment to using solar design in the next 6 months and 23.5% felt likely to consider using solar design in 18 months prior to the workshop. After the workshop, the percentage doubled to 10.8% within 6 months, and changed to 20% within 18 months. (See Appendix F for the change in likelihood to build based on solar experience.)

3.4 PROBLEMS ENCOUNTERED BY BUILDERS AND DESIGNERS WHO HAD PREVIOULY BUILT OR DESIGNED A SOLAR HOME

Of the participants, 35.8% had designed, built, or used a solar building. Table 3-8 lists the most common problems encountered before, during, or after the home was built. In some instances the problems builders encountered may not be attributable to solar homes only, but to new home construction in general. In a survey conducted by the Bureau of Marketing Research, "availability of financing" was a problem faced by 47% of the builders surveyed. Of the builders, 21% stated that "lack of qualified buyers" was a problem, 22% stated that "quality of labor" was a problem, and 16% stated that "environmental and governmental regulations" were troublesome. See Appendix H for complete results of the survey.

Table 3-8. PROBLEMS ENCOUNTERED BY BUILDERS AND DESIGNERS WHO HAD PREVIOUSLY BUILT OR DESIGNED A SOLAR HOME

Problems		No. of Builders and Designers (%)
No Problems		21.8
Problems:		79.2
Locating reputable designers or hardware manufacturers	16.9	
Installation quality problem	14.3	
Delays due to building code conflicts	11.9	
Financing of the builder	11.9	
Financing of the buyer	11.2	
Difficulty in selling passive solar home	10.0	
Other	1.9	
TOTAL		100.0

Percentage based on 110 responses from builders and designers. Categories of problems are not mutually exclusive. See Appendix G for responses of other participants.

3.5 AWARENESS OF SOLAR TAX CREDITS

A solar tax credit is available and would be subtracted from the amount of state or federal income taxes a person owes each year. The federal tax credit allows up to a 40% credit for the first $10,000 spent on cost and installation of an active system and limited features on a passive system. In addition, twenty-three states have passed legislation providing for a state solar tax credit. In some states, an eligible taxpayer may receive up to a 70% cumulative federal and state tax credit on the material and installation costs of their solar system. Other states do not provide any additional incentives to the federal solar tax credit. States in the west tend to have passed more solar legislation and provide more incentives in the way of tax credits than do states in the south or mid-west. (See Appendix I for a list of state income and property tax incentives.) Likewise, builder-participants in the west were more knowledgeable of both state and federal solar tax credits than builders attending the workshops in the south or midwest. In general, the builders were more aware of the federal tax credits than the state* (see Table 3-9).

*In the south, workshops included in the evaluation were held in Kentucky and Georgia. Neither of those states provided income tax incentive at the time of the workshop. Georgia did provide property tax incentives. In the mid-west, all the workshops evaluated were held in Missouri. Missouri did not have income tax or property tax incentives at the time the workshops were held.

Table 3-9. AWARENESS OF SOLAR TAX CREDITS BY REGION[a]

(Builders and Designers)

	State				Federal		
	Aware	Unaware	Unsure	Total	Aware	Unaware	Total
Total (n = 345)	66.5	22.0	11.5	100.0	82.9	17.1	100.0
Western Sun (n = 182)	85.7	7.6	6.7	100.0	90.7	9.3	100.0
Mid-American (n = 183)	55.4	23.8	20.8	100.0	77.8	22.2	100.0
Southern (n = 36)	22.2	77.8	—	100.0	61.1	38.9	100.0

[a]By percentage of total

3.6. ATTITUDES GOVERNING THE USE OF PASSIVE SOLAR DESIGN IN THE BUILDING INDUSTRY: BARRIERS AND INCENTIVES

3.6.1 Barriers

The conservative nature of the building industry has meant in the past that new technologies undergo a long gestation period before being assimilated by builders, regulatory agencies, financiers, and consumers. Precedents set by other builders displaying applicability, reliability, and marketability should assist in facilitating the commercialization of passive solar design. However, according to the workshop results, lack of understanding of the sophisticated design process and performance, and a perceived high cost of construction were the leading barriers inhibiting full-scale adoption. On both the pre- and post-training forms, 10 possible barriers to passive space heating system construction were listed. Builders and designers indicated on the pre-training form that the top four barriers standing in the way of passive construction were:

- expense to build,
- lack of information about performance,
- lack of information on where to begin or who to talk to, and
- lack of financing options.

Other barriers listed on the form included "building code conflicts," "passive systems are not attractive," "passive solar homes do not sell as well as nonsolar homes," "technology is not well developed," and "lack of warranties." After the

workshop, perhaps realizing that passive solar design might be accomplished through design modifications rather than expensive structural and material additions, "expense to build" dropped from the first most important barrier to fourth. "Lack of information on where to begin or who to talk to" moved up as the first most important barrier. (See Appendix J for percentages presented in tables in Sec. 3.5.1).

Participants also identified barriers that were not categorized on the survey form. Those mentioned most frequently included:

- initial costs too high (despite a 7-10-yr payback period),
- reluctance to change and general sense of inertia, lack of confidence,
- scarcity of experienced firms offering service and maintenance,
- inadequate marketing,
- builders' hesitation to innovate and move into unknown areas,
- lack of government cooperation,
- lack of knowledge of sales potential,
- lack of information about cost and energy savings (questionable cost/benefit ratio),
- scarcity of supplies of services due to overdemand,

- o lack of commitment on the part of builders and consumers to conserve energy and maximize efficiency,
- o technology is still improving, and
- o overheating of solar systems in the summer (particularly in the south).

Not surprisingly, two out of the four most important barriers listed by builders attending the solar workshops are similar to the most troublesome problems facing the housing industry in general. A national survey of 520 builders, conducted by the Bureau of Building Marketing Research, stated that the high cost of mortgage money, the availability of financing, and general economic conditions were problems most commonly encountered by builders (McNeilly 1980, p. 76). It is to be expected that those factors troublesome to builders in the housing industry in general would be troublesome to builders seeking financing in a relatively new field such as passive solar design (see Appendix N for National Survey Results).

3.6.1.1 Barriers: By Region

The top four barriers varied slightly among the regions. "Lack of warranties" and "building code conflicts" tended to be more of a barrier for builders in the Western Sun region than other regions. In the Southern region, "lack of technology" was checked most frequently. A common problem among new technological innovations, perhaps more evident in the south, is an initial skepticism and belief that buying later is preferable, as the technology will improve with time. See Table 3-10 for the rank ordering of the four most important barriers.

Table 3-10. MOST IMPORTANT BARRIERS TO PASSIVE SOLAR CONSTRUCTION BY REGION

Builders and Designers Pre- and Post-Training

Barriers	Order of Importance by Region							
	All Builders		Western Sun		Mid-America		Southern	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Expense to build	1	4	1	4	1	3	2	2
Lack of performance information	2	2	2	2	2	2	1	—
Lack of information about where to begin or who to talk to	3	1	3	1	3	1	4	1
Lack of financing options	4	3	4	3	4	4	—	4
Lack of warranties	—	—	5	—	—	—	—	—
Technology not there	—	—	—	—	—	—	3	3
Building code conflicts	—	—	—	5	—	—	—	—

Rank Order: 1 = Most important, 2 = Next most important, etc.

3.6.1.2 Barriers: By Home-Builder Size and Solar Experience

What are the barriers that inhibit full-scale adoption of solar energy? Do they differ among builders depending on the number of homes they construct each year or by the amount of previous solar experience a builder has had? Survey results indicated that there is some variance to the barriers.

Size of Home Builder Firm

Among the very small volume builders (1-5 homes), "solar homes are not attractive" was a more important problem than "expense to build." For both the medium- (26 to 100 homes) and large- (more than 100 homes) volume builders "lack of technology" was among the top four barriers listed after the workshop. For the medium volume builder "expense to build" was the most inhibiting factor, and for the large volume builder "lack of information about performance" was the number one factor. "Expense to build" did not even appear among the top four for the large volume builder (see Table 3-11).

Amount of Solar Experience

For those builders who had never built a solar home before, insufficient information on where to begin or to whom to talk was the number one barrier listed on the post-training form. Lack of confidence in the technology was also cited as one of the top four barriers before the workshop. Those who had previously designed, installed, or used a solar system listed "lack of performance data" as their number one problem. They also listed "lack of financing options" and "building code

Table 3-11. MOST IMPORTANT BARRIERS TO PASSIVE SOLAR CONSTRUCTION BY SIZE OF HOME BUILDER

Builders and Designers Pre- and Post-Training

Barriers	All Builders (100%)		Size of Home Builder: Very Small (1-5) (44.4%)		Small (6-25) (33.1%)		Medium (26-100) (11.3%)		Large (100) (11.3%)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Expense to build	1	4	2	—	1	4	3	1	1	—
Lack of performance Information	2	2	1	2	2	2	1	4	3	1
Lack of information about where to begin	3	1	4	1	3	1	—	2	4	2
Lack of financing options	4	3	3	3	4	3	2	—	—	4
Passive solar homes not attractive	—	—	—	4	—	—	4	—	2	—
Technology not there	—	—	—	—	—	—	—	3	—	3

Rank Order: 1 = Most important, 2 = Next most important, etc.

conflicts" more often than those who had had no previous experience. "Expense to build" was one of the top barriers on the post-training form for all participants excluding those who had used solar systems before. See Table 3-12.

3.6.2 Incentives

Recent studies on market penetration of solar energy state that increased economic incentives such as tax credits and institutional incentives are necessary to ensure a transition to solar energy (Stobaugh 1979). Results from the workshop study indicate that although economic (tax credits) and institutional incentives (more appropriate financing options) were among the four most important incentives, "rapidly increasing gas and electric prices" was the number one incentive for more than 40% of the builder participants. In addition, participants often commented that "freedom from inflation, dwindling fuel supplies, and foreign control," and a "necessity to develop alternative energy sources and conserve gas and electricity," were among their top reasons for deciding to use solar design.

The top four factors that influence builders' decision to build a solar home did not differ after the workshop. (Appendix J shows how the frequency of responses did change.)

Table 3-12. MOST IMPORTANT BARRIERS TO PASSIVE SOLAR CONSTRUCTION BY SOLAR EXPERIENCE

Builders and Designers Pre- and Post-Training

Barriers	All Builders (100%)		Amount of Solar Experience							
			No experience (19.9%)		No plans to build (5.1%)		Seriously planning to build (39.1%)		Previous experience (35.9%)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Expense to build	1	4	1	2	1	3	2	4	2	—
Lack of performance information	2	2	2	3	4	2	1	3	1	1
Lack of information about where to begin	3	1	3	1	2	1	3	1	3	2
Lack of financing option	4	3	—	4	—	—	—	2	4	3
Technology not there	—	—	4	—	3	—	4	—	—	—
Building code conflicts	—	—	—	—	—	4	—	—	—	4

Rank order: 1 = Most important, 2 = Next most important, etc.

3.6.2.1 Incentives: By Region

Results showed that incentives remained fairly constant across all regions. However, "availability of blueprint and technical information" was more of an influence in the Mid-American and the Southern regions than in the Western region. Tax credits, because they represent a more substantial savings, were rated higher in Western Sun than in the Mid-American or the Southern regions* (See Table 3-13).

3.6.2.2 Incentives: By Home-Builder Size and Solar Experience

Size of Home Builder Firm

Incentives did not vary substantially among the different-sized firms in the post-training results. "Improved physical appearance" was checked more frequently among medium volume builders (26-100 homes) than the others, and "availability of blueprints and technical information" was more of a factor to the small volume builder (6-25 homes) (see Table 3-14).

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*Workshops evaluated in the Midwest were held in Missouri. Workshops evaluated in the South were held in Kentucky and Georgia. None of these states offer an income tax credit for solar design. Evidently, the federal tax credit is not a significant influence in the south. However, for over 60% of the Western attendees and 48% of the Mid-America attendees, tax credits were cited as one of the top three influences.

Table 3-13. MOST IMPORTANT INCENTIVES IN MAKING A DECISION TO BUILD A PASSIVE SOLAR HOME BY REGION

Builders and Designers Pre- and Post-Training

Incentives	Order of Importance by Region							
	All Builders		Western Sun		Mid-American		Southern	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Rapid increase in gas and electric prices	1	1	1	1	2	1	2	2
Consumer demand	2	2	2	4	1	2	1	1
Tax credits	3	3	3	2	3	3	3	—
Better financing for buyer	4	4	4	3	4	—	—	5
Blueprint and technical information	—	—	—	—	—	4	—	4
Warranties and performance guarantees	—	—	—	—	—	5	—	—
Better financing for builder	—	—	—	5	—	—	—	—
Improved physical appearance	—	—	—	—	—	—	—	3

Rank order: 1 = Most important, 2 = Next most important, etc.

Table 3-14. MOST IMPORTANT INCENTIVES IN MAKING A DECISION TO BUILD A PASSIVE SOLAR HOME BY SIZE OF HOME BUILDER

Pre- and Post-Training

Incentives	All Builders (100%)		Size of Home Builder							
			Custom (1-5) (43.9%)		Small (6-25) (33.3%)		Medium (26-100) (11.4%)		Large (more than 100) (11.4%)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Rapid increase in gas and electric prices	1	1	1	1	2	2	1	2	1	1
Consumer demand	2	2	2	2	1	1	2	1	2	2
Tax credits	3	3	3	3	3	3	3	4	3	3
Better financing for buyer	4	4	4	4	4	—	4	3	4	4
Blueprint & technical information	—	—	—	—	—	4	5	—	—	—
Improved physical appearance	—	—	—	—	—	—	—	5	—	—

Rank order: 1 = Most important, 2 = Next most important, etc.

Amount of Solar Experience

"Availability of blueprints and technical information" was more important after the workshop than "financing options" to those builders with no solar experience. "Financing of the builder" rather than "consumer demand" was the second most influential factor for those who had considered solar design but had no plans. The other categories reflected the total results (see Table 3-15).

Table 3-15. MOST IMPORTANT INCENTIVES IN MAKING A DECISION TO BUILD A PASSIVE SOLAR HOME BY SOLAR EXPERIENCE

Builders and Designers Pre- and Post-Training

Incentives	All Builders (100%)		Amount of Solar Experience							
			No Experience (19%)		No plans to build (3.6%)		Seriously planning to build (43.1%)		Previous experience (34.4%)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Rapid increase in gas and electric prices	1	1	1	2	1	1	1	1	1	1
Consumer demand	2	2	2	1	2	3	2	2	2	2
Tax Credits	3	3	3	4	4	4	3	3	3	3
Better financing for buyer	4	4	—	—	—	—	4	4	4	4
Better financing for builder	—	—	4	—	—	2	—	—	—	—
Blueprint and technical information	—	—	—	3	3	—	—	—	5	—
Warranty and performance guarantees	—	—	—	—	5	—	—	—	—	—

Rank order: 1 = Most important, 2 = Next most important, etc.

SECTION 4.0

TARGET TRAINING PROGRAMS FOR BUILDERS

4.1 SELECTING TARGET AUDIENCES

Determining builders' attitudes toward solar design provides a basis for developing training programs that promote the commercialization of solar design. But since home builders are not necessarily a homogeneous group, the barriers and the economic or marketing incentives they encounter vary. In particular, the decision-making process among home building firms differs depending on the volume of homes constructed.

Using the results of a survey completed by the National Association of Home Builders and the results of the solar workshops, this section provides data on what representative size firm is responsible for building the greatest percentage of homes in the United States. General background on the decision-making process within each representative size firm is also presented.

There is not a set method for choosing a target group of builders who will be most influential in promoting and using solar design. This section provides a variety of factors that should be taken into consideration when choosing target audiences for outreach and education programs. After the target audience has been defined, a description of specific training formats developed to meet the needs of builders who are potential adopters of solar design will be presented.

4.2 NATIONAL ASSOCIATION OF HOME BUILDERS SURVEY RESULTS

In 1976, the National Association of Home Builders conducted a survey of 1215 builders. Results showed that 61.6% of all single family units were built by 8.1% of the home builders. These homes were built by large firms (more than 100 homes per year). The small volume home builders, comprising 40.2% of all builders, were responsible for building only 4% of the homes constructed in 1976 (see Table 4-1).

These results are important for determining new target builders that will promote the commercialization of solar design in home building. Market research has shown that educational programs as well as economic and institutional incentives should be provided to encourage the initial 20% to 30% of the consumer market to use a given new product. Once initial adoption has been achieved, increasing returns in adoption will result through momentum generated by the early adopters (Roesner 1979, p. 14).

Research also shows that diffusion of a new product occurs in a concentric pattern, radiating from the core of early adopters (Midgley 1977). The contacts and influences of the early adopters can be very instrumental in promoting the commercialization of a new product. In promoting solar design among builders, this research raises an important question about future program development: should educational programs be designed to introduce the basic concepts of solar energy to a large number of people, or should efforts be concentrated on a chosen few by continuously providing progressively advanced follow-up material until they are using solar design on a full-scale and continued basis?

Table 4-1. NATIONAL STATISTICS ON SINGLE-FAMILY HOME BUILDERS

Number of Homes Built	Percentage of Builders	Percentage of Homes Built
Less than 10	40.2	4.0
10 - 25	26.6	9.1
26 - 50	15.8	11.7
51 - 100	9.2	13.6
101 - 500	7.2	42.8
more than 500	0.9	18.8
TOTAL	100.0	100.0

Source: Ahluwalia, Sheehan, and Sumichrast 1979.

Using the results of the NAHB survey, if 33.3% of the homes built by large volume builders were solar homes, then 20% of all new homes would be solar. This would involve convincing one-third of the 8.1% of large volume builders or 2.7% of all home builders.

On the other hand, 81% of the homes built by small volume builders (1-50 homes per year) would have to be solar homes before 20% of the new home market could be affected. This would involve convincing four-fifths of the 82.6% of small volume builders or 66.9% of all home builders to use solar design (see Table 4-2).

4.3 SOLAR WORKSHOP RESULTS

One method of determining the potential impact the solar workshops could have in convincing home builders to build solar homes is to total the number of new homes constructed, or affected, by all builder-participants and then categorize the builders by the volume of homes they construct each year.

Results indicated that the builders attending the solar workshops represented a total of 16,413 homes built in 1979-80. This represents 1.4% of the 1,194,000 total national housing starts in 1979. Results also showed that more than 50% of the builder-participants represented small volume firms and that they were responsible for building only 3% of the total homes built by all the participants. On the other hand, 3% of the builder-participants represented large volume firms and were responsible for 43% of the total homes constructed.

Table 4-2. CONVINCING HOME BUILDERS TO BUILD WITH SOLAR: AFFECTING 20% OF THE NEW HOME MARKET

Number of Homes Built	NAHB Survey		Percentage of Builders Needed to be Convinced To Build Solar Homes
	Percentage of Builders	Percentage of Homes Built	
1 - 50	82.6	24.8	66.9
51 - 100	9.2	13.6	30.4
more than 100	8.1	61.6	2.7
TOTAL	100.0	100.0	100.0

Table 4-3 shows the percentage of the 16,413 homes built by the builder-participants by home-builder size, and these results, although not identical, do parallel the results of the NAHB survey.

Analysis of the NAHB and Solar Workshop Surveys

One obvious conclusion to the results of the NAHB and the solar workshop surveys is that future educational and incentive programs that promote the commercialization of solar design in new residential construction should be oriented toward the larger volume home builders to affect the greatest proportion of the new home market with the expenditure of a lesser amount of resources.

However, as indicated earlier, the large-volume home builder is not as eager to adopt new features in home construction as is the smaller-volume builder. It was also shown that the smaller-volume home builders were in the more advanced stages of the decision-making process than were the larger volume home builders. In addition, the small volume home builder indicated the greatest intent to build a solar home following the one-day workshop. This leads to the conclusion that it may take a different scale of effort and package of information to convince the large volume home builder to build solar homes than is necessary to convince the small builder.

The Decision-Making Process by Volume of the Home Building Firm

Convincing any volume home builder to use solar design entails an understanding of the builder's business organization. The needs of a large, corporate builder are

Table 4-3. WORKSHOP RESULTS BY PERCENTAGE AND NUMBER OF HOMES BUILT

Number of Homes Built	Percentage of Builders	Percentage of Homes Built
Less than 10	54.2	3.1
10 - 25	20.4	4.4
26 - 50	7.1	3.9
51 - 100	5.3	5.9
101 - 500	9.8	39.5
More than 501	3.1	43.2
TOTAL	100.0	100.0

different than those of the custom home builder. According to one study of the home building industry:

> Builders using a "custom" process depend on client and/or consultant interactions in an individualized decision making process. . . . Solar design can be tried for the first time more easily by a custom builder. Supportive conditions, such as fewer budgetary limitations or an interested client, can provide an atmosphere under which solar design can be tested and demonstrated. (Booz-Allen 1980, pp 7-8.)

This same study goes on to describe other decision-making processes among the building industry depending on the sales volume of the firm. Many firms that build less than 200 homes per year rely on information obtained from outside sources including plan services for information on design and equipment. The study states that these firms, consisting of relatively small staffs, "gather and evaluate data from external sources of information while directing construction teams hired on an as-needed basis" (Booz-Allen 1980, p. 9).

Another type of firm in the home building industry is the large-volume, corporate firm. Dominated by an internal decision-making process, the large-volume firms

> . . . rely on in-house or hired staff, make decisions which relate to a large number of homes, and make their decision primarily on economic criteria. . . . Final decision making occurs at the highest level of management. Chief executive offices, financial and cost control offices and other top corporate managers are invalued in design and equipment decisions, since each design is reproduced many times. (Booz-Allen 1980, p. 4.)

Promoting a design style change among the large corporations involves institutional change within the decision-making hierarchy. This constitutes a much more

involved effort than convincing the small-volume or custom builder to change to a new design.

In developing new training programs for builders a dominant factor in promoting the use of solar design is to appropriate the right training package to the primary decision makers within the organization. Unfortunately, this report has a limited scope and cannot address this issue.

4.4 EDUCATIONAL NEEDS: WORKSHOP RESULTS

This section lists various topics from the workshop agenda that builder participants stated were particularly useful to them, topics that needed additional coverage, and topics they would like to see offered in the future. The subsequent section outlines specific training programs for builders depending on the volume of homes they build each year and the amount of solar experience they have had.

As discussed earlier, the workshop participants were considered "early adopters" of passive solar design in residential housing. The rate varied at which the participants have adopted or used solar design. The participants also determined which workshop presentations were especially helpful.

4.4.1 Topics Particularly Useful

The builders generally considered passive system design options and concepts to be the most useful information presented at the workshop. Builders who rely on the experiences of their peers to legitimize passive solar design considered case histories presented by local and regional builders to be the second most useful information. Presentation of the technical design details, including rules of thumb and installation instructions, ranked third in importance.

The majority of builders stated that the overall nature of the program was most helpful. In addition, when asked what was particularly useful to them, builders' comments included:

- wide variety of material presented without dwelling excessively in one area;
- simplicity of implementing solar design in residential buildings;
- dispelling the belief that solar heating was all active or mechanical;
- site orientation, window area, overhangs, house design, insulation, retrofits, greenhouses, and general information about available technology; and
- the handouts and workbook.

Builders who had used solar design before found the technical design information more valuable and case histories less valuable than those who had no experience. Importance of the workbook was predominantly mentioned by those who had solar design experience.

4.4.2 Presentations Needing Improvement and Future Topics

Of the builders who responded to the question regarding what could be improved, 27% stated that details on technical design and construction were inadequate. Architects, in particular, needed more information in this area.

The second comment mentioned most often was a request to improve the speaker's presentation and media materials ("A poor presentation can suggest a poor product").

Other suggestions to improve future workshops included:

- Have a more complete display of materials and supplies available.
- Make arrangements for attendees to have access to speakers and follow-up resources. Provide actual performance data on installed systems including initial costs, calculated losses and efficiencies, and operating costs.
- Demonstrate different models.
- Present a selection of detailed plans that may be used to obtain bids for every phase of construction.
- Have detailed drawings available.
- Have solar homeowners discuss the advantages and disadvantages from a consumer's point of view.
- Inform the builder of ways to convince consumers to install solar systems in their home.
- Attract a wider audience (general public, utility companies, teachers, etc.).
- Increase it to a two-day program.

- Have an advanced level seminar.
- Present less material, and provide more time.
- Needs more detailed information on techniques, materials, and feedback from other builders.
- Feature a small group discussion after the lectures.
- Provide more workshop type classes, less lecture; have students work on techniques while the instructor teaches.
- Include a solar homes tour or field trip.
- Provide warranty data for consumers.
- Provide a book listing national and regional manufacturers of solar materials.
- Discuss contractor-builder liabilities.
- Discuss consumer responsibilities.
- Discuss specific case histories of mass installations of single-family development. Provide a step-by-step analysis.
- Present studies on salability of solar versus conventional homes.
- Detail code problems with installation.
- Present life-cycle cost analysis and projected monthly savings.

Participants were also asked to list topics they would like to see covered in future workshops that were not offered in the pilot series. Cooling systems, hybrid and active systems, underground homes, solar domestic hot water, and commercial heating were the topics listed most frequently.

Table 4-4 lists the participants response rate to the questions regarding particularly useful topics and topics they would like to see covered in the future.

Table 4-4. EDUCATIONAL NEEDS: BUILDERS RESPONSES

Topics		Response (%)
Particularly Useful		
Passive systems and design		30.9
Case histories		24.4
Technical design details		15.3
Workbook		8.3
State incentives and policy		5.8
Marketing considerations		5.8
Other		4.4
Financing details		3.3
Solar Access		1.8
TOTAL		100
Need More Information About		
Technical design details		26.9
Improve speakers' presentation		15.7
Passive design details		13.4
Case histories by builders		12.0
Marketing information		11.1
Other		4.6
Financing details		4.2
State incentives and policy information		3.7
Less technical design details		3.2
Solar access		1.9
Building code information		1.4
Less solar access detail		0.9
Less state incentive and policy information		0.5
Less financing details		0.5
TOTAL		100
In The Future		
Cooling		39.2
Hybrid and/or active systems		11.2
Underground homes		9.6
Solar domestic hot water (DHW)		6.4
Commercial heating		4.0
Other		29.6
Computer simulation and design tools	6.5	
Profile of solar home buyers	4.6	
Swimming pool heaters	4.6	
Thermal shades	2.8	
Back up heating systems	2.8	
Solar home tour	1.8	
Envelope homes	1.8	
Conservation (insulation, weather-stripping)	1.8	
Mobile home retrofit	0.9	
Landscape and shading	0.9	
Concrete dwellings	0.9	
TOTAL		100

4.5 REVISED TRAINING FORMATS DESIGNED FOR SPECIFIC TARGET AUDIENCES

Based on the responses of the workshop participants, different training formats have been developed to address the needs of home builders by the number of homes they build each year. The master agenda is listed first and is based on the format used in the pilot series of workshops. It incorporates the suggestions made by the participants.

4.5.1 Master Agenda

I. Welcome and Introduction

Welcoming remarks provided by local Home Builder Association official.

II. The Problem

1. Energy Overview.

   Discuss past energy resources and transitions.

2. Define short- and long- range economic and energy issues, problems, and solutions.

   A. Discuss energy alternatives and options for the future.

   B. Discuss economic and social advantages and disadvantages of conventional energy sources and solar energy.

   C. Discuss potential barriers and myths associated with the commerialization of solar energy, as commonly identified by builders and

homeowners. Lead into purpose and description of the workshop agenda.

III. Introduction to Passive Solar Design

1. Introduce passive solar techniques (heating and cooling methods).
   A. Present the basic theory of sun tempering; include
      a. solar geometry and the ecliptic,
      b. site orientation (appropriate subdivision lay-out and house orientation), and
      c. principles of heat transfer (conduction, convection, and radiation).
   B. Present the principles of energy efficient design and conservation measures; include
      a. insulation before insolation, and
      b. building thermal retention.
   C. Describe passive solar design; include
      a. glazing techniques: direct and indirect gain techniques,
      b. thermal mass: heat capture, transport, and storage,
      c. shading and overhangs, and
      d. night insulation.
2. Discuss advantages and disadvantages of passive, active, and hybrid systems; include
   A. technical description of solar domestic hot water
   B. advantages and disadvantages of generic systems.

IV. Technical Design Details

1. Give technical description and details of passive solar systems; include
   A. construction details: sizing of systems,
   B. installation guidelines and standards,
   C. rules of thumb,
   D. design tools and computer simulations, and
   E. performance criteria

V. Economic Cost/Benefits Of Passive Solar Systems

1. Explain solar economics; include
   A. life cycle costs,
   B. initial cost estimates,
   C. payback periods, and
   D. first year savings.
2. Discuss the solar investment as an edge against inflating energy costs.

VI. Discussion of Builder Concerns

1. Provide an overview of local building codes that influence passive solar design in residential buildings; e.g., FHA restrictions; solar access laws; zoning.
2. Discuss builder liabilities.
3. Discuss financing for the builders and homeowners.
4. Discuss the role that utilities play in the commercialization of solar energy (e.g., the Residential Conservation Service).
5. Discuss where to go for hardware.
6. Questions and answers.

VII. Case Studies

Examples of successes and problems presented by experienced and reputable solar builders.

VIII. Marketing

1. Discuss marketing as an energy conservation package and recognize that solar systems alone will not sell the home.
2. Discuss the economic cost/benefits of solar energy as a marketing tool.
3. Present the state and federal tax credits, and other applicable incentive programs.
4. Discuss marketing techniques and methods of educating the consumer. Include a profile of the potential solar home buyer.

IX. Resources in the Solar Energy Field

1. Discuss local, regional, and national resources and contact persons available for immediate reference; include
   A. solar consultants, suppliers, installers;
   B. architects and designers;
   C. Solar Energy Research Institute and Regional Solar Energy Centers;
   D. hotlines; and
   E. bibliographies.
2. Provide a schedule of future workshops to be held in the region.

X. Topical Session: Small Groups

Provide a variety of session options that address specific topics; e.g., DHW, installation, information sources, subdivision development, solar access,

financing, tax credits, design tools, case studies, problems, retrofit, hands-on demonstrations, consumer education.

XI. Display of Model Systems, Equipment, and Market Literature

Display systems and equipment by local distributors during lunch, breaks, and before and after the workshop.

XII. Hand-Out Materials and Text

Prepare a text in the form of a workbook including notes and supplemental reading materials covering the contents of the workshop. Workbook should be made available to the participants before the workshop.

4.5.2 Training Topics

Tables 4-5, 4-6, and 4-7 present training topics for the small-volume builder, the medium-volume builder, and the large-volume builders, respectively. Topics of discussion are ranked and separated into the various stages of adoption. Also included are the most important barriers and incentives to passive solar construction.

Table 4-5. SMALL HOME BUILDER TRAINING TOPICS

(Volume: 1-25 homes per year)

Adoption Stages	Order of Needs		
	Topics Particularly Useful	Need More Information About	Future Topics
Awareness and Interest	passive system design concepts case histories	passive system design concepts technical design details marketing case histories	hybrid and active systems industrial heating
Evaluation	passive system design concepts case histories technical design details workbook marketing information	technical design detail passive system design concepts marketing information case histories	cooling systems underground homes DHW active and hybrid systems
Trial	passive systems technical design details case histories workbook	technical design details case histories passive system design concepts marketing information solar access building code information	cooling systems active and hybrid systems underground homes DHW industrial heating sunspaces

OTHER CONSIDERATIONS:

Most Important Barriers	Most Important Incentives
Lack of performance information	Rapid increase in gas and electric prices
Expense to build	Consumer demand
Lack of financing options	Tax credits
Lack of information about who to talk to or where to begin	Better financing for buyers

Table 4-6. MEDIUM HOME BUILDER TRAINING TOPICS

(Volume: 26-100 homes per year)

Adoption Stages	Order of Needs		
	Topics Particularly Useful	Need More Information About	Future Topics
Awareness and Interest	passive system design concepts	case histories	
Evaluation	case histories marketing	lending and financing options	cooling systems
Trial	passive system design concepts workbook technical design details	lending and financing options technical design details marketing information case histories	underground homes industrial heating DHW

OTHER CONSIDERATIONS:

Most Important Barriers
- Lack of performance information
- Lack of financing options
- Expense to build
- Passive solar not attractive
- Technology is not there

Most Important Incentives
- Rapid increase in gas and electric costs
- Consumer demand
- Tax credits
- Better financing for buyers
- Improved appearance

Table 4-7. LARGE HOME BUILDER TRAINING TOPICS

(Volume: More than 100 homes per year)

Adoption Stages	Order of Needs		
	Topics Particularly Useful	Need More Information About	Future Topics
Awareness and Interest	case histories passive system design concepts marketing	technical design details passive system design concepts building codes	
Evaluation	case histories passive system design concepts technical design details workbook solar access tax credits	technical design details passive system design concepts marketing information case histories	
Trial	passive system design concepts technical design details lending and financing options case histories		cooling systems DHW

OTHER CONSIDERATIONS:

Most Important Barriers
- Expense to build
- Passive solar homes are not attractive
- Lack of performance information
- Lack of information about who to talk to or where to begin
- Technology not there
- Lack of financing options

Most Important Incentives
- Rapid increase in gas and electric costs
- Consumer demand
- Tax credits
- Better financing for buyer

4.6 REGIONAL HOUSING STARTS

Determining the target group of builders by volume of homes built might provide a basis for developing programs that promote solar design in new construction. Another approach might be to focus on where new housing starts are the highest. According to 1979 census data, of the 1,194,000 homes constructed in 1979, 43.7% were built in the South, 25.6% were built in the West, 20.4% in Mid-America, and 10.3% in the Northeast. Table 4-8 shows the results of a study completed in 1978 indicating the projected location of new construction for the years 1975 through 1985.

Table 4-8. LOCATION OF NEW CONSTRUCTION 1975-85

(In millions of housing units)

Region	New Housing Starts
South	8.77 to 9.78
West	4.45 to 5.02
Mid-America	4.05 to 4.51
Northeast	3.00 to 3.31

Source: Van Houten, 1978

SECTION 5.0

CONCLUSIONS

The major objective of the workshops was to promote the commercialization of solar design in the home-building industry by:

- educating the home-builder in passive solar design techniques,
- promoting favorable attitudes toward solar design, and
- motivating builders to use solar design in residential construction.

Based on the responses of the workshop participants, the project was considered successful. An impressive 95.4% of the participants stated they would recommend this workshop to other builders. One attendee in Missouri commented: "Our entire sales staff (175 members) should attend the next workshop as well as all builders in the area." In rating the workshop contents, 91.9% of the participants indicated that it was good or excellent and 85.6% indicated that the presentation of the material was good or excellent. (See Appendix K for response of all participants and regional results.)

Results strongly indicated that builder's attitudes toward solar design did change favorably, as did their intent to build using solar technologies. Since the pre- and post-training forms are the sole basis for this report, it is not possible to determine whether the participants have actually followed through on the commitment to use solar design either on a trial or continuous basis.

As stated throughout this report and based on previous research on the diffusion of innovations, change occurs in incremental stages. A brief introduction to solar design does not provide a sufficient basis for making the transition from conventional to solar design for most builders. Builders who have had little or no previous exposure to solar design will probably need continuous access to information and the precedence of other builders. Builders who have used solar design before need to be continuously informed in this new dynamic field.

Studies have shown that as the risk factor associated with change increases, so does the need for increased information (Rogers and Shoemaker 1971). Participants at the workshop clearly indicated that the lack of information about where to begin or who to consult was the number one barrier to solar construction. The evidence in this report does not directly indicate that solar design is perceived as a large risk; however, the findings by Rogers and Shoemaker regarding perceived risks and subsequent need for information might lead to that conclusion.

The entire scope of possible informational programs is far-reaching. Below are suggestions for expanding educational outreach; the list is not intended to be complete.

- One program worth noting for its format, ability to provide tangible evidence for others to see, and ability to mitigate the financial and social risks involved in making a design change is the Denver Builders' Program. A pilot program, it works with local builders in providing financing for solar consultants, design reviews, continuous educational seminars, and model

homes open to the public. (Currently, contact SERI, Denver Builders' Program Manager for more information.)

Other, less involved, but just as important formats, might include:

- One-day workshops similar to those described in this report.
- Short 1-2-hour miniseminars that could be integrated into meetings regularly sponsored by local builder organizations. Topics could include an overview of passive solar design; technical design details for more advanced groups; marketing strategies; state and federal tax incentives; solar access; educating the buyer; design reviews; energy conservation through insulation and weatherstripping; and retrofit problems.
- A solar-update newsletter to be sent as a follow-up to workshop participants. Include local resources and suppliers, addresses of solar homes and solar home-builders, other workshops, bibliography, soalr information magazines, and resource people who can help mitigate problems.
- An educational package sent as follow-up to workshop participants including: Solar home buyer profile, marketing tips, evaluation of workshops they have attended, additional case histories, etc.
- Regional toll-free numbers available to home builders that provide advice and problem-solving.
- Possible audiences to be addressed in new residential construction include:
  - Real estate developers and agents:

    Builders await evidence of consumer acceptance. The real estate agent is in direct contact with the buyer. The agent's ability to educate the buyer is a marketing tool.

- Building code officials, financiers, utility company representatives, educators, and suppliers:

  These groups should be included in the builder workshops to promote increased communication among all institutions that influence the commercialization of passive solar design.

- Subcontractors (HVAC, plumbing, solar design, etc.)

  A national survey of home builders (McNeilly 1980, p. 72) stated that 65% of the builders surveyed used subcontractors. These subcontractors could have a significant influence in home building.

- Builders who have had no previous exposure to solar design:

  An attempt should be made to introduce the passive solar design to the builder least likely to adapt it. One-to-two-hour seminars could be integrated into the meetings of local home builder organizations. A general overview and listing of resources and future workshops should be made available. Seminars should be presented by respected local solar home builders.

SECTION 6.0

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APPENDIX A

ORGANIZATIONS INVOLVED IN WORKSHOP DEVELOPMENT AND IMPLEMENTATION

ORGANIZATIONS INVOLVED IN WORKSHOP DEVELOPMENT AND IMPLEMENTATION

Workshop Advanced Planning, Coordination, Development, and Review:

- National Association of Home-Builders
- Solar Energy Research Institute
- Regional Solar Centers

Workshop Development, Implementation, and Review:

- State and Local Builder Organization
- State and Local Government

Associated Organizations:

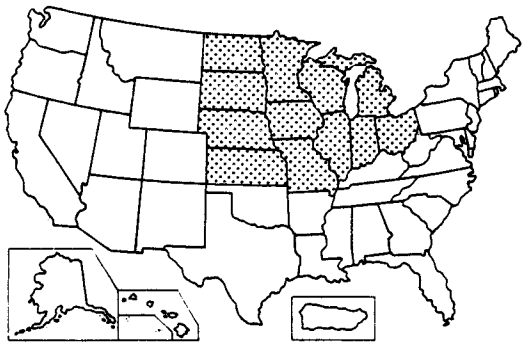
- National Savings & Loan
- Solar Industries Association
- American Banking Association
- Building Code Association
- Sheet Metal Workers Industries Association
- State and Regional Solar Energy Association

APPENDIX B

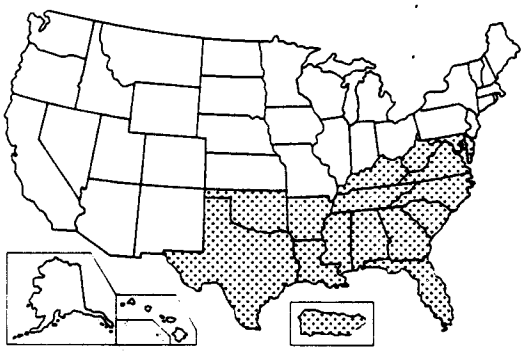
REGIONAL SOLAR ENERGY CENTERS

Regional Solar Energy Centers

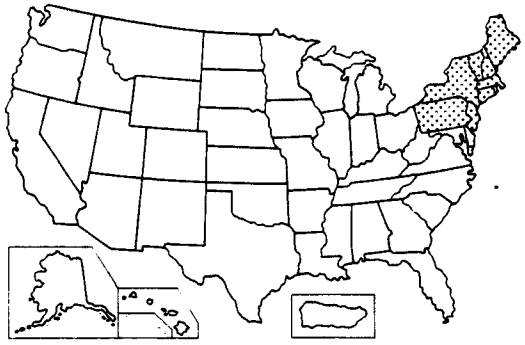
In addition to the national Solar Energy Research Institute, the Department of Energy funds four Regional Solar Energy Centers (RSECs) whose focus is moving solar technology into the marketplace. RSECs work closely with state energy offices, industry, and varied organizations within their regions to provide general solar information and technical assistance through onsite libraries, computerized data systems, seminars and workshops, and distribution of reports. Scope of services will vary for each region.



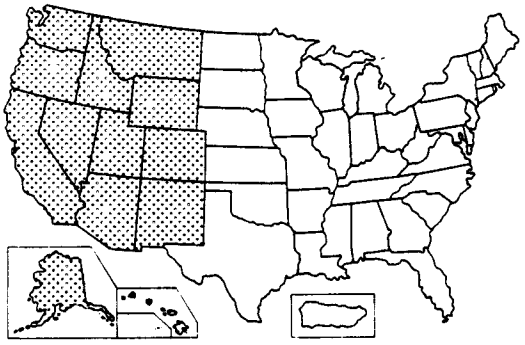
Mid-American Solar Energy Complex (MASEC)
8140 26th Avenue S.
Minneapolis, MN 55121
(612) 452-5300



Southern Solar Energy Center (SSEC)
61 Perimeter Park
Atlanta, GA 30341
(404) 458-8765



Northeast Solar Energy Center (NESEC)
470 Atlantic Avenue
Boston, MA 02110
(617) 292-9250



Western Solar Utilization Network (WSUN)
715 S.W. Morrison, Suite 800
Portland, OR 97205
(503) 241-1222

Taken from the **Wind Energy Information Directory**, 1980 (May)
SERI/SP-69-290R

APPENDIX C

PRE- AND POST-TRAINING FORMS

Preregistration Form

(The purpose of this information on participants is to help us make the workshop as practical as possible for those of you who plan to attend)

I. What has your experience been in designing or building passive heated homes? (Please circle proper number)

1. This is my firxt exposure to passive solar design
2. Considered solar, but have no plans to use in near future.
3. Seriously considered and plan to use solar in near future.
4. Have designed, installed or used solar systems.

II. What do you think are the four most important barriers that stand in the way of passive space heating system construction? (Please rank four barriers, 1 = most important, 2 = next most important, etc.)

___ 1. Building code conflicts
___ 2. Expense to build
___ 3. Lack of information about performance
___ 4. Passive systems are not attractive
___ 5. Lack of information on where to begin or who to talk to
___ 6. Passive solar homes don't sell as well as non-solar homes
___ 7. Lack of financing options
___ 8. Technology is not well-developed
___ 9. Lack of warranties
___ 10. Other (Please specify) _____

III. How likely is it that you will design or build a passive solar home

a. in the next 6 months? (Please circle proper number)

1. Very Likely 2. Likely 3. Unsure 4. Unlikely 5. Very Unlikely

b. in the next 18 months? (Please circle proper number)

1. Very Likely 2. Likely 3. Unsure 4. Unlikely 5. Very Unlikely

IV. Which of the following reasons have, or would, most influence (d) your decision to design or build a passive solar home? (Please rank four reasons; 1 = most important, 2 = next most important, etc.)

___ 1. Speedy inspection and approvals
___ 2. Warranty and performance guarantees
___ 3. Rapid increase in gas and electric prices
___ 4. Tax credits
___ 5. Consumer demand
___ 6. Better financing for builder
___ 7. Improved physical appearance
___ 8. Blueprints and technical info
___ 9. Better financing for buyer
___ 10. Other (Please specify) _____

V. Which of the following best describes your current occupation? (Please circle proper number)

1. Developer or Planner
2. General Contractor
3. Sub-contractor (HVAC, solar, etc.)
4. Architect, Designer or Draftsman
5. Supplier, Manufacturer, Sales, or Marketing
6. Engineer
7. Financer or Appraiser
8. General Public, Student or Other
9. Educator or Consultant
10. Building Code Inspector or Government Representative
11. Other _____ Consultant

IV. In the past what source of passive solar information has been most useful to you? (Circle proper number)

1. Handbook
2. Other Builders
3. Suppliers or Distributors
4. Seminar (1-2 hours)
5. Workshop (1-2 days)
6. University Course
7. Other _____

VII. To ensure a complete evaluation of the workshop, please write your name, or initials, company and address on both the pre-registration and post-evaluation forms.

Name/company _____

Address _____

City and State _____

Workshop Feedback

(The purpose of this information is to assist us in improving future workshops. Thank you for your assistance.)

I. How do you rate the content of the Workshop? (Please circle proper number)

1. Poor 2. Fair 3. Good 4. Excellent

II. How do you rate the presentation of the Workshop material? (Please circle proper number)

1. Excellent 2. Good 3. Fair 4. Poor

III. Before attending today's Workshop were you aware of: (Please circle proper number)

a. Whether solar tax credits are available in your home state? 1. Yes 2. No

b. The federal solar tax credits? 1. Yes 2. No

IV. In this Workshop, what did you find particularly useful? (Please specify)

V. What do you think could be improved in this Workshop? (Please specify)

VI. What other topics would you like to see covered in future Workshops? (Please specify)

VII. How likely is it that you will design or build a passive solar home?

a. in the next 6 months? (Please circle proper number)

1. Very Likely 2. Likely 3. Unsure 4. Unlikely 5. Very Unlikely

b. in the next 18 months? (Please circle proper number)

1. Very Likely 2. Likely 3. Unsure 4. Unlikely 5. Very Unlikely

VIII. What do you think are the four most important barriers that stand in the way of passive solar space heating construction? (Please rank four barriers; 1 = most important, 1 = next most important, etc.)

___ 1. Lack of Warranties

___ 2. Technology is not well developed

___ 3. Lack of financing options

___ 4. Passive solar homes don't sell as well as non-solar homes

___ 5. Lack of information on where to begin or whom to talk to

___ 6. Passive systems are not attractive

___ 7. Lack of performance information

___ 8. Building code conflicts

___ 9. Expense to build

___ 10. Other (Please specify _____

IX. Which of the following reasons have, or would, most influence (d) your decision to design or build a passive solar home? (Please rank four reasons; 1 = most important, 2 = next most important, etc.)

___ 1. Better financing for buyer
___ 2. Speedy inspections and approval
___ 3. Blue prints and technical information
___ 4. Improved physical appearance
___ 5. Better financing for builder
___ 6. Consumer demand
___ 7. Tax credits
___ 8. Rapid increase in gas and electric prices
___ 9. Warranty and performance guarantees
___ 10. Other (Please specify) _____

X. a) Have you ever designed, built, or used a passive solar building? ___Yes ___No

b) If yes, what problems if any have you encountered? (Please circle proper numbers)

1. No problems
2. Installation quality problems
3. Delays due to code conflicts
4. Financing of the builder
5. Financing of the buyer
6. Locating reputable designers or hardware manufacturers
7. Difficulty in selling passive solar homes
8. Other (Please specify)_____

XI. How long have you been in your present occupation? _____ Number of Years

XII. Which of the following best describes your current occupation? (Please circle proper number)

1. Developer or Planner
2. General Contractor
3. Sub-contractor (HVAC, solar, etc.)
4. Architect, Designer or Draftsman
5. Supplier, Manufacturer, Sales, or Marketing
6. Engineer
7. Financer or Appraiser
8. General Public, Student or Other
9. Educator or Consultant
10. Building Code Inspector or Government Representative

XIII. What is the approximate number of homes you built or designed in the last year, if any?

XIV. Would you recommend this Workshop to other builders or designers? (Please specify)

___ No ___ Yes

XV. To ensure a complete evaluation of the workshop, please write your name or initials, company and address.

Name/company _____
Address _____
City and State _____

APPENDIX D

NUMBER OF PRE- AND POST-TRAINING FORMS RETURNED BY REGION

NUMBER OF PRE- AND POST-TRAINING FORMS RETURNED BY REGION

	Number of Pre-Forms	Number of Post-Forms	Total Number of Forms	Both Pre- and Post-Form Returned by Same Person
Western Sun	272	275	547	125
Mid-America	224	187	411	157
Southern	72	69	141	7
Total	568	531	1099	289

APPENDIX E

NATIONAL STATISTICS ON HOME BUILDERS

Table E-1. NATIONAL STATISTICS ON NUMBER OF YEARS IN BUSINESS BY HOME BUILDER SIZE

No. of years in business	Size of Home Builder (Units Started)				
	1-10	10-25	26-100	101-500	more than 500
less than 5	46.2	32.8	22.9	23.2	5.6
5-9	20.6	25.9	21.9	21.1	11.1
10-14	9.4	11.9	16.6	12.6	27.8
15-19	7.2	9.1	13.3	14.7	11.1
more than 20	16.6	20.3	25.1	28.4	44.4
	100%	100%	100%	100%	100%

Source: National Association of Home-Builders, 1976 (Ahlowalia 1979).

Table E-2. NATIONAL STATISTICS ON THE SIZE OF HOME BUILDERS
[Single Family Builders (%)]

Number of Homes Built	National	Regions			
		Western Sun	Mid-America	South	N.E.
1-10	38.9	27.6	44.4	41.8	36.2
10-25	26.8	20.4	25.6	29.3	32.3
26-50	15.6	18.9	13.5	16.0	15.7
51-100	9.3	14.6	7.4	9.4	5.5
101-500	7.8	15.0	7.7	3.2	7.9
more than 500	1.5	3.4	1.3	.35	2.4
TOTAL (%)	100.0	100.0	100.0	100.0	100.0

Source: National Association of Home Builders, 1976 (Ahlowalia 1979).

Table E-3. SOLAR WORKSHOP RESULTS[a]
[Size of Home Builder (%)]

Number of Homes Built	Total	Regions		
		Western Sun	Mid-America	Southern
1-10	54.2	42.5	68.5	50.0
10-25	20.4	16.0	18.5	46.2
26-50	7.1	8.5	6.5	3.8
51-100	5.3	10.4	1.1	0.0
101-500	9.8	16.0	5.4	0.0
more than 500	3.1	6.6	0.0	0.0
TOTAL	100.0	100.0	100.0	100.0

[a]204 builders surveyed.

APPENDIX F

RESULTS OF PARTICIPANTS RESPONSES BEFORE AND AFTER WORKSHOPS

Table F-1. AMOUNT OF SOLAR EXPERIENCE BY REGION[a]
(All Participants)

Regions	Awareness Stage No experience with solar systems	Interest Stage Considered solar design but have no plans in the near future	Evaluation Stage Seriously considered, and plan to use solar in the near future	Trial Stage Have designed, installed, or use solar systems	Total
Total n = 545	25.0	6.4	37.2	31.4	100.0
Western Sun n = 256	26.6	5.1	34.8	33.6	100.0
Mid-America n = 217	21.7	5.5	39.6	33.2	100.0
Southern n = 47	25.5	10.6	38.3	25.5	100.0

[a]By percentage of total

Table F-2. LIKELIHOOD OF BUILDING OR DESIGNING A PASSIVE SOLAR HOME IN THE NEAR FUTURE
(Pre- and Post-Training Results)

Builders and Designers	Likelihood to Use Solar[a]					
	Very Likely	Likely	Unsure	Unlikely	Very Unlikely	Total
Pre Workshop						
6 mo. n = 391	32.0	23.8	24.3	11.5	8.4	100.0
18 mo. n = 348	39.1	32.2	19.8	5.5	3.4	100.0
Post Workshop						
6 mo. n = 343	39.9	22.4	19.8	12.2	5.5	100.0
18 mo. n = 310	51.6	28.2	12.3	4.7	3.2	100.0

[a]By percentage of total

Table F-3. LIKELIHOOD TO BUILD A PASSIVE SOLAR HOME IN 6 MONTHS AND 18 MONTHS: PRE- AND POST-TRAINING RESULTS BY REGION
(Builders and Designers)

Region	Likelihood to Use Solar[a]					
	Very Likely	Likely	Unsure	Unlikely	Very Unlikely	Total
Western Sun[b]						
6 months n = 80						
Pre	31.3	21.2	26.2	7.5	13.7	100.0
Post	41.3	17.5	18.8	13.7	8.8	100.0
18 months n = 73						
Pre	45.2	21.9	21.9	6.8	4.1	100.0
Post	47.9	24.7	17.8	5.5	4.1	100.0
Mid-America[b]						
6 months n = 114						
Pre	35.1	21.9	27.2	11.4	4.4	100.0
Post	37.7	21.1	26.3	13.2	1.8	100.0
18 months n = 100						
Pre	49.0	27.0	15.0	6.0	3.0	100.0
Post	50.0	32.0	10.0	7.0	1.0	100.0
Southern[b]						
6 months						
Pre n = 46	28.3	17.4	28.3	19.6	6.5	100.0
Post n = 36	50.0	13.9	16.7	11.1	8.3	100.0
18 months						
Pre n = 42	42.9	23.8	26.2	4.8	2.4	100.0
Post n = 33	54.5	27.3	15.2	3.0	0	100.0

[a]By percentage of total

[b]Western Sun and Mid-America percentages are based on the same number of responses in the pre and post set. The Southern region, because of the low frequency of responses is based on total number of pre- and post-training responses.

Table F-4. AMOUNT OF SOLAR EXPERIENCE AND LIKELIHOOD TO BUILD OR DESIGN A PASSIVE SOLR HOME IN THE NEAR FUTURE
(Builders and Designers)

Solar Experience	Likelihood to Use Solar[a]				
	Very Likely	Likely	Unsure	Unlikely	Very Unlikely
Pre 6 mo. n = 195	6 mo	6 mo	6 mo	6 mo	6 mo
No solar experience (19.0%)	5.4	16.2	43.2	10.8	24.3
Considered solar, but have no plans (4.1%)	0	0	37.5	37.5	25.0
Seriously plan to use solar (43.1%)	22.6	26.2	34.5	11.9	4.8
Used solar (33.8%)	63.6	22.7	6.1	4.5	3.0
Pre 18 mo. n = 179	18 mo	18 mo	18 mo	18 mo	18 mo
No solar experience (19%)	23.5	32.4	23.5	11.8	8.8
Considered solar, but have no plans (4.5%)	0	25.0	37.5	25.0	12.5
Seriously plan to use solar (43.6%)	42.3	32.1	19.2	2.6	3.8
Used solar (33.0%)	72.9	10.2	11.9	5.1	0
Post 6 mo. n = 198	6 mo	6 mo	6 mo	6 mo	6 mo
No solar experience (18.7%)	10.8	13.5	45.9	16.2	13.5
Considered solar, but have no plans (4.0%)	0	0	50.0	37.5	12.5
Seriously plan to use solar (42.9%)	34.1	23.5	23.5	15.3	3.5
Used solar (34.3%)	64.7	19.1	7.4	7.4	1.5
Post 18 mo. n = 183	18 mo	18 mo	18 mo	18 mo	18 mo
No solar experience (19.1%)	20.0	40.0	25.7	5.7	8.6
Considered solar, but have no plans (4.4%)	0	50.0	12.5	37.5	0
Seriously plan to use solar (43.2%)	49.4	35.4	10.1	3.8	1.3
Used solar (33.3%)	75.4	9.8	9.8	4.9	0

[a]By percentage of total

APPENDIX G

PARTICIPANTS WHO HAD BUILT, DESIGNED, OR USED A SOLAR HOME

Table G-1. PERCENTAGE OF PARTICIPANTS

	Had used solar	Had not used solar	Total
Builders and Designers (n = 341)	35.8	64.2	100.0
Other (n = 166)	18.7	81.3	100.0
Total (n = 507)	30.2	69.8	100.0

Table G-2. PROBLEMS ENCOUNTERED BY PARTICIPANTS
(All Participants)

Problems[b]	Total n = 135	Regions[a] Western Sun n = 73	Mid-America n = 52	Southern n = 10
No Problems	33.6	31.5	34.6	50.0
Problems	66.4	68.5	65.4	50.0
Locating reputable designers or hardware manufacturers	25.5	21.9	28.8	20.0
Installation quality problems	21.2	24.7	13.5	20.0
Delays due to building code conflicts	19.0	27.4	—	—
Financing of the builder	16.8	12.3	25.0	10.0
Financing of the buyer	17.5	17.8	21.2	—
Difficulty in selling passive solar homes	14.6	17.8	13.5	—
Other	2.9	2.7	—	—

[a]By percentage of total

[b]Categories of problems are not mutually exclusive.

APPENDIX H

MOST TROUBLESOME PROBLEMS BY PERCENTAGE

THE MOST TROUBLESOME PROBLEMS FACED BY BUILDERS

Problems	%
Cost of mortgage money	65
Availability of financing	47
Economic conditions	30
Increased materials costs	28
Quality of labor	22
Lack of qualified buyers	21
Environmental/govt. regulations	16
Increased land cost	13
Higher selling prices	10
Availability of good land	9
Availability of labor	7
Quality control	6

Source: Bureau of Building Marketing Research. 1980 (July). "1980 Profile: The Builders of America." Professional Builder. Vol. 45 (No. 7): p 76. 520 Builders surveyed.

APPENDIX I

STATE INCOME AND PROPERTY TAX INCENTIVES

Income Tax Incentives

	Duration	Measurement Formula	Deduction or Credit	Eligible Taxpayer: Residential Installer/Owner	Costs: Installation	Costs: Supp. Equip.	Costs: Remodel	Eligible Tech.	SHACOB	Passive	H. Water	Wind	Biomass	PV	Hydro	Building
Alabama																
Alaska	12-31-82	No 1	C	●		●	●		●		●	●	●		●	R
* Arizona	12-31-89	35 less a year	C,D	●	●	●			●	●	●	●	●	●	●	R,C
Arkansas	12-31-89	No 3	D	●		●			●	●	●	●	●		●	R,C
* California	1-1-81	No 4	C		●	●			●	●	●	●		●		R,C
Colorado		No 3	D	●	●	●	●		●	●	●	●				R,C
Connecticut																
Delaware		No 1	C	●	●		●				●					R
Florida																
* Georgia																
Hawaii	12-31-81	No 5	C	●	●				●	●	●	●	●			R,C
Idaho		No 6	D		●		●	●	●		●	●	●	●		R
Illinois																
Indiana																
Iowa																
Kansas	7-1-83	No 7	C,D	●	●	●		●	●		●	●		●		R,C
* Kentucky																
Louisiana																
Maine																
Maryland																
Massachusetts		No 3	D		●	●		●	●		●					C
Michigan			C	●	●				●	●	●	●			●	R
Minnesota	12-31-82		C	●	●		●		●	●	●	●	●			R
Mississippi																
* Missouri																
Montana	12-31-82	No 8	C	●	●	●	●		●	●	●	●	●		●	R
Nebraska		No 9	D	●	●	●	●		●	●	●	●	●		●	R,C
* Nevada																
New Hampshire																
New Jersey																
New Mexico		No 7	Rebate	●	●	●			●	●	●					R
New York																
North Carolina		No 7	C	●		●	●		●		●					R,C
North Dakota		No 10	C	●		●	●		●	●	●	●	●	●		R,C
Ohio			C													
Oklahoma		No 11	C	●	●	●	●		●	●	●					R
Oregon	1-1-85	No 7	C		●	●	●		●	●	●	●	●	●	●	R
Pennsylvania																
Rhode Island																
South Carolina																
South Dakota																
Tennessee																
Texas																
Utah																
Vermont	7-1-83	No 7	C	●	●	●	●		●	●	●	●		●	●	R,C
Virginia																
Washington																
West Virginia																
Wisconsin	12-31-84	No 12	D				●		●	●	●		●	●		R,C
Wyoming																

* Cities where workshops were held

Source: Parker, Steve. 1979 (Dec.). State Solar Energy Incentive Primer: A Guide to Selection and Design. SERI/SP-434-470. Golden, CO: Solar Energy Research Institute.

Property Tax Incentives

	Duration	Measurement Formula	Exemption or Credit	Valuation Separate or Non-Assessed	Building	Eligible Technologies	SHACOB	Passive	Hot Water	Wind	Biomass	PV	Hydro
Alabama													
Alaska													
* Arizona	12-31-89	2	E	NA	R,C		●	●	●	●		●	
Arkansas													
* California													
Colorado		5[1]	E	S			●	●	●				
Connecticut	15 yrs	3	E[2]		R,C		●		●	●			●
Delaware													
Florida		3					●	●	●				
* Georgia	1988	2	E[3]		R,C		●	●	●				
Hawaii		2	E				●		●	●	●	●	●
Idaho													
Illinois		2	C	S			●	●	●	●	●	●	●
Indiana		2	E	S	R,C		●						
Iowa	12-31-85		E		R		●						
Kansas	12-31-85	5[3]	C		R,C		●			●		●	
* Kentucky													
Louisiana		1	E	NA	R,C		●	●	●			●	
Maine	1-1-83	2	E		R,C		●	●	●				
Maryland	3 yrs	8	E,C		R,C		●	●					
Massachusetts	20 yrs	2	E	S	R,C		●		●	●		●	
Michigan	1-1-85	2	E	NA	R,C		●	●	●	●		●	●
Minnesota		2	E	NA	R,C		●						
Mississippi													
* Missouri													
Montana			E				●	●	●	●	●		
Nebraska													
* Nevada		4	C	S	R		●			●	●		●
New Hampshire	Perm	5	E		R,C		●		●	●			
New Jersey	12-31-82	2	E	S	R,C			●	●	●	●	●	●
New Mexico													
New York	15 yrs	2	C	S			●	●			●		
North Carolina	12-1-85	3	E	NA	R,C		●						
North Dakota		2	E	S	R,C		●						
Ohio													
Oklahoma													
Oregon	1-1-98	2	E	S	R,C		●	●	●				
Pennsylvania													
Rhode Island	4-1-97	6	E	S	R,C		●						
South Carolina													
South Dakota	5.3 yrs	15[4]	E	S	R,C		●	●	●	●	●	●	
Tennessee	1-1-88	2	E	NA			●						
Texas			E		R,C		●		●	●	●	●	
Utah													
Vermont		5	E[5]	NA	R,C		●	●	●	●	●	●	
Virginia	5 yrs	5[6]	E	S			●	●	●			●	
Washington	7 yrs	2	E	S	R,C		●	●	●				
West Virginia													
Wisconsin													
Wyoming													

*Local option to exempt.

Footnote Set A

1. Manufacturing Equipment
2. 100% of Actual Value
3. 35% of tax refunded
4. 70% heating load capability for buildings or additions
5. excludes waterwheels
6. excludes corporations in solar business
7. HUD Standards
8. Res., Comm. Then a 3 yr. declining rate (75, 50, 25%) applies.
9. Res. Minimum-actual installed cost. Commercial-50% of actual installed cost.
10. Excludes either whole or partial amount of assessed value, which includes installation costs.
11. For supplemental (49% max.) SES.

APPENDIX J

BARRIERS AND INCENTIVES

The following tables on barriers and incentives compare the pre- and post-training responses from the same individual.

Table J-1. **MOST IMPORTANT BARRIERS TO PASSIVE SOLAR CONSTRUCTION**
(Builders and Designers)

Pre-Training Barrier	Percentage Stating Importance of Barrier				Post-Training Barrier	Percentage Stating Importance of Barrier			
	1st	2nd	3rd	4th		1st	2nd	3rd	4th
1. Expense to build	27.4	14.0	15.9	10.0	1. Insufficient info.	26.3	16.9	11.5	10.0
2. Lack of perform. info	22.1	30.3	17.2	10.8	2. Lack of perfm. info.	15.3	28.1	15.9	8.3
3. Insufficient info.	18.9	16.9	14.6	12.5	3. Lack of finance	16.3	12.9	14.0	16.7
4. Lack of finance	10.5	10.7	17.8	14.2	4. Expense to build	16.8	10.1	14.0	16.7
Total number surveyed in each group	190	178	157	120		190	178	157	120

Note: Totals do not add up to 100% because only the top 4 out of 11 responses are indicated in each category.

Full Description of Barriers

Building code conflicts
Expense to build
Lack of performance information
Lack of information about where to begin or who to talk to (insufficient information)
Lack of financing options
Lack of warranties
Passive systems are not attractive
Technology is not well developed

Table J-2. MOST IMPORTANT BARRIERS TO PASSIVE SOLAR CONSTRUCTION
(Builders and Designers by Region)

Pre-Training Barrier	Percentage Stating Importance of Barrier				Post-Training Barrier	Percentage Stating Importance of Barrier			
	1st	2nd	3rd	4th		1st	2nd	3rd	4th
West Sun									
1. Expense to build	29.1	16.2	19.4	11.3	1. Insufficient info.	24.1	14.9	14.9	9.4
2. Lack of perform. info.	25.3	27.0	16.4	9.4	2. Lack of perf.info.	10.1	33.8	14.9	5.7
3. Insufficient info.	16.5	12.2	17.9	17.0	3. Lack of finance	19.0	12.2	10.4	18.9
4. Lack of finance	11.4	14.9	16.4	17.0	4. Expense to build	19.0	9.5	10.4	11.3
5. Lack of warranties	1.3	1.4	3.0	15.1	5. Bldg. code conf.	7.6	9.5	14.9	18.9
Total number surveyed in each group	79	74	67	53		79	74	67	53
Mid-America									
1. Expense to build	25.9	10.9	18.2	9.1	1. Insufficient info.	27.8	18.8	9.1	9.1
2. Lack of perform. info.	19.4	32.7	15.9	12.1	2. Lack of perf. info.	18.5	20.8	19.3	10.6
3. Insufficient info.	20.4	20.8	12.5	10.6	3. Expense to build	14.8	9.9	17.0	21.2
4. Lack of finance	10.2	6.9	18.2	16.7	4. Lack of finance	14.8	13.9	18.9	15.2
Total number surveyed in each group	108	101	88	66		108	101	88	66
Southern[a]									
1. Lack of perform. info.	40.4	10.9	25.0	2.8	1. Insufficient info.	28.6	43.8	4.2	4.8
2. Expense to build	27.7	23.9	9.1	8.3	2. Lack of perf. info.	8.6	15.6	41.7	9.5
3. Tech not there	12.8	17.4	27.3	22.2	3. Tech. not there	17.1	9.4	20.8	19.0
4. Insufficient info.	8.5	19.6	11.4	13.9	4. Lack of finance	11.4	12.5	8.3	19.0
Total number surveyed in each group	47	46	24	39		35	64	24	39

[a]Southern region totals are presented because the number of pre- and post-training surveys returned by the same builder was negligible.

Table J-3. MOST IMPORTANT BARRIERS TO PASSIVE SOLAR CONSTRUCTION (By Size of Home Builder)

Pre-Training Barrier	Percentage Stating Importance of Barrier				Post-Training Barrier	Percentage Stating Importance of Barrier			
	1st	2nd	3rd	4th		1st	2nd	3rd	4th
Very small (1-5 homes) 44.4%									
1. Lack of perform. info.	23.7	35.6	12.3	11.1	1. Insufficient info.	29.2	22.4	14.5	9.1
2. Expense to build	20.3	10.2	15.8	11.1	2. Lack of perf. info.	13.5	22.4	17.4	10.9
3. Lack of finance	6.8	20.3	21.1	14.8	3. Lack of finance	16.9	12.9	23.2	9.1
4. Insufficient info.	16.9	16.9	22.8	9.3	4. P.S. not attractive	3.4	5.9	5.8	16.4
Total number surveyed in each group	59	59	57	54		89	85	69	55
Small (6-25 homes) 33.1%									
1. Expense to build	34.1	11.6	23.3	5.1	1. Insufficient info.	32.5	17.1	10.6	8.8
2. Lack of perform. info.	15.9	30.2	9.3	12.8	2. Lack of perf. info.	16.9	21.4	22.7	7.0
3. Insufficient information	18.2	23.3	9.3	10.3	3. Lack of finance	14.3	14.3	10.6	8.8
4. Lack of finance	9.1	11.6	16.3	20.5	4. Expense to build	10.4	7.1	16.7	10.5
Total number surveyed in each group	44	43	43	39		77	70	66	57
Medium (26-100 homes) 11.3%									
1. Lack of perform. info	26.7	42.9	35.7	8.3	1. Expence to build	24.	8.0	4.5	14.3
2. Lack of finance	26.7	14.3	0	16.7	2. Insufficient info.	16.	16.0	4.5	4.8
3. Expense to build	26.7	0	7.1	25.0	3. Tech not there	12.	16.0	13.6	4.8
4. P.S. not attractive	0	14.3	20	13.3	4. Lack of perf. info.	8.0	12.0	31.8	19.0
Total number surveyed in each group	15	14	14	12		25	25	22	21
Large (more than 100 homes) 11.3%									
1. Expense to build	53.	6.7	20.0	6.7	1. Lack of perfm. info.	24.1	10.7	3.7	17.4
2. P.S. not attractive	0	20.0	20.0	13.3	2. Insufficient info.	6.9	17.9	18.5	17.4
3. Lack of perform. info.	20.	6.7	26.7	33.3	3. Tech not there	6.9	10.7	25.9	13.0
4. Insufficient information	13.3	13.3	6.7	20.0	4. Lack of finance	17.2	10.7	7.4	21.7
Total number surveyed in each group	15	15	15	15		29	28	27	23

Table J-4. MOST IMPORTANT BARRIERS TO PASSIVE SOLAR CONSTRUCTION
(Builders and Designers By Amount of Solar Experience)

Pre-Training Barriers	Percentage Stating Importance of Barrier				Post-Training Barriers	Percentage Stating Importance of Barrier			
	1st	2nd	3rd	4th		1st	2nd	3rd	4th
No experience with solar (19.9%)									
1. Expense to build	46.8	15.2	17.8	6.7	1. Insufficient info.	33.3	8.6	14.7	10.3
2. Lack of perform. info.	20.3	30.4	23.3	9.0	2. Expense to build	30.6	2.9	17.6	10.3
3. Insufficient info.	11.3	21.5	9.6	16.4	3. Lack of perf. info.	5.6	37.1	14.7	17.2
4. Tech not there	3.8	10.7	13.7	14.9	4. Lack of finance	13.9	11.4	8.8	27.6
Total number surveyed in each group	79	79	73			36	35	34	29
No plans to build (5.1%)									
1. Expense to build	45	15.8	6.3	0	1. Insufficient info.	57.1	28.6	14.3	0
2. Lack of perform. info.	25	15.8	0	20.0	2. Lack of perf. info.	14.3	28.6	57.1	14.3
3. Tech not there	10	21.1	31.3	0	3. Expense to build	0	28.6	14.3	14.3
4. Lack of perform. info.	10	15.8	31.3	6.7	4. Bldg. code conf.	0	0	28.6	28.6
Total number surveyed in each group	20	19	16	15		7	7	7	7
Seriously planning to build (39.1%)									
1. Lack of perform. info.	26.5	21.7	18.6	7.3	1. Insufficient info.	22.2	23.1	0	12.3
2. Expense to build	29.0	9.9	14.5	13.7	2. Lack of finance	22.2	11.5	12.1	21.1
3. Insufficient info.	14.8	17.8	19.3	7.3	3. Lack of perf. info.	12.3	24.4	16.7	1.8
4. Tech not there	3.9	11.2	9.7	19.4	4. Expense to build	16.0	9.0	13.6	15.8
Total number surveyed in each group	155	152	145	124		81	78	23	57
Used Solar (35.9%)									
1. Lack of perform. info.	24.6	21.2	22.6	12.3	1. Lack of perf. info.	22.7	22.6	19.6	9.3
2. Expense to build	24.6	19.7	15.3	9.4	2. Insufficient info.	22.7	14.5	10.7	11.6
3. Insufficient info.	13.4	12.9	0	8.5	3. Lack of finance	19.7	14.5	23.2	7.0
4. Lack of finance	12.	12.1	13.7	11.3	4. Bldg. code conf.	16.1	16.1	7.7	20.9
Total number surveyed in each group	143	132	124	106		66	62	13	43

Table J-5. MOST IMPORTANT INCENTIVES IN MAKING DECISION TO BUILD A PASSIVE SOLAR HOME
(Builders and Designers)

Pre-Training Incentives	Percentage Stating Importance of Incentives				Post-Training Incentives	Percentage Stating Importance of Incentives			
	1st	2nd	3rd	4th		1st	2nd	3rd	4th
Very small (1-5 homes) 44.4%									
1. Rapid gas & elect.	40.9	17.9	10.4	9.2	1. Rapid gas & elect.	32.8	20.1	15.6	13.1
2. Consumer demand	30.1	19.0	15.6	12.3	2. Consumer demand	24.2	14.0	13.6	10.8
3. Tax credits	5.9	21.8	25.3	16.9	3. Tax credits	2.7	20.7	22.7	19.2
4. Better finance buyer	5.9	12.3	13.6	13.8	4. Better finance buyer	12.4	14.5	9.1	16.2
Total number surveyed in each group	186	179	154	130		186	179	154	130

Note: Tables do not add up to 100% because only 4 out of 11 responses are indicated in each category.

Full Description of Incentives:
Rapid increase in gas and electric prices
Consumer demand
Tax credits
Better financing for buyer
Better financing for builder
Warranty and performance quarantees
Availability of blueprints and technical information
Improved physical appearance

Table J-6. MOST IMPORTANT INCENTIVES
(Builders and Designers by Region)

Pre-Training Incentives	Percentage Stating Importance of Incentives				Post-Training Incentives	Percentage Stating Importance of Incentives			
	1st	2nd	3rd	4th		1st	2nd	3rd	4th
Western Sun									
1. Rapid gas and elect.	47.4	12.3	8.3	3.9	1. Rapid gas and elect.	32.9	26.0	10.0	15.7
2. Consumer demand	17.1	23.3	16.7	15.7	2. Tax credits	3.9	23.3	23.3	13.7
3. Tax credits	7.9	27.4	25.0	9.8	3. Better finance buyer	19.7	15.1	13.3	15.7
4. Better finance buyer	7.9	8.2	13.3	15.7	4. Consumer demand	14.5	15.1	16.7	7.8
					5. Better finance build	7.9	12.3	10.0	13.7
Total number surveyed in each group	76	73	60	51		76	73	60	51
Mid-America									
1. Consumer demand	38.0	16.2	15.1	10.3	1. Rapid gas and elect.	33.3	14.3	19.4	11.5
2. Rapid gas and elect.	36.1	21.9	1.8	11.5	2. Consumer demand	30.6	13.3	11.8	12.8
3. Tax credits	4.6	18.1	25.8	20.5	3. Tax credits	.9	19.0	22.6	21.8
4. Better finance buyer	9.3	15.2	14.0	12.8	4. Blueprint & Tech.	12.0	7.6	16.1	9.0
Total number surveyed in each group	108	105	93	78		108	105	93	78
Southern[a]									
1. Consumer demand	46.7	14.0	7.5	8.6	1. Consumer demand	57.6	3.4	19.0	0
2. Rapid gas and elect.	31.1	14.0	25.0	11.4	2. Rapid gas and elect.	15.2	41.4	19.0	5.3
3. Tax credits	4.4	11.0	25.0	14.3	3. Tax credits	3.0	3.4	4.8	36.8
4. Blueprint & Tech	2.2	25.6	2.5	2.9	4. Blueprint & Tech.	9.1	17.2	19.0	0
5. Warranty & performance	11.1	11.6	12.5	14.3	5. Better finance buyer	3.0	6.9	19.0	21.1
Total number surveyed in each group	45	43	40	35		33	29	21	19

[a]Southern region totals are presented because the number of pre and post surveys returned by the same builder was negligible.

Table J-7. MOST IMPORTANT INCENTIVES
(By Size of Home Builder)

Pre-Training Incentives	Percentage Stating Importance of Incentives				Post-Training Incentives	Percentage Stating Importance of Incentives			
	1st	2nd	3rd	4th		1st	2nd	3rd	4th
Few (1-5 homes) 43.9%									
1. Rapid gas and elect.	41.4	22.8	9.3	8.5	1. Rapid gas and elect.	34.9	20.7	14.5	12.3
2. Consumer demand	25.9	24.6	11.1	14.9	2. Tax credits	23.3	15.9	11.6	12.3
3. Tax credits	8.6	19.3	29.0	17.0	3. Better finance buyer	2.3	20.7	20.3	14.0
4. Better finance buyer	10.3	10.5	20.4	6.4	4. Consumer demand	18.6	9.8	7.2	24.6
Total number surveyed in each group	58	57	54	47		86	82	69	57
Small (6-25 homes) 33.3%									
1. Consumer demand	43.2	14.0	14.6	7.7	1. Consumer demand	34.2	17.8	13.8	14.3
2. Rapid gas and elect.	31.8	14.0	24.4	7.7	2. Rapid gas and elect.	23.7	28.8	14.5	3.6
3. Tax credits	2.3	23.3	17.1	20.5	3. Tax credits	5.3	16.4	20.3	23.2
4. Better finance buyer	4.5	9.3	22.2	25.6	4. Blueprint & Tech.	11.8	4.1	17.4	10.7
Total number surveyed in each group	44	43	41	39		76	73	65	56
Medium (26-100 homes) 11.4%									
1. Rapid gas and elect.	33.3	20.0	0.	14.3	1. Consumer demand	23.1	19.2	8.3	9.5
2. Consumer demand	26.7	20.0	35.7	7.1	2. Rapid gas and elect.	19.2	30.8	16.7	14.3
3. Tax credits	20.	26.7	21.4	0	3. Better finance buyer	19.2	15.4	0	9.5
4. Better finance buyer	13.3	26.7	14.3	7.1	4. Tax credits	11.5	15.4	20.8	9.5
5. Blueprint & Tech.				28.6	5. Improved appearance			20.8	14.5
Total number surveyed in each group	15	15	14	14		26	26	24	21
Large (more than 100 homes) 11.4%									
1. Rapid gas and elect.	40.	14.3	14.3	0	1. Rapid gas and elect.	37.	19.2	16.0	13.6
2. Consumer demand	20.	35.7	14.3	8.3	2. Consumer demand	29.6	26.9	28.0	9.1
3. Tax credits	6.7	14.3	28.6	25.0	3. Tax credits	3.7	19.2	24.0	27.3
4. Better finance buyer	13.3	7.1	7.1	16.7	4. Better finance buyer	11.1	11.5	12.0	22.7
Total number surveyed in each group	15	14	14	12		27	26	25	22

Table J-8. MOST IMPORTANT INCENTIVES

(Builders and Designers by Amount of Solar Experience)

Pre-Training Incentives	Percentage Stating Importance of Incentives				Post-Training Incentives	Percentage Stating Importance of Incentives			
	1st	2nd	3rd	4th		1st	2nd	3rd	4th
No experience with solar 19%									
1. Rapid gas and elect.	29.7	13.9	21.2	9.7	1. Rapid gas and elect.	30.6	11.1	6.1	6.5
2. Consumer demand	27.0	25.0	9.1	3.2	2. Tac credits	25.0	13.9	21.2	12.9
3. Tax credits	8.1	19.4	15.2	19.4	3. Better finance buyer	22.2	13.9	12.1	9.7
4. Better finance buyer	5.4	8.3	18.2	12.9	4. Consumer demand	0	16.7	18.2	16.1
Total number surveyed in each group	37	36	33	31		36	36	33	31
No plans to build 3.6%									
1. Rapid gas and elect.	57.0	0	33.3	9.7	1. Rapid gas and elect.	42.9	28.6	20.0	0
2. Consumer demand	42.9	28.6	0	16.7	2. Consumer demand	28.6	14.3	0	0
3. Blueprint & Tech.	0	42.9	0	33.3	3. Tax credits	14.3	28.6	20.0	0
4. Tax credit	0	14.3	33.3	16.7	4. Blueprint & Tech.	0	0	20.0	60.0
5. Warranty & performance	0	14.3	0	57.1					
Total number surveyed in each group	7	7	6	6		7	7	5	5
Seriously planning to build 43.1%									
1. Rapid gas and elect.	45.2	18.5	7.8	16.7	1. Consumer demand	35.4	17.9	15.5	12.3
2. Consumer demand	26.2	9.9	20.8	13.8	2. Rapid gas & elec.	20.7	14.1	12.7	14.0
3. Tax credits	7.1	25.9	20.8	13.8	3. Tax credits	4.9	20.5	25.4	15.8
4. Better finance buyer	6.0	11.1	18.2	18.2	4. Blueprint & Tech.	13.4	12.8	9.9	21.1
Total number surveyed in each group	84	81	77	65		82	78	71	57
Used Solar 34.4%									
1. Rapid gas and elect.	38.8	22.7	9.7	10.7	1. Rapid gas and elect.	31.3	25.8	13.8	10.4
2. Consumer demand	32.8	25.8	14.5	12.5	2. Consumer demand	26.6	16.1	17.2	10.4
3. Tax credits	4.5	19.7	32.3	20.0	3. Tax credits	3.1	24.2	24.1	16.7
4. Better finance buyer	6.0	16.7	12.9	20.0	4. Better finance buyer	15.6	9.7	8.6	16.7
5. Blueprint & Tech.	1.5	1.5	8.1	30.0					
Total number surveyed in each group	67	66	62	56		64	62	58	48

APPENDIX K

EVALUATION OF WORKSHOP

Table K-2. FUTURE EDUCATIONAL NEEDS BY REGION
(All Participants)

Western Sun

What was particularly useful? n = 154		What information could be improved or increased? n = 130	
Case histories by builders	35.1%	Technical design details	20.8%
Technical design details	19.5%	Passive system design	17.7%
Passive systems design	14.9%	Improve speaking Presentation and visual aids	16.2%
Workbook	7.8%	Case histories by local builders	11.5%
State incentives and policy	5.2%	Marketing details	7.7%
Marketing details	5.2%	Lending and financing information	6.2%
Other	12.3%	Other	19.9%

Future Topics

Cooling systems	27.8%
Active and/or hybrid	7.6%
Other	54.5%

(Computer simulation for performance prediction, life-cycle costs and projected monthly expenses, home buyer education programs, insulation, solar domestic hot water (SHW) swimming pool heating, passive space heating, back-up systems, building code problems, commercial building heating.)

Table K-1. RATING BY ALL PARTICIPANTS

How do you rate the content of the workshop? (n = 530)

	Poor	Fair	Good	Excellent	Total
Builders & Designers n=351	0.6	8.0	56.1	35.3	100%
Other n=179	0.6	6.7	57.5	35.2	100%
Total n=530	0.6	7.5	56.6	35.3	100%

How do you rate the presentation of the workshop material? (n = 530)

Builders & Designers n=351	0.9	12.6	52.9	33.7	100%
Other n=179	1.7	14.5	53.1	30.7	100%
Total n=530	1.1	13.2	52.9	32.7	100%

Would you recommend this workshop to other builders or designers? n = 517

	Yes	No	Total
Builders & Designers	96.0	4.0	100%
Other	94.1	5.9	100%
Total	95.4	4.6	100%

Table K-2. FUTURE EDUCATIONAL NEEDS BY REGION (Concluded)
(All Participants)

Mid-America

What was particularly useful? n = 95		What information could be increased or improved?	
Passive System design	50.5%	Technical design details	40.9%
Technical design details	12.6%	Improve speaker presentations and visual aids	18.2%
Case histories by builders	8.4%	Passive system design	9.1%
Other	28.5%	Case histories by builders	9.1%
		Other	22.7%

Future Topics

Underground homes	24.2%
Cooling systems	9.1%
DHW	9.1%
Other	39.4%

(Wind generating equipment, actual design plans, state policies and incentives, computer simulation for performance prediction, landscaping, thermal shades, life cycle costs and projected monthly expenses.)

Southern

What was particularly useful? n = 24		What information could be increased or improved? n = 18	
Passive systems design	58.3%	Marketing details	50.0%
Case histories by builders	20.8%	Case histories by builders	27.8%
Workbook	12.5%	Technical design details	22.2%
Other (marketing, solar access)	8.4%		

Future Topics (n = 11)

Hybrid and/or active systems	54.5%
DHW	18.2%
Underground houses	18.2%
Cooling	9.1%