

SELLING THE SOLAR HOME



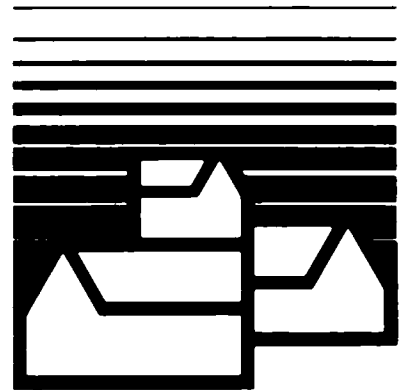
Some preliminary
findings.

Residential Solar # **1**
Program Report
Published by the U.S.
Department of Housing
and Urban
Development, Solar
Demonstration
Program, in
cooperation with the
U.S. Department of
Energy.



This report was prepared under contract to the U.S. Department of Housing and Urban Development by Real Estate Research Corporation. The findings and conclusions are those of the contractor, and do not necessarily reflect the policy or views of the U.S. Department of Housing and Urban Development.

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Prepared for Division of
Energy, Building
Technology and
Standards, Office of
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of Housing and Urban
Development.



DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
WASHINGTON, D. C. 20410

OFFICE OF THE ASSISTANT SECRETARY
FOR POLICY DEVELOPMENT AND RESEARCH

IN REPLY REFER TO:

To the Solar Community:

The Department of Housing and Urban Development has been part of the national solar challenge since September 3, 1974, when the President signed the Solar Heating and Cooling Demonstration Act of 1974 (PL 93-409).

When the Energy Research and Development Administration and, more recently, the Department of Energy were created, HUD's involvement with solar energy continued as it began to work closely with the new agencies to encourage residential use of solar energy.

Because one of the most important elements in the HUD program is the dissemination of information about the use of solar energy in residences, I am especially pleased to be able to introduce Selling the Solar Home: Some Preliminary Findings. It is our first technical report on the solar demonstration program.

It will shortly be followed by two more reports: Building the Solar Home, an outline of technical details of interest to solar manufacturers and residential builders, and Living in the Solar Home, which will detail experiences of some purchasers of solar homes. All three publications will be revised as additional data become available and will be supplemented by further reports as the program continues.

This first report initiates a new stage in the process of providing practical guidance to the Nation's housing industry as it searches for ways to reduce the homeowner's dependence on conventional sources of energy. I hope it, and the reports to follow, will be useful to you.

Donna E. Shalala
Assistant Secretary

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Foreword

As part of the Department of Housing and Urban Development's Residential Solar Heating and Cooling Demonstration Program, Real Estate Research Corporation (RERC) is monitoring and assessing the market acceptance of solar homes. This document is the first of a series of reports describing the factors which influence the construction and sale of solar residences in local markets across America.

This report has two purposes. First to serve as a guide to marketing approaches utilized and market experiences to date in the HUD demonstration program; second, to summarize some of the preliminary findings emerging from interviews of actual participants in the residential solar marketplace. The problems are noted as well as the successes—for the early recognition and timely solution of difficulties may contribute as much to the long run encouragement of innovation as initial success.

This report should prove of special interest to solar equipment manufacturers and distributors, the home building industry and the financial community. All play central roles in the acceptance of solar home heating and cooling. The equipment manufacturer, builder or developer, and the lender must respond to the same central marketplace question: "Who will buy what kind of solar house, and under what conditions?" No final answers are yet available. This document provides preliminary information which will clarify some of the most important marketing issues surrounding solar energy and dispel some of the myths associated with these systems.

A

Overview

One central objective of the Residential Solar Heating and Cooling Demonstration Program is to identify and analyze marketplace issues which affect solar housing. Making this information available to interested industry and professional groups should stimulate greater participation in solar systems utilization. In effect, knowledge of successful experience gained through demonstration projects will eliminate many of the uncertainties associated with the acceptance of solar energy.

HOW THE PROGRAM WORKS

DEMONSTRATION PROJECTS

Grants to cover the basic costs of including solar hot water, heating or cooling systems in new residential construction are made to builders and developers across the United States as part of a five-year Congressionally authorized program. The program is now at its midpoint. Three cycles of grants—55 projects in early 1976, 102 projects in the fall of 1976, and 169 in 1977—have been awarded. The fourth and fifth cycles are scheduled for the spring of 1978 and early 1979, respectively. A research team has been established to monitor many of these projects for general solar system performance and marketability.

HUD awards grants for a full range of residential applications. "Captive market" projects such as student dormitories as well as single-family units constructed on a speculative basis are included. The projects which must compete in the private real estate marketplace provide direct insight into solar's market acceptance. The projects which have been studied to date are shown on the following map. In general, these are "for sale" homes, appealing to a wide segment of the American home buying public.

MARKET ACCEPTANCE DATA COLLECTION

A number of projects from each award cycle are carefully selected for in-depth market acceptance analysis. Comprehensive interviews are conducted with key actors in the construction and marketing process. In addition to those directly involved with the solar demonstration project—the grantee builder, the lender providing short term construction finance and in some cases permanent financing, and the utility which provides auxiliary or back-up service to the solar home—other "comparative" builders and lenders in the same locality are also interviewed to identify their perception of the local marketability of solar residences and their views towards solar systems in general.

SOLAR GRANT SITES Included in this report



SOLAR GRANT SITES STUDIED

CYCLE I

La Grangeville, New York
 Berryville, Virginia
 Vienna, Virginia
 Virginia Beach, Virginia
 Greenville, South Carolina
 De Kalb County, Georgia
 Shenandoah, Georgia
 Dacula, Georgia
 Dade County, Florida
 Summit Meadows, Wisconsin
 Bloomington, Minnesota
 Dallas, Texas
 Fort Collins, Colorado
 Aurora, Colorado
 Westminster, Colorado
 Santa Fe, New Mexico
 Stansbury Park, Utah
 Ashland, Oregon
 Camarillo, California
 Kaneohe, Hawaii

CYCLE II

East Derry, New Hampshire
 Waitsfield, Vermont
 Malta, New York
 Northampton Twp., Pennsylvania
 Penn Valley, Pennsylvania
 Columbia, Maryland
 Winston-Salem, North Carolina
 Clarkston, Georgia
 Lawrenceville, Georgia
 Winter Springs, Florida
 Greenwood, Indiana
 Sheboygan, Wisconsin
 Eden Prairie, Minnesota
 West Des Moines, Iowa
 Shawnee, Kansas
 Evergreen, Colorado
 Pocatello, Idaho
 Albuquerque, New Mexico
 Davis, California
 Coos Bay, Oregon
 Hemet, California
 Ewa Beach, Hawaii

When a solar home is sold, the purchaser is questioned as are a number of "comparative purchasers;" individuals who have bought a conventional home in the same general price range and location as the solar unit.

Local government officials, in the building code department, the tax assessors' office and the planning and zoning agency, can encourage or create barriers to the development of a solar market. These officials are interviewed to identify their policies on solar energy and to investigate the effects their operating procedures may have on the solar market.

SOME PRELIMINARY FINDINGS

Even at this early point in the program, common points in the practical experience of builders, financial institutions and other key actors are emerging. These are summarized below. A more detailed picture of solar market acceptance, including a description of the sample upon which these findings are based, is presented in the later sections of this report.

BUILDERS

Builders represent the mainstream of America's residential construction industry. Solar demonstration participants are typically small to medium-sized entrepreneurs, with half constructing fewer than 50 units of housing a year. They work in local markets (only one-fifth build on a regional scale), and almost all specialize in residential construction. Nearly 50% of the participants have been in the business for more than 10 years (and only 15% for less than two years), indicating strong interest in solar energy among established professionals.

Solar homes, priced generally in the middle (\$50,000-\$80,000) range, offer comparable amenities and are compatible in design with conventional homes in the same local market area. Active solar systems, combining domestic hot water and heating, are most often used.

Problems in the delivery of solar equipment have been encountered by 40% of participating builders and developers. A number of grantees also voice concern over difficulties in installing solar systems.

Builders have experienced almost no resistance from local government authorities in obtaining site plans or zoning approval for solar homes. Building code departments have been cooperative in inspecting and certifying solar homes. Anticipated problems in obtaining construction or permanent financing have not materialized. Ninety-five percent of the demonstration builders have had no difficulty in arranging loans.

MARKETING SOLAR HOMES

Successful sales most often derive from traditional promotional techniques, including newspaper advertisements, open houses and individual referrals. Feature articles and other special media exposure in many cases create increased traffic to solar units and the subdivision in which they are located.

Marketing efforts which stress the residence itself—price, location, interior layout, amenities—appear to be more effective than efforts which focus entirely on the solar energy system. In other words, the home must meet a prospective purchaser's basic housing needs before a solar unit is given serious consideration.

Local and regional market characteristics are of critical importance in marketing a solar equipped residence. Homes in the "wrong" market—those that are over-priced for the locality, for example, or which are outside of existing growth areas—can be difficult to sell.

PURCHASERS

Purchasers of demonstration homes do not represent a "fringe" market. They tend to be young, small, well educated households with higher than average incomes. A large majority (80%) are previous home owners, and a similar proportion lived in the same metropolitan area prior to buying the demonstration home. Significantly, the "profile" of solar purchasers is indistinguishable from that of families who have bought similarly priced conventional homes in the same areas.

Buyers are attracted to solar homes because of the general features of the home and out of an interest in energy savings. Newspaper advertisements and stories are the most frequently mentioned sources of initial information about the solar unit. Energy saving materials, construction quality, the solar system, value, price and resale potential are all cited as "very important" factors in purchasing the house.

Solar purchasers interviewed so far have not had difficulty in arranging mortgage financing. Loans appear to have been processed routinely and have been made at prevailing rates and terms.

LENDERS

Financial institutions express cautious optimism about residential solar energy applications. Although awaiting further information on technical performance and the economics of solar systems, lending institutions are making solar loans if justified by overall financial status of the applicant.

Funds for construction have generally been obtained from local saving and loan institutions and commercial banks. Permanent financing has most frequently been arranged by S&L's.

Financial institutions report that the valuation of solar homes is difficult. In the absence of comparative sales, lenders are unsure of the best means of appraising solar residences. However, a clear majority (70%) believe that the resale potential of solar units is strong.

AUXILIARY UTILITY SERVICE

Auxiliary, or back-up utility service to solar demonstration homes is provided approximately equally by electric and natural gas companies. Hook-ups and service have been arranged by builders without difficulty.

Utilities have granted prevailing residential rates to solar units. Few utility officials (about 10%) believe that their rate structures discourage solar systems. However, many energy companies are considering, or have applied for, rate changes which have the potential to reduce the full cost savings of solar energy.

About half of the utilities believe that solar energy is now a practical alternative in their service area. Some are investigating the possibility of leasing or servicing solar systems installed in residential units. Opinion is mixed among both natural gas and electric utilities on the question of whether widespread solar use would have a positive or a negative impact on their company's operations.

Almost all of the utility companies receive customer inquiries on solar energy, and many are involved in research projects to develop answers to these questions.

LOCAL GOVERNMENT AGENCIES

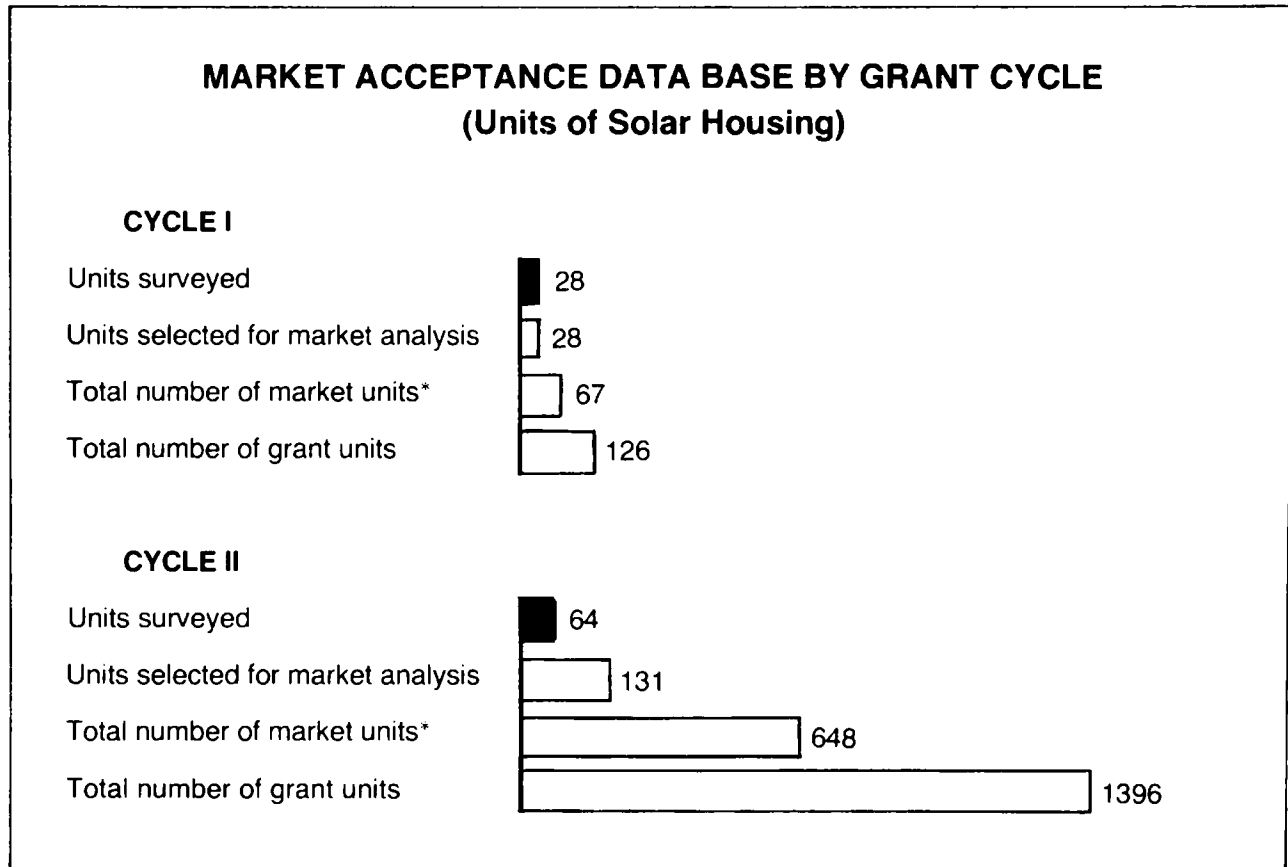
Building code, tax assessment and planning and zoning officials have had little experience with solar energy. Model building codes are, with few exceptions, silent on solar systems and in many cases inspectors have ignored the system in approving the homes.

State legislation in some jurisdictions exempts all or a portion of the value of a solar system from local real property taxes. Many of the solar demonstration homes have not been appraised, and as a result tax assessors have not yet developed procedures for valuing solar equipment.

Planning, zoning and subdivision ordinances largely ignore solar energy and its implications for land use regulation. Few concrete examples of resistance or interference by planning/zoning departments have been encountered, although the hypothetical possibility of conflicts over "solar rights" is sometimes mentioned.

LIMITATIONS OF THIS REPORT

Of the grants awarded in each of the five cycles of the demonstration program, a limited number are being selected by HUD for detailed market acceptance evaluation. This first report is based only on completed interviews with participants in the first and second cycles. As builders receiving grants in the third and later award cycles complete their projects the number of market acceptance analysis sites will increase.



The number of sites and the number of interviews is quite small. As a result, the findings presented in this report must be considered to be preliminary and tentative. This does not mean that they are unreliable. It does mean that great care must be taken not to generalize beyond the cases which are presented.

Each of the following sections begins with a description of the number and the types of interviews which have been conducted. The total sample includes:

*"Market units" are those which are sold in the competitive real estate market, as opposed to units constructed for college dormitories, public housing and other "captive" markets.

INTERVIEWS CONDUCTED FOR THIS REPORT

PARTICIPANT GROUPS	NUMBER OF CASES
Builder (Grantee)	40
Comparative Builder	98
Purchaser	22
Comparative Purchaser	29
Construction Lender	17
Permanent Lender	19
Comparative Lender	26
Auxiliary Utility	18
Alternative Utility	13
Planning and Zoning Official	22
Building Code Official	25
Tax Assessor	23

B

The Builder's Perspective

Builders, whether they operate out of the back of a pickup truck, a trailer in a subdivision or from a downtown office, are critical factors in residential solar development. Builders “read” the market for signs of change in the demand for housing, for emerging growth patterns and for clues to future home buyer preferences. Their experiences in marketing the demonstration units are of great interest to other builders and to the manufacturers and distributors of solar equipment and the financial community as well.

Interviews with builders are conducted when construction of demonstration homes is completed. Forty participating builders have been surveyed. In addition, 98 comparative builders—selected on the basis of their similarity to participants in terms of the type and price of units constructed—have been interviewed. The purpose of including comparative builders is twofold: they provide a control group against which to compare participating builders; and, because they are themselves potential solar builders, their perceptions of the current and future marketability of solar systems will affect the spread of this innovation.

BUILDER CHARACTERISTICS

Builders and developers participating in the HUD demonstration program represent the mainstream of the American residential construction industry. The HUD Solar Residential Heating and Cooling Demonstration Program has attracted grant applications from each section of the United States. (See the map in the previous section for the geographic distribution of builders included in this report.) More significantly, participating builders generally share the characteristics of comparable builders working in the same localities. This means that the experience and knowledge gained in the demonstration projects can be directly and quickly translated into practice by other members of the construction industry.

Sixty-three percent of the grantee builders have been active in the construction industry for five years or more. Only 15% are newcomers to the profession. Builders of conventional homes, the comparative builders, display similar levels of experience. Sixty-nine percent of this group have been building for more than a decade, and 10% can be characterized as beginners, with less than two years experience.

SCOPE OF CONSTRUCTION ACTIVITY

Participating Builders

Comparative Builders

National

Regional

- Local -

The builders and developers surveyed to date are approximately evenly divided into small and large scale entrepreneurs. Fifty-one percent of both comparative and participating builders construct fewer than 50 units of housing per year. But, almost a third (31%) of those involved in the solar demonstration program build less than 10 homes annually—a proportion roughly twice the size of that for comparative builders.

AVERAGE NUMBER OF UNITS PER YEAR

	Participating Builders	Comparative Builders
9 or less	31%	15%
10- 24	15	20
25- 49	5	16
50- 99	10	9
100-249	13	17
250-749	18	11
750+	8	6
DK/NA	—	—
Total	100%	100%
	(N = 40)	(N = 98)

The demonstration program is the first experience with solar systems for 78% of the grantees. Builders' motivations in becoming involved with solar construction are varied: 13% see the program as an opportunity to test the market and 20% applied for a grant because they believed it would provide publicity for their general building activity. More than half of those involved (51%) cite no specific goals which they seek to attain through building a demonstration project. These builders generally refer vaguely to their participation as a "challenge" or simply "a good idea."

THE SOLAR DEMONSTRATION HOMES: TARGET MARKETS

Applicants for HUD solar demonstration grants are free to choose the design of the home they intend to build, its location and the type and manufacturer of the solar equipment utilized. Indeed, a key objective of the program is to encourage a diversity of applications and to promote continuous innovation. Grants are awarded in five cycles to insure flexibility and accommodate the rapid changes in the state of the art of solar residential heating and cooling.

The 40 grantee builders have completed 92 housing units, of which 69 have so far been surveyed and inspected. The residences range from modest townhouses to large free-standing homes. This diversity is reflected in the range of asking prices for the completed units: \$25,000 to \$169,000. Eight homes are priced at over \$100,000. The majority, however, fall into the middle and upper-middle price ranges: 23 homes between \$30,000 and \$49,000; 15 homes between \$50,000 and \$69,000 and 22 homes between \$70,000 and \$100,000. These figures indicate that solar homes can be constructed to meet the full range of American housing needs.

The absolute cost of a new home is most meaningful in relation to the local market in which it is to be sold. In general, the solar homes are located in the "right" price market areas. However, in five or six exceptional cases the solar homes have been overpriced in comparison with conventional units in the same proximate area; for example, a solar residence with an asking price of \$70,000 sited next to homes costing \$50,000. The fact that solar homes can be constructed in a variety of price ranges suggests that overpricing is not an inherent obstacle to the acceleration of solar acceptance.

Solar homes typically cost more per square foot than conventional homes of similar total price. This differential reflects the costs of the solar equipment. However, the solar homes offer amenities which are directly comparable to conventional units. And, the homes generally correspond closely in design to other residences for sale in the same localities.

Approximately 80% of the solar homes are located in subdivisions. Seventy-five percent of the builders report that the availability of a site determined the location of the solar home. Twenty-five percent chose a specific location because of the area's market appeal.

Grantees under the HUD program select a solar system and manufacturer of their choice. Active systems heavily outweigh passive systems in the first three grant cycles. Liquid or hydronic systems are employed ten times as frequently as air-type systems. There is increasing interest in hybrid systems which combine active and passive components, but only three such systems were installed in the first two cycles of the program. Builders cite the following reasons for selecting a solar system:

REASONS FOR SELECTING PARTICULAR SYSTEMS		
Manufacturer experience		45%
Engineer/Architect Recommendation		37
Developed own system		10
University Recommendation		3
DK/NA		5
Total		100%
		(N = 40)

Because the basic costs of the solar system are awarded to the builder under the HUD program, participants have a variety of alternatives in treating the solar costs when pricing their homes. Nine of the 40 builders (23%) have included the entire value of the system in their asking price and six others (15%) included part of the value. A majority of builders (62%) have elected to pass through the entire value of the solar system to the purchaser.

Although most builders have, in effect, not charged purchasers for all or part of the cost of the solar equipment, about half (48%) believe that system costs can be recovered when selling a solar home. This means that the participants are divided on this critical issue. Comparative builders are less likely than participants to believe that system costs can be recovered.

COULD THEY RECOVER SOLAR COST IN THE ASKING PRICE		
	Participating Builders	Comparative Builders
Yes	48%	21%
No	40	42
Don't Know	12	37
Total	100%	100%
	(N = 40)	(N = 98)

Delivery of Solar equipment to the construction site on time and intact has been a problem for participating builders. Forty percent of the grantees experienced delivery delays. Installation difficulties have been reported in approximately 25% of the demonstration projects.

Builders have not experienced resistance from financial institutions or from local government agencies. The following figures evidence the cooperation participants have received.

PERCENTAGE OF PARTICIPATING BUILDERS WHO HAD PROBLEMS WITH LOCAL INSTITUTIONS	
Getting construction loans	5.0%
Getting permanent financing	5.0%
Getting zoning approval	2.5%
Getting site plans approved	5.0%
Getting building code approval	2.5%
(N = 40)	

MARKETING APPROACHES

Solar home builders are targeting their homes to nearly the same markets as comparative builders in their area. Both groups of builders were asked to describe their intended market in terms of home price, age and family status. The results:

	By Price		By Age		By Life Cycle			
	Participating	Comparative	Participating	Comparative	Participating	Comparative		
Luxury	23%	24%	Young	39%	41%	Single, young couples	15%	7%
Discretionary	55	33	Middle Aged	25	25	Couples/families	53	61
Price Sensitive	13	20	Elderly	3	3	Elderly	5	8
Mixed	8	13	Mixed	25	25	Mixed	20	19
DK/NA	1	10	NA/DK	8	6	NA/DK	7	5
Total	100%	100%		100%	100%		100%	100%
	(N = 40)	(N = 98)		(N = 48)	(N = 98)		(N = 40)	(N = 98)

Luxury, discretionary, and price sensitive are terms used to define typical segments of the local housing market. They are defined as follows:

Luxury: Generally composed of high income individuals who can afford high priced homes (usually \$80,000+), and who are willing to pay a premium for amenities.

Discretionary: Generally composed of individuals in the middle to upper middle income range, who can afford a house in the \$50,000-\$80,000, and who are more limited in their choice of housing and household amenities than luxury market home buyers. Discretionary buyers may begin trade-offs between higher priced housing and fewer amenities, and lower priced housing and higher levels of amenities.

Price Sensitive: This group generally consists of new home buyers, with relatively little disposable income, who buy housing in the under \$50,000 price range. They are generally in the lower-middle or middle income range. Within specific house price ranges, this group may also engage in trade-offs between house price and a desired level of amenities.

The major difference between those building a solar home and those building non-solar units is in the builder's perception of the buyer's price range. Grantees apparently see their market as concentrated among discretionary purchasers.

Although the difference, especially with such limited samples, is small, these data also suggest that the solar builders are more likely to target their units to singles or childless couples (15%) than are conventional builders (7%).

Builders have employed traditional marketing techniques to sell their homes. The following marketing approaches, in order of most frequent use, have been undertaken: open house (88%), newspaper advertisements (78%), press releases (73%), special events (55%), furnished model home (48%), and unfurnished model home (45%). The open house is judged by builders to be the most effective marketing tool.

Seventy percent of those who employed newspaper advertisements stressed the solar system in advertising copy. Slightly more than half (55%) focused on solar energy in their brochures and other promotional material. Feature newspaper articles appeared in the local press in several of the grantee communities, and these stories constituted a form of free publicity for the solar home and for the subdivision in general.

Traffic to view the solar homes has been significant. In some cases the drawing power of the solar home has had the spillover effect of enhancing the marketability of other homes in the same subdivision. But builder opinion is split on this issue: 45% believe that a solar unit increases marketability of conventional homes in the same subdivision, 48% report no impact, and one builder is of the opinion that the solar home made the other homes more difficult to sell.

SATISFACTION WITH THE SOLAR EXPERIENCE

Participating builders, as the following responses indicate, are pleased with the operation of the HUD demonstration program.

SATISFACTION WITH THE HUD EXPERIENCE	
Satisfied	88%
Dissatisfied	7
DK/NA	5
Total	100%
	(N = 40)

Sixty-eight percent of the participants state that they would build additional solar units outside of the demonstration program. Others are awaiting clearer market response or lower solar system costs. Comparative builders are about half as likely to indicate an interest in building a non-HUD sponsored solar home. When asked to specify the factors that would influence them to build unassisted solar units, most builders cited specific market conditions, system costs, and interest from the general public.

BUILD SOLAR OUTSIDE DEMONSTRATION PROGRAM?		
	Participating Builders	Comparative Builders
Yes	68%	32%
No	18	37
DK/NA	14	31
Total	100%	100%
	(N = 40)	(N = 98)

FACTORS THAT WOULD INFLUENCE BUILDING UNASSISTED SOLAR UNITS	
Market Factors	28%
System Costs	23
Public Interest	13
Improved Technology	8
On Contract Only	8
DK/NA	20
Total	100%
	(N = 40)

The Purchasers: a Preliminary Profile

This "profile" of the solar home purchaser is based on only 22 households. Purchasers are not interviewed until they have lived in the home for at least one month. Of the solar home buyers, 18 have purchased units awarded grants during the first cycle of the program. As such, they are not necessarily representative of households who will buy solar residences constructed in the later phases of the program. Twenty-nine "comparative purchasers," or families who have bought homes in the same community—often the same subdivision—as the solar home have also been interviewed.

The findings contained in this section are not intended to be interpreted as generalizations to any larger population of home buyers. They are presented as preliminary clues to a purchaser profile which will be fleshed out as the tempo of demonstration home sales accelerates. Raw data are employed in this and subsequent sections because the number of interviews is so small.

PURCHASER CHARACTERISTICS

Naturally, there are differences even among the 22 purchasers interviewed. Nevertheless, certain commonalities have been observed:

- A majority (17) of the purchasers owned a home prior to buying a solar unit; only five were renters making a first purchase. A large number (18) lived in the same metropolitan area before choosing the solar house. Four purchasers moved to the area from another part of the state or from another state.
- Small households predominate. Four purchasers are single individuals, 5 are couples without children, 9 are couples with children (5 of whom have one child) and 4 purchasers are retirees.
- Sixteen buyers are under the age of 35. Three are over 65 and three are in their late 30's or 40's.
- Most purchasers (11) have incomes of between \$20,000 and \$30,000 per year. Six households earn less than \$20,000 and five have an income exceeding \$30,000.
- College degrees are held by 15 of the 22 purchasers; and of these, 5 have advanced degrees. Seven of the buyers have completed high school.

The solar purchasers are in most respects indistinguishable from comparative purchasers. As many of the comparative purchasers have college educations as do purchasers, and they are similar in age and income levels. They, too, are predominantly previous home owners as opposed to first-time buyers.

Two differences appear between the two groups. The comparative purchasers are slightly more likely than solar buyers to have children. And, their children tend to be older than those of the solar home buyers. In addition, 10 of the 29 comparative purchasers lived in another state prior to moving into the area of the solar home. Thus, comparative purchasers appear to be more likely to be "long distance" movers than solar purchasers.

THE PURCHASE DECISION

The decision to purchase a solar home is the ultimate test of market acceptance. For clarity and convenience, available evidence is described in relation to three basic elements of this process: attraction to the solar home; expectations from the solar system; and financing of the purchase.

Eighteen of the solar purchasers were in the market and actively seeking a home when they encountered the solar home. Only 4 were required to move because of a job change or another compulsory circumstance. Comparative purchasers, as shown below, want to change residences for much the same reasons, although job related factors and a desire for more room are mentioned more frequently by this group.

REASONS FOR MOVING		
	Solar Purchaser	Comparative Purchaser
Change in household size	5	7
Change in job	3	7
Wanted better housing	1	3
Wanted to be closer to work	1	1
Utility costs too high	1	—
Wanted more room	1	5
Wanted to own a home	4	2
Retirement	3	3
Other*	3	1
Total	22	29

*Other reasons include: wanted a solar house; to be nearer to family; to change homes.

The majority (14) of the solar buyers initially learned of the solar home through newspaper advertisements or feature news stories. Others became aware of the demonstration unit through individual referrals (3), friendship with the builder (3) and through other indirect means.

Although the purchasers were attracted to the solar home by advertisements, they did not all visit the homes with the express intention of buying a solar equipped residence. Eight of the purchasers did not initially plan to buy a solar home. The remainder were interested in solar homes out of a concern for saving on utility bills (7), preserving the environment (5) and satisfying technical curiosity (2). Several buyers reported that they were attracted by features of the house itself—its price, location and availability.

The concept that the general features of the home as well as the solar system attract potential buyers, is supported by the builders' view of why people visit the demonstration units:

PRIMARY REASON FOR VISITING DEVELOPMENT AS PERCEIVED BY BUILDERS		
	Participating Builders	Comparative Builders
General location	25%	25%
House (price/style/quality)	15%	37%
Solar	20%	—
Other	28%	18%
DK/NA	12%	20%
Total	100%	100%
	(N = 40)	(N = 98)

Purchasers of solar homes and purchasers of conventional units were asked to rank a wide variety of home and subdivision characteristics as to their importance in making a decision to buy a home. The following characteristics were mentioned most often as being "very important."

FACTORS RANKED AS "VERY IMPORTANT" IN PURCHASE DECISION	
<u>Solar Purchasers</u>	<u>Comparative Purchasers</u>
Energy saving material	Resale
Construction quality	Construction quality
Solar system	Price
Value	Value
Price	Energy saving material
Resale	

Even with the limited data available, it is significant that both groups find the same factors important in choosing a home. Many other variables—quality of schools, accessibility to work, builder reputation, neighborhood quality, and the like—are mentioned by various purchasers as having influenced their decision. But none of these factors are mentioned as often as those listed above.

The solar system is deemed very important to the purchase decision by those who have bought solar homes. But it is not seen as the most important attribute of the home. This perception is consistent with the views of the builders of solar units.

PRIMARY REASON FOR CONSUMER DECISION TO BUY AS PERCEIVED BY BUILDERS		
	<u>Solar Home Builders</u>	<u>Conventional Builders</u>
General location	23%	20%
House price	20%	20%
House style/value	10%	17%
House quality	10%	13%
Solar	8%	—
Other	29%	30%
Total	100%	100%
	(N = 40)	(N = 98)

The decision to purchase a solar home usually requires arranging a mortgage. None of the 22 solar home buyers had difficulty in financing their solar units. Conventional loans were obtained from a variety of local financial institutions by 17 of the purchasers. Three others applied for and received guaranteed loans through the Veterans Administration, and two paid cash for the unit. Loan terms—generally between 25 and 30 years—and interest rates—the majority between 8½% and 9%—were those prevailing at the time of the sale.

With the exception of those who obtained VA financing, the solar purchasers tend to make large down payments. Ten of the solar buyers made down payments in excess of 25% of the price of their home.

SATISFACTION WITH THE SOLAR HOME

Purchasers are interviewed a short time after they have moved into the solar residence. Three were questioned after they had been in the house less than a month, 15 were in the home between one and six months and four families had occupied the home for more than half of a year. Follow-up telephone interviews, at six month intervals, will provide additional data on the experience of solar home ownership.

Seventeen of the 22 purchasers like their home, or like it very much, and five are either neutral about it or dissatisfied. In terms of particular aspects or attributes of their solar home, the buyers list the following as the sources of greatest satisfaction and dissatisfaction:

SPECIFIC SOLAR HOME ATTRIBUTES		
	<u>Most Satisfied</u>	<u>Least Satisfied</u>
Style	2	—
Size	2	3
Layout	3	—
Kitchen	—	1
Number of Rooms	1	1
Quality	6	1
Solar System	3	5
Location	1	1
Energy Saving Features	5	—
Other	1	3

Solar purchasers were asked if they had special concerns in relation to a solar home which they would not have with a conventional residence. A majority (13) said they had none. Six were worried about possible breakdowns in the solar system, and seven expressed concern over maintenance of the solar equipment. Many purchasers also feel a strong need for an owners manual similar to those which are made available with household appliances.

Purchasers are interviewed soon after their move into the solar home. This is done to accurately capture their perceptions of the purchase decision. As a result, many have not had operational experience with the solar equipment. Four of the systems were reported as not hooked up at the time of the interview. Mixed feelings are expressed as to satisfaction with the solar system, as indicated below:

SATISFACTION WITH SOLAR SYSTEM	
1. Like it very much.....	4
2. Like it	2
3. It's okay.....	5
4. Don't like it	3
5. Don't like it at all	1
6. Don't know, no experience	7
	22

D

The Financial Community

As seen in the preceding sections, neither builders nor purchasers participating in the HUD program have had difficulty in obtaining financial commitments.

The wider market acceptance of solar energy will be influenced by the willingness of financial institutions to provide construction financing to builders and mortgage loans to purchasers of solar housing. If it is significantly more difficult to obtain loans or if the terms are less favorable than for houses with conventional energy systems, the extensive development of solar energy will be impeded.

To determine the effect of financing on solar market acceptance, interviews have been conducted with representatives of 62 lending institutions. The interviews are designed to capture the financial community's attitudes towards solar energy; to determine how solar units are valued; and to discover whether loan applications are treated differently than those for non-solar housing. Those questioned include lenders who provided construction financing for solar builders (17 interviews); mortgage loans to purchasers of solar units (19); and comparative, or non-participating, lenders who have not provided financing under HUD's program (26 interviews).

PROFILE OF FINANCIAL INSTITUTIONS

Lending decisions are affected by an institution's size, primary market orientation and geographic service area. Participating lenders do not differ markedly from comparative lenders. They are similar in size, type of lending procedures, and the markets they serve. Taken together, they represent a broad cross-section of the local lending community and typical financing patterns. Construction financing is most often provided by commercial banks and savings and loan associations. Permanent financing for home mortgages has been obtained from a variety of institutions, although predominantly from S&L's.

PROFILE OF PARTICIPATING LENDING INSTITUTIONS

		Construction Lenders	Mortgage Lenders
1. Type of Lending Institution:	Savings & Loan	8	11
	Mutual Savings Bank	1	2
	Commercial Bank	8	2
	Independent Mortgage Bank		3
	Insurance Company		1
	Other		
		-----	17
2. Total Assets/Deposits:	Less than 10 million	1	3
	\$ 10- 24 million		
	25- 49 million	2	
	50- 99 million	2	2
	100-499 million	8	7
	500-999 million	1	5
	1 billion +	2	2
Not applicable	1		
	-----	17	19
3. Lending Emphasis:	Construction/short-term	5	1
	Mortgage/long-term	5	14
	Both	7	4
	-----	17	19

VIEWS ON SOLAR ENERGY

Lenders have not traditionally examined the energy features of the properties they finance. Interviews with participating and comparative lenders indicate that concern about fuel costs and energy conservation is widespread. But, high priority is not given to the energy characteristics of a residence in making construction loans to builders or permanent loans to purchasers. The following tables list home features, in order of importance, as ranked by officials of financial institutions which have made solar loans. Energy efficiency and the solar system rank in the second half of the lists of important home features. A similar pattern emerges from the data on permanent loan criteria.

LENDING CONSIDERATIONS FOR CONSTRUCTION FINANCE

(IN ORDER OF IMPORTANCE)

Solar Construction Loans

Site Location

Site design and layout

Unit design and floor plans

Type, size and price or
rent of proposed unit

Materials/construction

Construction methods/
technology

Solar energy system

Unit options/amenities

HVAC system

Energy efficiency

Project amenities

Non-Solar Construction Loans

Type, size and price or rent
of proposed unit

Materials/construction

Site location

Site design and layout

Unit design and floor plans

Project amenities

Construction methods/
technology

HVAC system

Unit options/amenities

Energy efficiency

LENDING CONSIDERATIONS FOR PERMANENT FINANCE

(IN ORDER OF IMPORTANCE)

Non-Solar Permanent Loans	Solar Loans: Permanent Financing Arranged by Builder/Developer	Solar Loans: Permanent Financing Arranged by Purchaser
Type, size and price or rent of proposed unit	Site location	Site location
Site design and layout	Site design and layout	Site design and layout
Site location	Type, size and price or rent of proposed unit	Type, size and price or rent of proposed unit
Unit design and floor plans	Project amenities	Unit design and floor plans
Project amenities	HVAC system	HVAC system
Materials/construction	Solar energy system	Project amenities
HVAC system	Unit design and floor plans	Unit options/amenities
Construction methods/technology	Unit options/amenities	Materials/construction
Energy efficiency	Materials/construction	Construction methods/technology
	Construction methods/technology	Solar energy system
	Energy efficiency	Energy efficiency

Financial institutions have had very little experience with solar energy. Two of 17 institutions providing construction finance to HUD-sponsored builders have financed a solar home outside of the grant program. Three of the 26 non-participating lenders have made solar related loans.

However, lenders do react in generally positive fashion to the concept of solar energy and to the viability of a solar residential market. Twelve participating lenders report that their institution has a favorable attitude towards financing solar projects, and only one expressed an unfavorable view. Their views of the need for solar energy in their community are mixed: nine believe there is a need, six do not, and two are unsure. These conclusions are mirrored in the views of comparative lenders.

Some lenders express concern about a builder's ability to recover the full costs of a solar system if a system is installed without the benefit of a HUD demonstration grant. Of the 12 non-participating construction lenders, seven believe that builders in their area could not recover the full solar system costs. Those who have made solar loan construction commitments are more positive: 11 of the 17 feel that equipment and related costs can be successfully passed on to the consumer.

Representatives of financial institutions address the question of the purchaser's risk in buying a solar residence more positively. Only two of the participating lenders believe that it will be difficult to resell a solar home, and 13 of the 17 believe that the solar system will add to the value of the residence. The attitudes of the comparative lenders—those who have not actually made solar loans—are also positive. Their views on these issues are summarized as follows:

ATTITUDES OF NON-PARTICIPATING PERMANENT LENDERS			
	Difficulty of Solar Resale		Solar Effect on Value
Yes	3	Adds to Value	9
No	9	No Effect	4
Not Sure	2	Not Sure	<u>1</u>
	14		14

THE LOAN PROCESS

Participating institutions have not altered their loan procedures or criteria when making solar mortgages. Comparative lenders report that were they to process a solar loan, it would be treated in the same way as a request for financing conventional properties. Although it is not institutional policy, in a small number of cases higher level officials have become involved in the loan decision. In at least one case, it was noted that a board member expressed the opinion that the institution should consider financing solar energy projects.

Rates and terms granted solar builders and purchasers have, with two minor exceptions, been those prevailing locally at the time of application. One builder received better terms than normal because of the publicity the lending institution received as a result of being involved with a solar house. In another case, a higher rate was charged because it was the builder's first business venture, a common lending practice at that institution.

Lenders, both participating and comparative, agree that in providing construction or permanent financing to a builder **the applicant's experience, or "track record" is the key criterion.** Previous business relations with the institution are also a factor in a lender's willingness to provide financing. The builder's size is in almost all cases not deemed important.

In considering purchaser mortgage commitments, institutions typically examine the ability of the borrower to meet monthly mortgage payments. Monthly costs consist of principal, interest, taxes and insurance (PITI). Energy costs are recognized as a major, and increasingly burdensome home operating expense. Fourteen of the 19 participating mortgage lenders and 11 of the 15 comparative lenders report that their institutions are considering the inclusion of energy costs in defining an applicant's financial ability to take on a mortgage. However, only two institutions do, in fact, consider energy costs in determining an individual's mortgageability.

VALUATION OF SOLAR SYSTEMS

The appraisal of a solar home for purposes of permanent finance is an unresolved issue within the financial community. The builder and purchaser benefit from appraisal practices which include the cost of the solar system in the value of the home.

Lenders report that the most common appraisal technique for residential units is the market valuation method, which is based on the sales of comparable units. However, at this time there are few, if any, solar homes in the market area served by local financial institutions. As a result, appraisers have wide discretion in determining value. The diverse practices of the interviewed permanent lenders reflect uncertainty over the question of appraising solar systems.

**TREATMENT OF SOLAR SYSTEM
COST IN APPRAISING HOME VALUE**

	Participating Lenders	Comparative Lenders
Exclude Cost	2	4
Include Entire Cost	5	—
Considered "Somehow" in the Appraisal	4	4
Offset by Loan-to-Value Ratio	1	2
DK/NA		
Total	7	4
	19	14

The issue of the valuation of a solar home is a two-edged sword. At time of purchase, an appraisal technique which includes the full costs of the solar system in the value of a home is desired by builders and purchasers. However, homes are also appraised for purposes of real property taxation. In this context it would be a positive benefit to the home owner if the value of the solar system were not included in the valuation of the property. For, higher property taxes would decrease the rate of return on the solar equipment realized through smaller fuel bills.

Backup Systems: The Role of Utilities

The HUD Solar Residential Heating and Cooling Demonstration Program requires that auxiliary, or backup utility service, be available to each grant unit. None of the grantees surveyed at this time have encountered problems obtaining backup service from local utility companies.

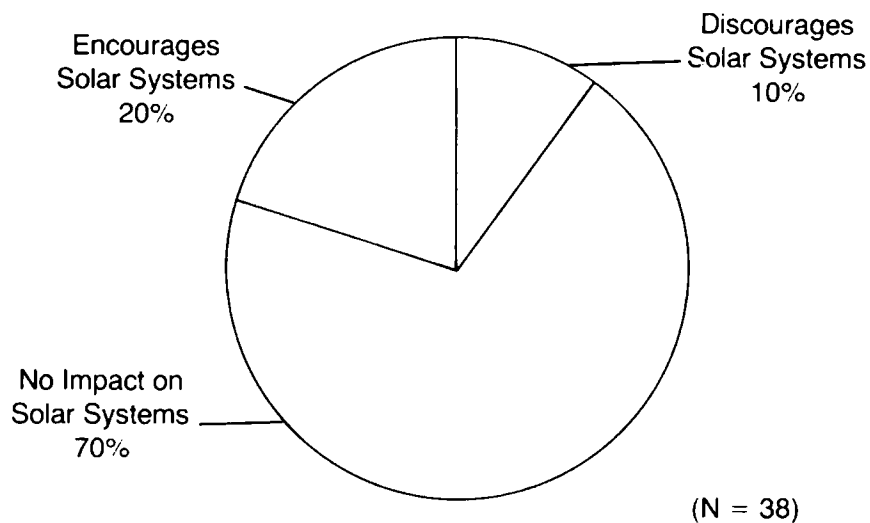
Thirty-eight utility representatives have been interviewed in order to determine their company's views toward solar energy, their treatment of solar backup systems and their rate and pricing philosophy. Twenty-one utilities provide auxiliary service and 17 represent the alternative energy form in the grant area. Some HUD demonstration units rely on home heating oil for their backup energy source. Interviews to date are evenly divided between electric and natural gas utilities and do not include representatives of oil companies.

AUXILIARY UTILITY SERVICE

The sample of utility companies reflects the different types of utilities that exist nationally. These utilities range from small municipal utilities which serve limited geographic areas to large power companies which serve entire states. Most of the utilities represented in this report are public corporations.

Public utilities cannot refuse service to a customer unless a general moratorium exists. However, the rate structure adopted by a utility can affect the savings which are realized with solar systems. The 21 companies providing natural gas or electric power to the demonstration homes have granted the local residential rate to the solar customers. Their general belief is that these rates do not have an impact on the economic viability of solar heating and cooling.

EFFECT OF PRESENT UTILITY RATE STRUCTURES ON USE OF SOLAR SYSTEMS



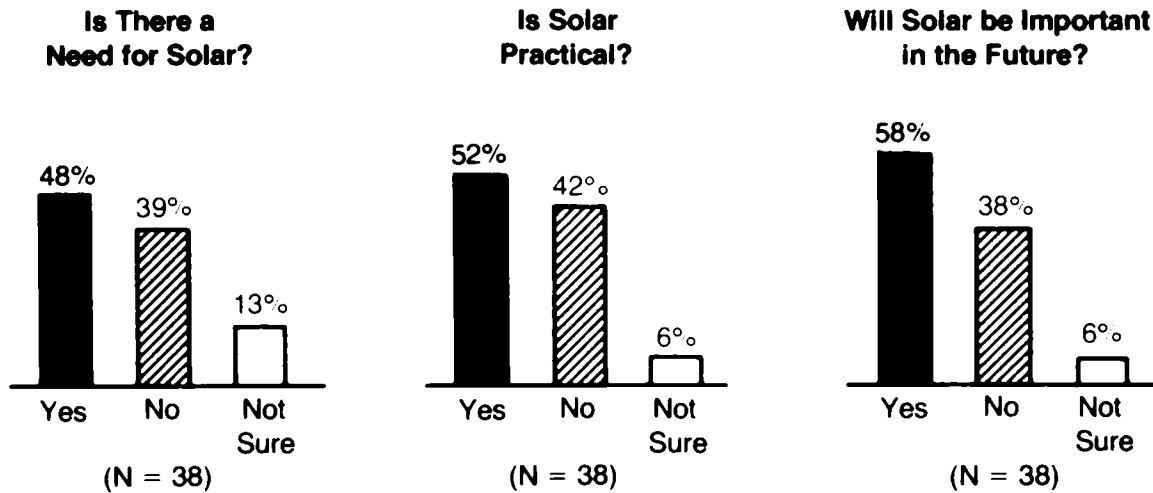
However, almost a third (30%) of the utilities are considering or have applied for changes in their rate structure. Nine of the 21 auxiliary utilities are thinking about the possibility of a special rate which would apply to backup systems. Thus, the status of auxiliary systems and the monthly rates which will be charged solar customers are issues which will have to be followed carefully as the use of solar energy accelerates.

VIEWS TOWARDS SOLAR

Utility companies are watching solar energy applications in their area and nationally. Thirty-two of the 38 utilities (84%) report that they have research staff studying solar energy. Several utilities have established solar demonstration projects of their own to develop technical data on solar system performance. Twenty-eight companies were aware of the solar grant house in their service region, and 26 had visited the home.

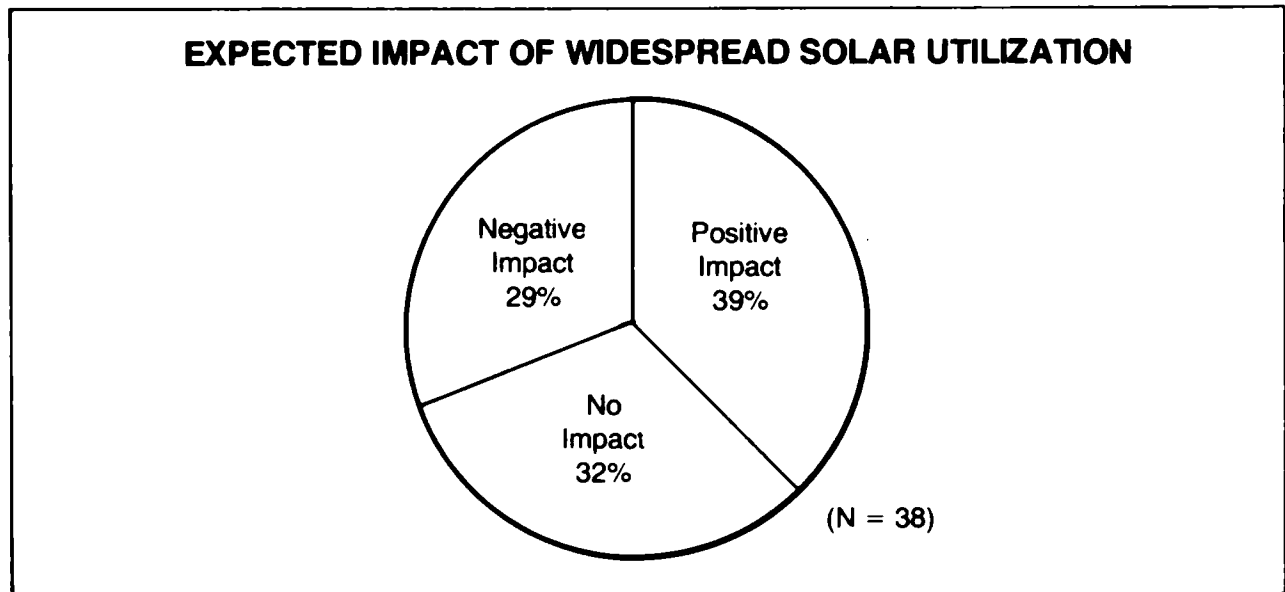
This interest does not translate into universal optimism concerning the future of solar residential heating and cooling. Utilities were asked whether they think there is a need for solar in their area, whether they think solar is practical and whether they believe it will have an important role in their area over the next 10 to 15 years. About half of the respondents, as shown below, have positive views towards solar energy in their service area:

ATTITUDES OF UTILITY COMPANIES TOWARD SOLAR ENERGY



Utility companies are very active in energy conservation efforts. Thirty-seven of the 38 have established conservation programs. These efforts bring them into close contact with consumer attitudes toward energy conservation and solar energy. Twenty-five utilities (66%) feel that there is widespread consumer interest in solar systems within their market area, and 84% (32) report that they have received specific requests for information on solar energy. The questions that they most frequently receive from customers include: system costs (66% of the questions), energy savings (15%), and equipment (13%).

Utility company officials are also asked to assess the impact that widespread use of residential solar systems would have on their company. A variety of expectations have been expressed, ranging from the negative (it would reduce sales) to the neutral (it is under study) to the positive (it would save energy, reduce peak loads). Positive views slightly outweigh negative views.



Those utilities which have been surveyed do not express a strong interest in developing a direct involvement in solar systems, other than through the provision of backup service.

EXPANDED UTILITY INVOLVEMENT IN SOLAR ENERGY		
	<u>Interest in Leasing</u>	<u>Interest in Servicing</u>
Yes	21%	26%
No	39	45
Not Sure	40	29
	(N = 38)	(N = 38)

The Institutional Context: Local Government

The powers and responsibilities of a variety of local government agencies will affect residential solar market acceptance. Three typically local functions—building code inspection, tax assessment and planning and zoning—have direct roles in land use and construction regulation.

Recognizing that these processes may create barriers or constraints to innovation in solar energy, the Department of Housing and Urban Development has commissioned special comprehensive studies of model building codes, land use controls and the legal issues (i.e., "solar rights") which will affect solar market acceptance.

PROFILE

The local government officials who have been interviewed generally represent small towns, suburban and rural areas rather than large or central city areas. This fact reflects the general location of most new housing growth in the United States, particularly single-family housing units. The code inspectors, tax assessors and planning and zoning officials serve diverse jurisdictions:

	Municipal Government	County	State	Total
Tax Assessment	3	17	3	23
Zoning and Planning	12	6	4	22
Building Code Inspection	18	7	0	25

The size of the staff available to these agencies is generally dependent upon the population size of the individual jurisdictions, and reflects the relatively small size of the areas in which the solar demonstration homes have been located. Professionals in these agencies have not typically had practical experience with solar systems other than that gained by working with the demonstration homes. Knowledge of solar energy, as reported by government representatives, is limited. Code inspectors are best informed, and planning and zoning personnel are least well informed.

KNOWLEDGE ABOUT SOLAR ENERGY

	Code Officials	Tax Assessors	Planning/Zoning Officers
Very Knowledgeable	6	4	2
Somewhat Knowledgeable	9	6	4
Slightly Knowledgeable	4	9	11
Not at All Knowledgeable	6	4	5
	25	23	22

BUILDING CODE INSPECTION

Twenty-three of the 25 building code departments follow a building code, generally one of the well known model documents. Some jurisdictions rely on more than one code, and minor administrative amendments to meet local conditions are common. The most frequently employed model codes are the BOCA (Basic) (14 users), the ICBO (Uniform) (6 users) and IAPMO (Uniform Plumbing) (4 users).

Most of the building ordinances in local use do not mention solar installations. Six localities have adopted specific solar requirements as amendments to their code. Only one of these contains extensive solar provisions, including specific standards for heat loss, glazing, roof overhangs and solar easements. Seven jurisdictions have adopted energy conservation ordinances, including insulation and double glazing requirements. Such requirements should encourage solar energy which works best in energy efficient units.

Code officials usually work closely with the builder during the construction of a solar home. In most instances, as indicated in a previous section, the builder is a local businessman and well known to the official. In some cases (9 of 23) the inspection process is reported to have taken longer than in the case of a conventional home. However, this is a result of the officials' personal curiosity and desire to learn about solar systems rather than government policy or regulation.

Nine solar demonstration projects were required to make changes in the housing units or the solar system, or provide additional information to building inspectors. Two localities required complete system engineering drawings. In three cases studies were made of roof structure and load capacity, one of which resulted in the requirement of roof structure reinforcement. Ventilation modifications were demanded in two units. And, two builders were asked to make minor design changes to comply, in one case, with a historic preservation ordinance, and in the other with subdivision regulations. However, none of these changes were deemed important by either the builder or the building department.

Code officials also voice concern about potential health hazards, even though they have not encountered them with the demonstration homes.

These prospective concerns include possible freezing of liquid systems, excess roof loads caused by solar collectors and cross-connections, which could bring antifreeze solutions into contact with drinking water.

Because they have not had experience with solar energy, inspectors examine the systems on an individual basis. A majority (16 of 23) rely on manufacturers' descriptions and specifications in reviewing the systems. Some officials would like to see product certification standards and procedures established, and some note a need for performance standards other than those provided by manufacturers. However, four inspectors believe that a premature attempt to certify systems and develop standards could have the undesirable effect of arbitrarily limiting further technological innovation.

TAX ASSESSMENT

Appraisal or assessment procedures used by local tax assessors and lenders are of three types: replacement value (cost less depreciation), comparable sales (fair market value), and a combination technique. Five jurisdictions employ the replacement value method, 12 utilize comparable sales and six rely on a combination approach.

Assessors who use the fair market value approach encounter problems that, as discussed in Section D, are also encountered by fee appraisers and lenders. Because the key to their approach is comparable sales—and thus far there have been few solar sales—it is very difficult for assessors to determine value. As a result, valuation for tax purposes is based on the assessor's judgment as to the value of the solar equipment.

It is normal procedure in all of the 23 tax assessment departments to wait until a home is sold before an appraisal of the property is made. Nine of the 23 officials interviewed assessed the value of the solar system as part of the house without specifying the degree of its contribution to total value. In two instances the solar unit was not valued at all. The other officials either had not yet appraised the solar home or were unsure of how their staff had treated the solar system in reaching an assessment figure.

Many states are considering or have passed legislation which exempts all or part of the solar system from real property taxes. As more jurisdictions move in this direction there will be less confusion at the local level over the value of solar equipped homes.

ZONING AND PLANNING

With only one exception, planning and zoning officials state that there are too few solar units being built in their area to warrant change in planning and zoning regulations. This generally passive posture is confirmed by the participating builders who have encountered no major problems with these officials. Whenever builders have had problems they were of the type experienced by all builders in the community. In some areas, for example, growth control policies have delayed construction; but these delays were generally experienced by all builders. No specific mention has been made of solar design or equipment as a factor in the delay of the approval of plans or zoning applications.

Planning and zoning officials believe that widespread utilization of solar systems in their community could create conflicts with existing plans and ordinances. The issue of "solar rights" was mentioned by 7 of the 22 respondents. There is potential conflict (mentioned by 5 officials) between subdivision ordinances, historic preservation ordinances and design conventions and expanded solar development. However, planners believe that these issues will be largely limited to the retrofit of existing structures rather than in the new construction of well designed solar residences.



Conclusion

SOLAR MARKET ACCEPTANCE WHERE DO WE GO FROM HERE?

The HUD Residential Solar Heating and Cooling Demonstration Program is a complex effort. Over its projected five year duration it will involve hundreds of American home builders and purchasers. Scores of lenders, utility company personnel and local government officials will participate in the demonstration, both directly and indirectly.

The purpose of the program, simply put, is to stimulate the growth of a self-sustaining solar energy industry. Manufacturers and builders constitute the core of this emerging industry. Industry infrastructure—equipment supply, distribution, installation, repair and service capacity—is also important. But the widespread acceptance of solar in the residential marketplace requires more than a product.

The attitudes and actions of the financial community, local regulatory bodies and alternative energy suppliers can spell the difference between making solar energy attractive to builders and purchasers and limiting its adoption. The early findings outlined in this report suggest that significant barriers to solar market acceptance have not materialized. Although preliminary and tentative, these findings include:

- Builders are interested in but not yet fully committed to solar energy. They await further evidence on market acceptance in their locality. Builders participating in the HUD program are pleased with its operation.
- Purchasers of solar homes are motivated by the same goals as buyers of non-solar homes. They want energy savings, value, quality construction and resale potential at a price they can afford. A solar system, by itself, will not sell a house.
- Financial institutions will support solar builder/developers if a project meets standard loan criteria. Mortgages have been obtained by purchasers without difficulty.
- Utilities have mixed reactions to solar energy. Pricing of back-up service—a key variable in the economics of solar—is unsettled, and warrants continuing attention.
- Local government officials react passively to solar applications in their communities. Building code inspection, tax assessment and zoning enforcement processes do not yet address solar issues directly.

This is the first status report on solar market acceptance. The data are clearly limited. The third, fourth and fifth grant award cycles will greatly expand the number of market units that can be analyzed. Moreover, as practical, "hands on" experience with the solar market increases the state of the art of solar marketing and the changing attitudes of key participants in market acceptance will be monitored.

Future reports will contain more detailed descriptions of the market acceptance process. Regional trends will be evaluated as well as differences between types of solar applications. Later reports, based on the successful sale of a larger number of solar homes, will employ the practical experience of builders to suggest guidelines and strategies for expanding solar utilization in local markets.

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