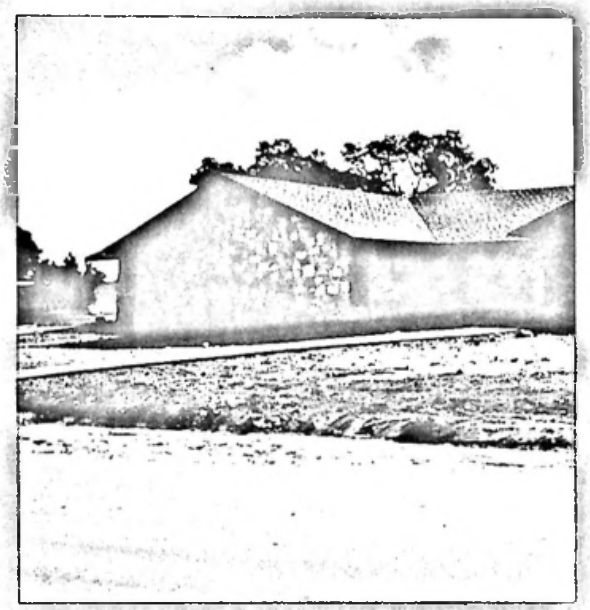
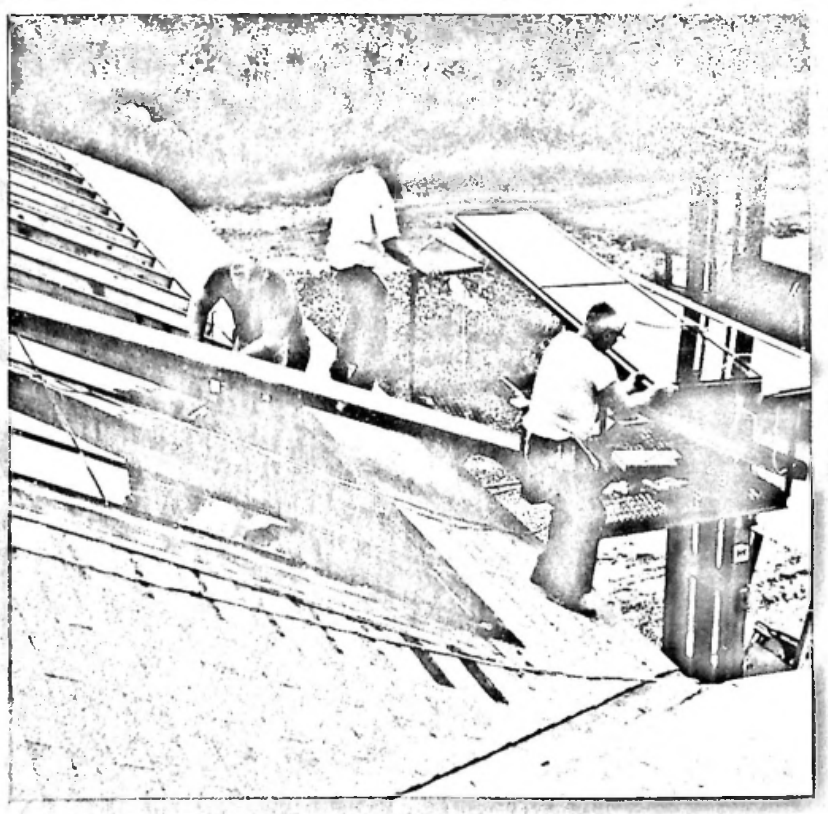
t of Housing and Urban Development
with the U.S. Department of Energy

Selling the Solar Home '80

Market Findings for the Housing Industry





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

ASSISTANT SECRETARY FOR
POLICY DEVELOPMENT AND RESEARCH

IN REPLY REFER TO:

TO THE READER:

Many factors will affect the rate at which solar energy is introduced into the housing market—some technical and some relating to market issues. The HUD residential solar heating and cooling demonstration program, by supporting many different types of solar projects and collecting data on their performance and on the experiences of builders in marketing these projects, is developing information which will give the housing industry a better understanding of and confidence in solar energy.

This report is the second in a series of studies of market factors affecting the acceptance and sale of solar homes. While the number of projects studied is still limited, we believe that the information on marketing practices and market experiences presented in this report will materially assist and encourage builders interested in including solar energy in future projects.

A companion report, *Building the Solar Home #2*, covering the same period of time, addresses technical information on system performance developed from the demonstration program. As additional information is collected in the later cycles of the HUD demonstration program, we will continue to refine and publish further revisions of these reports.

Donna E. Shalala
Assistant Secretary

Selling the Solar Home '80

Market Findings for the Housing Industry

Prepared for

Solar Demonstration Program
Division of Energy, Building Technology and Standards,
Office of Policy Development and Research,
U.S. Department of Housing and Urban Development
In cooperation with the U.S. Department of Energy

Prepared by

Real Estate Research Corporation
Chicago, Illinois

January 1980

Contents

Foreword

The Residential Solar Heating and Cooling Demonstration Program, one element of the National Solar Heating and Cooling of Buildings Program managed by the U. S. Department of Energy, was initiated by the U. S. Department of Housing and Urban Development under the provisions of the Solar Heating and Cooling Demonstration Act of 1974 (PL 93-409).

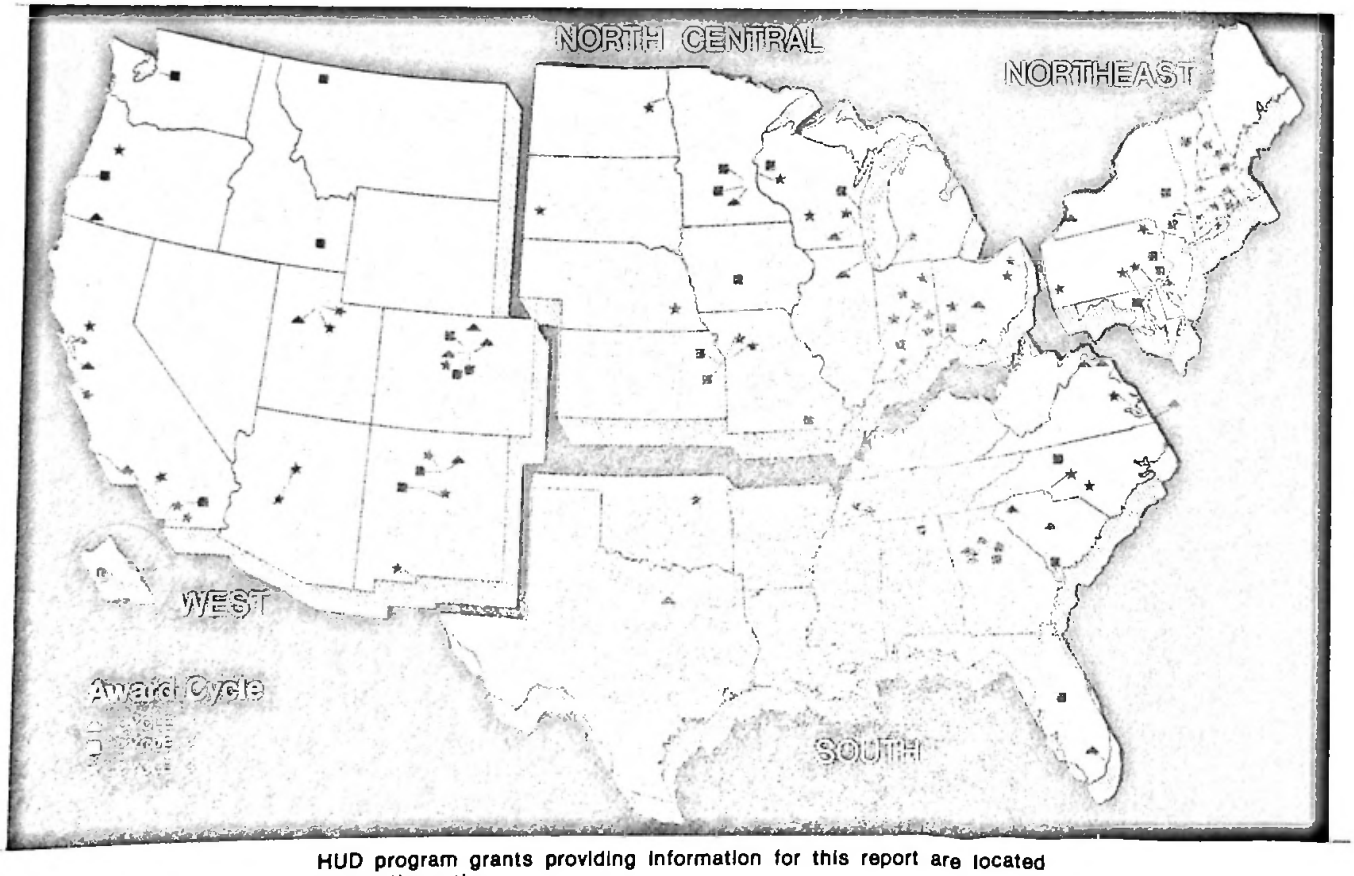
The principal objective of the HUD program has been to encourage the development of a residential market for solar energy. One major element of this program is the support of a large number of demonstrations of solar energy applications in various types of housing. Five sets or "cycles" of demonstration project awards have been made through November 1979.

These demonstration projects provide builders and developers an opportunity to gain actual experience with solar installations, offer the public a chance to see and buy solar homes, and permit HUD to collect data on solar system performance and market experience.

This second report on marketing experiences in the demonstration program is based on data collected by Real Estate Research Corporation from projects in Cycles 1 (awarded in January 1976), 2 (awarded in October 1976) and 3 (awarded in May 1977). The report is designed to provide preliminary answers to the following questions on the use of solar energy in single-family projects:

- ☐ What are the important considerations in planning a solar home?
- ☐ Need a solar house look different from a conventional house?
- ☐ What are the effects of advertising in the solar market?
- ☐ What factors affect the purchase decision?
- ☐ What characterizes the solar purchaser?
- ☐ What is it like to live in a solar home?

A SAMPLE OF HUD DEMONSTRATION SOLAR HOUSING



HUD program grants providing information for this report are located across the nation.

Market Data Collection

The market data collection process involves interviews with many participants in the housing industry. A number of projects from each award cycle have been selected by HUD for in-depth market acceptance analysis. Field visits are made to each project site.

Industry Interviews

Comprehensive interviews are conducted with key actors in the construction and marketing process. The grantee builder, the lender providing construction financing, and the utility which provides auxiliary or back-up service to the solar home are interviewed. Other "comparative" builders in the same locality are questioned on their perceptions of the local marketability of solar residences and their views toward solar systems in general.

Public Official Interviews

Local government officials in the building code department, tax assessor's office, and the planning and zoning agency can encourage or inhibit the development of a solar market. Interviews with these officials identify their policies on solar energy and examine the effects their operating procedures may have on the solar market.

Consumer Interviews

When a solar home is sold, the purchaser is interviewed, 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.

Follow-up interviews are conducted at six-month intervals. The purpose is to determine levels of satisfaction with the house, obtain information on energy use and utility costs, and identify attitudes toward solar energy. Purchasers of solar grant units are also asked about the operation, performance, and maintenance of their solar system.

Continuing Studies

This report is based on the first, second, and third grant cycles. It characterizes the early solar experience. But, because the demonstration program is an ongoing process, not all issues are fully addressed. For instance, passive designs are not discussed and findings and interpretations may change as this approach gets wider exposure in the residential building industry.

Several critical areas of concern, such as utility costs and savings or the appreciation/resale value of solar homes, are long-term issues. Preliminary findings are presented, but the analysis must remain tentative until there is more experience and data.

The number of interviews is quite small and does not represent a statistically valid sample of solar projects. Therefore, the findings cannot be generalized. Still, the marketing recommendations should serve to help builders gauge local markets and build solar homes which will appeal to prospective homebuyers.

A more detailed presentation of data relating to solar marketing and market acceptance is provided in a two-volume study: *Marketing and Market Acceptance Data from the Residential Solar Demonstration Program: 1979. (NTIS/PB-80/115298)*

Information on this report, as well as others describing the solar projects, can be obtained from the National Solar Heating and Cooling Information Center, P.O. Box 1607, Rockville, Maryland 20850.

Profiles

The Solar Market: An Overview

Houses equipped with solar heating and hot water systems appeal to the American homebuyer. This is the overall finding emerging from the HUD demonstration program.

The following sections outline key aspects of selling a solar home. First, however, the basics of the market—the solar home, the builders, the purchaser—are described. These "profiles" are based on extensive, ongoing data collection efforts. The study employs field visits and in-depth interviews with builder and purchaser.

Solar Homes: Typical in the Speculative Market

Houses constructed under the HUD Residential Solar Demonstration Program are similar in style and offer the same home amenities as conventional housing built in the same areas.

This conclusion is based on field inspections of 168 solar units and 208 non-solar, or comparative, housing units constructed by both HUD grantees and comparative builders.

An active solar system is used for both heating and domestic hot water in 83% of the homes that have been surveyed. Two-thirds of the systems utilize a liquid transfer medium, with the remaining third utilizing air. The active solar system is augmented in some houses with passive design elements.

TYPICAL DEMONSTRATION SOLAR HOUSE

Based on the average or median value for each house characteristic

Type of House	Single family detached
House Size	1,765 square feet, 3 bedrooms 2 baths, no basement
Lot Size	1/4 acre
Solar System	Liquid system for heating and hot water
Cost of Solar System (Reported by the Builder)	$11,600
Back Up Utility	Electric

The choice of an auxiliary, or back-up, fuel depends on hookups, cost and availability. Electric back-up systems are most common in the demonstration units.

Demonstration solar units are generally comparable in price to other homes on the market. However, they have a median living space of 1,765 sq. ft. as compared to 1,900 sq. ft. for conventional homes. Since the typical solar home offers slightly less living space, they are more expensive on a per square foot basis than conventional units.

A house does not have to be of ultramodern design to accommodate solar energy. In fact, solar homes sell better when they are designed to reflect local market preferences, which are typically for houses of traditional or contemporary architecture.

Demonstration homes have been priced to attract all market segments—from the discretionary to the luxury market.* If priced to meet conventional home competition, solar units in all ranges will sell.

Builders: Small Volume, Experienced

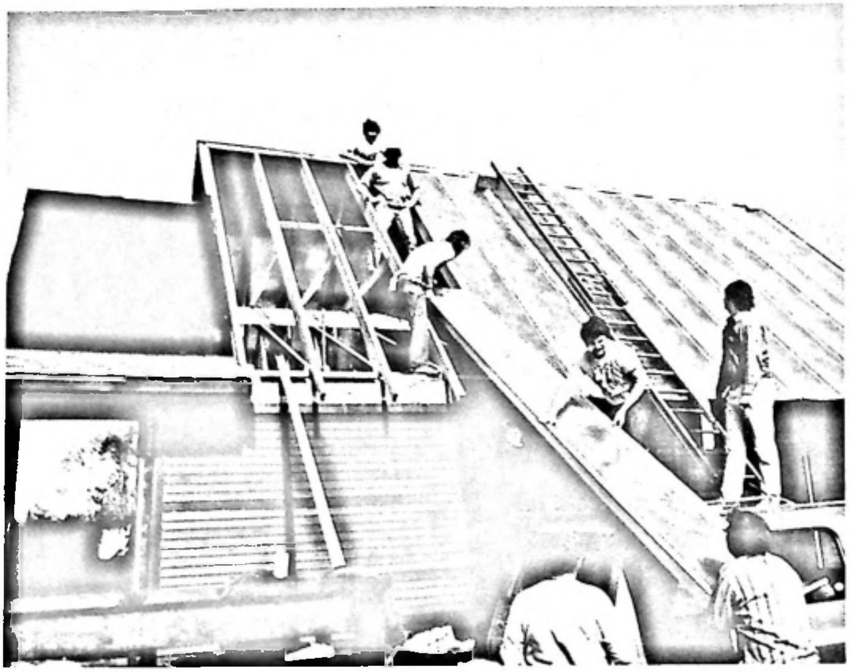
Solar builders are small volume, experienced homebuilders. They construct single-family detached housing for a middle-income

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

LUXURY: Composed of high income individuals who can afford high-priced homes and are willing to pay a premium for amenities. The precise dollar range for such housing varies by locality and region of the country.

DISCRETIONARY: Individuals in the middle to upper middle income range who are more limited in their choice of housing and household amenities than luxury market homebuyers. 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 consists of new homebuyers, 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, they may also engage in trade-offs between house price and desired level of amenities.



TYPICAL DEMONSTRATION SOLAR BUILDERS

Based on the average for participating builders

Experience in Residential Construction	10 years
Scope of Activities	Local (one city or county)
Type of Construction	Residential, single family, detached
Annual Unit Volume	21 units
Annual Dollar Volume	[illegible]

market. The HUD program participants are very similar—in company size, experience and construction specialty—to the industry as a whole.

The grantee builders surveyed so far average 21 housing units and slightly over $1 million in sales annually. With a median of 10 years in the business, they surpass the national average for years of construction experience.

For the majority of the program participants (76%), the solar grant house is their first experience with solar system installations in home construction. Almost three-quarters of these builders express a willingness to construct additional solar homes. Nearly half are actually constructing non-grant solar homes.

Overall, participating builders are positive about the cost-feasibility of solar construction. The median cost of the solar system, in the surveyed demonstration houses, as reported by the builders, is $11,600 for heating and hot water.

Over half believe that the additional cost of a solar system can be recovered in the sale price of the home. Thirty-one percent of the builders included the entire cost of the system in their asking price, 27% included part of the cost, and 34% elected to pass through the entire value of the solar system to the purchaser. In this case, the buyer, in effect, did not pay for the system. The remaining 8% have not as yet decided their course of action.

Purchasers: Mainstream Americans

Solar home buyers do not represent a fringe or narrow segment of the housing market. Homebuyers

of all ages, income groups and occupational types buy homes with solar systems.

This profile of the solar purchaser has been developed through interviews with 132 persons who bought homes constructed under the demonstration program.

The family characteristics of solar purchasers are similar in each region of the United States. The "average" solar household has three family members and an annual income of almost $30,000. The head of the household is just under 40 years of age and is employed in a professional or managerial occupation. Buyers generally owned their previous residence, which was located in the same metropolitan area.

Buyers who are interviewed immediately after purchasing their home cite potential energy and cost savings as the most attractive features of the solar system.

Two other aspects mentioned frequently by the home buyer are the qualitative advantages of solar energy and the relatively minor impact it has on their lifestyle.

The solar purchasers, while "mainstream" in background and socio-economic status, are more energy conscious than conventional home buyers. But concern for energy efficiency and fuel saving is spreading to all consumers.

PROFILE OF THE SOLAR PURCHASER

	Region				
	Northeast	South	North Central	West	Total
Age of Household Head	37.5	36.3	36.3	41.6	39.5
Household Size	3.0	2.8	2.8	2.7	2.7
Percentage Professional/ Managerial	73%	72%	79%	61%	66%
Annual Household Income	$34,000	$36,300	$26,700	$28,200	$29,800
Mean Years of Schooling Completed	16.3	16.6	15.7	16.1	16.1
Percentage Previous Homeowners	64%	67%	74%	64%	66%
Percentage Moving Within Same City	50%	76%	74%	74%	72%

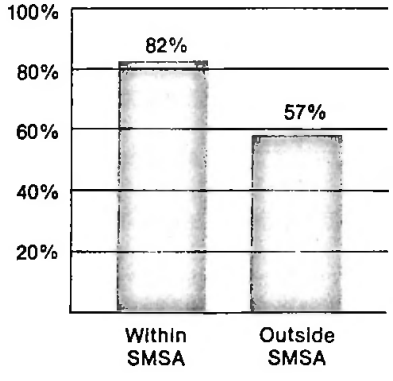
Planning for Solar Homes: Important Considerations

The experiences of builders participating in the HUD Residential Solar Demonstration Program indicate that careful planning for a solar house is essential before entering the construction phase.

Location, choosing a solar system, arranging financing and working with local government agencies all bear on successful marketing of solar homes.

METRO AREA HOMES SELL FASTEST

Percent of sold homes in SMSA/nonSMSA locations



Location: Critical Factor

It is an accepted maxim of the industry that location is the critical factor in the construction/marketing equation: Solar housing is no exception to the rule.

Know Your Local Market

The "best" location of a solar house is determined by specific characteristics of the local market, constrained by factors such as land availability and cost. Therefore, a builder's knowledge of the market area and local homebuyers' preference is extremely important.

Over three-quarters of the surveyed demonstration solar homes constructed under the program are located within a Standard Metropolitan Statistical Area (SMSA) of slightly over one million population. Within the SMSA, suburban or urban fringe locations characterized by short marketing periods and a high level of pre-sold construction activity are preferred by builders.

Innovation: Acceptance in Metro Area

Solar homes situated within an SMSA demonstrate a much stronger sales performance than do those located in smaller towns and rural areas. An active solar energy system is considered by many to be an innovation and its acceptance in the market follows the pattern of other innovations, generally spreading from metropolitan centers to non-metropolitan areas.

Within mature and developing suburbs, over three-fourths of the solar homes sold in less than 14 weeks. This suggests that builders exercise caution in constructing solar homes in other areas.

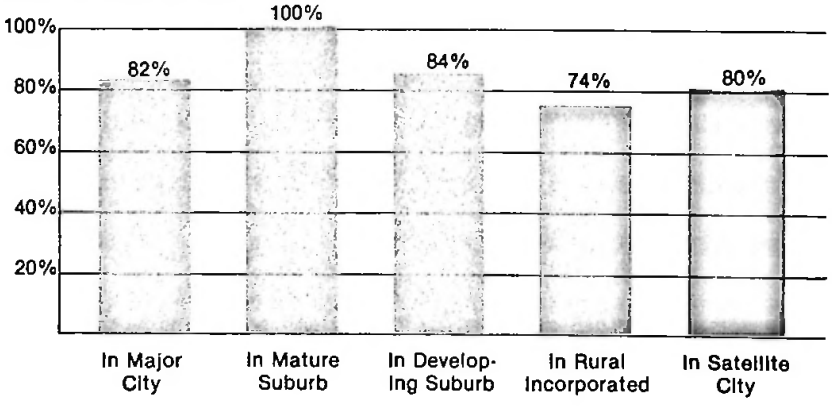
The stronger the local housing market, the better the sales of solar homes. Among 126 solar homes sold, well over half are located in a very strong and rapidly growing market area. Supporting the suburban locational preference of builders, the strongest solar sales occur in suburban and urban fringe market locations.

Price to Sell

The strength of the local housing market influences how rapidly any home—including a solar home—will sell.

SMSA MARKETS DISPLAY LITTLE VARIATION

Percent of sold homes by location



Solar homes are typically priced to attract the discretionary homebuyer. Solar units in the price sensitive and luxury markets are also selling well.

Units priced above neighboring dwellings are most difficult to market. Many of the HUD homes with poor sales performance have been found to be over-priced for their market. In most instances, these over-priced homes are larger or more luxurious than competitive houses on the market.

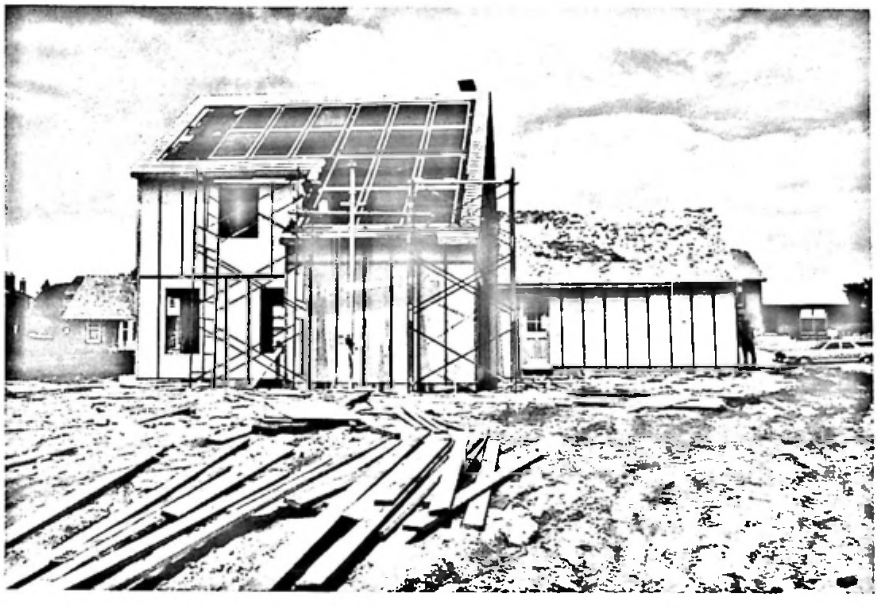
Siting the Solar Home

The site plan is an important concern for most homebuyers. In addition to the common aesthetic factors involved in siting, homes with active solar energy systems present some further considerations.

Shading: Will adjacent buildings or trees block sunlight from the collectors?

Easements: If these obstructions do not currently exist, can legal arrangements be made to guarantee continued access to sunlight?

Orientation: Will the site and building plan allow for optimal orientation and tilt of the collectors?



Solar access is emerging as a complex regulatory and planning issue. However, localities are acting to enhance both active and passive solar designs. Two recent publications highlight those concerns: *Protecting Solar Access in Residential Development* and *Site Planning for Solar Access*. These publications can be obtained from the National Solar Heating and Cooling Information Center, P.O. Box 1607, Rockville, Maryland 20850.

Functional Design Important

Participating builders have generally been successful in combining aesthetic and technical site requirements, although some compromise has usually been necessary.

A builder in the northeast, for example, sacrificed a small amount of collector efficiency in order to provide the homeowners with a panoramic view of the surrounding area.

Selecting the Solar System

Solar energy is a new technology to builders. Consequently, builders are not familiar with the engineering, sizing, performance, and cost criteria of solar devices.

And, solar manufacturers are still developing and refining delivery services and technical assistance to their equipment customers.

The HUD program has provided an opportunity for both solar manufacturers and builders to gain a knowledge of each other's needs. Many reference sources for the technical evaluation and sizing of solar energy systems are being developed.

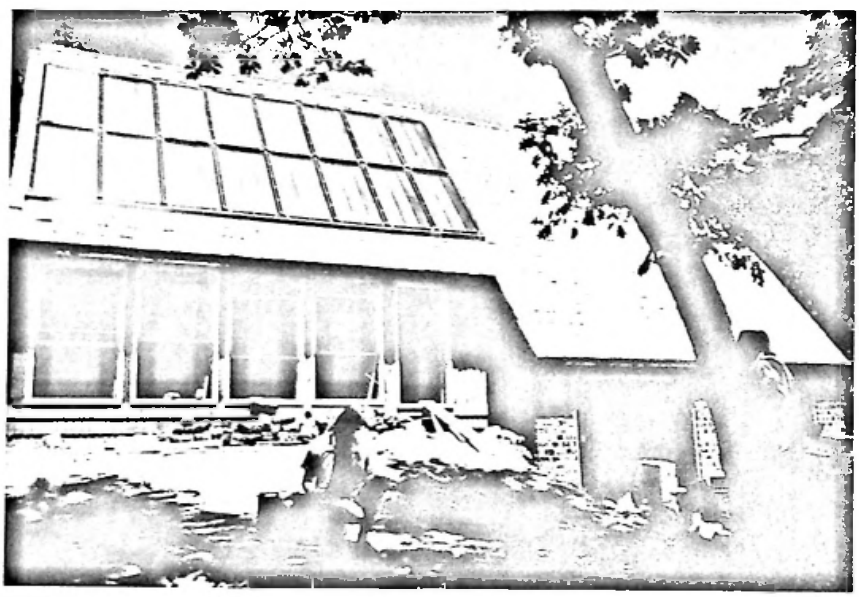
In the final analysis, the individual builder must choose and size the system. Out of 109 builders, only nine custom-designed and developed their own solar systems. Most builders employ a manufactured or "off the shelf" unit chosen on the recommendation of a local technical source or upon the advice of the manufacturer.

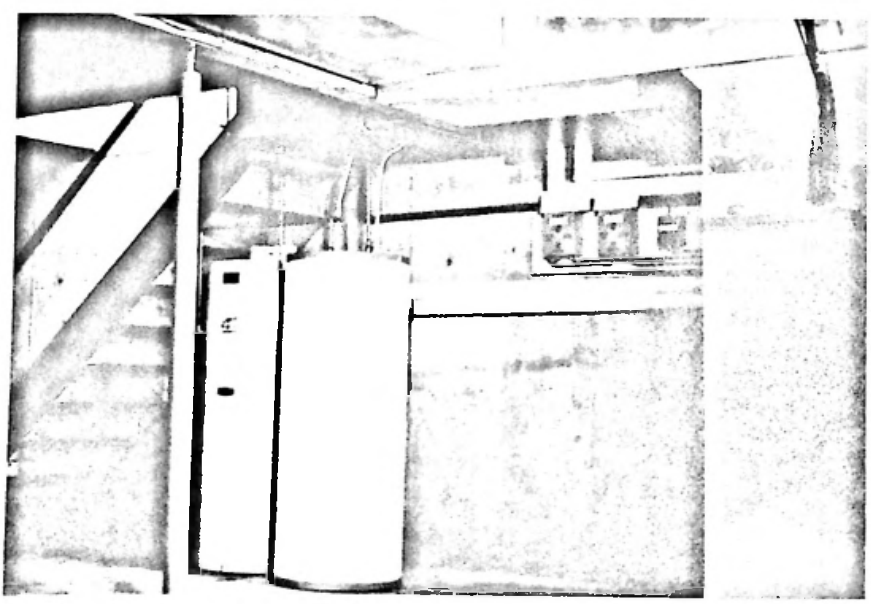
Starting with a knowledge of the type and size of job the solar system will be required to do, builders are faced with many different systems and configurations from scores of manufacturers.

Following is a preliminary checklist of issues affecting the choice of a system.

CHECKLIST FOR SELECTING A SOLAR SYSTEM

1. **Manufacturer's track record**
2. **Efficiency**
3. **Cost**
4. **Durability**
5. **Completeness of technical and installation information**
6. **Ease of repair**
7. **Required maintenance**
8. **Warranty**
9. **Ease of monitoring performance**



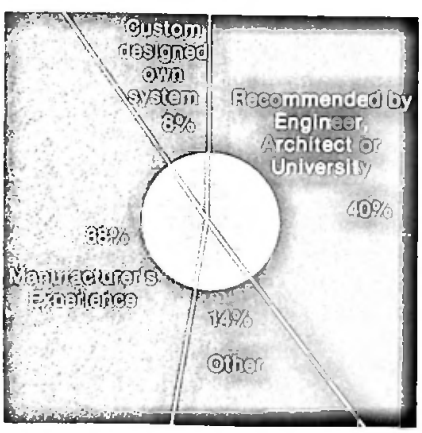


Performance: Collectors should be well-suited to the climate and the specific application. Manufacturers should be asked to explain all collector "efficiency" claims.

System efficiency includes more than collector efficiency; it takes into account storage and heat exchanger efficiency and any thermal losses occurring in the system.

Size and Cost: Solar systems for heating and hot water may range in price from $4,000-$15,000 depending upon such factors as size and performance. One way to combine cost and performance is to determine which collector or system delivers the most BTUs per dollar. Local market condi-

REASONS FOR SYSTEM SELECTION



tions, fuel prices, and climate can also be considered.

Durability: High quality components extend the useful life of a system and help avoid costly down-time and repairs. Builders will have to rely on a manufacturer's reputation, because of insufficient data.

Technical and Installation Information: The manufacturer should supply detailed information on the specifics of installing the system in terms applicable to standard building practices. A manufacturer's representative can often be helpful in this area.

Ease of Repair: Solar energy systems should be easy to repair. Are there qualified service personnel in the area? Will repairs be performed by the manufacturer's work force or will other personnel be needed? System components can be placed in the home to assure convenient service access.

Required Maintenance: General upkeep procedures should be performed easily by the homeowners. A manual describing operating, maintenance, and trouble-shooting procedures should be provided by the manufacturer to both the builder and the homeowners.

Warranty: Warranties protect the builder and the homeowner. The specificity of the warranty should be checked, as well as its terms and the record of the manufacturer in meeting obligations.

In general, no matter what warranties are provided, repair and replacement responsibilities should be clearly defined among the manufacturer, builder, and any subcontractors. HUD's Solar Residential Demonstration Program currently requires a 5-year warranty on solar collectors and a 1-year warranty on the complete system installation.

Ease of Monitoring Performance: Systems should be designed so that the builder or homeowner can easily determine when the system is operating and how well it is performing. Thermometers and operating lights can be used to show that the system is gathering and delivering heat for home use.

Manufacturer's Track Record: Have other builders in the area used the product? What were their experiences with delivery, installation, performance and warranty claims? Are they satisfied? Because the above issues are difficult to analyze, the manufacturer's reputation will be relied upon by many builders.

Securing Construction Financing

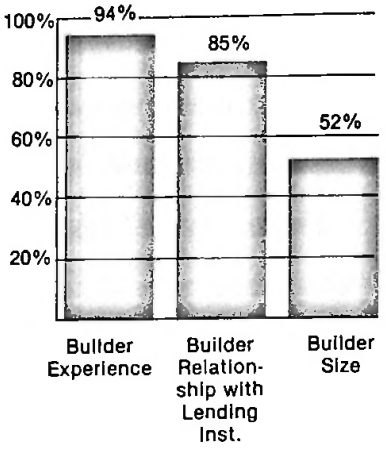
The builder's reputation, prior relationship with the lender, and thoroughness in planning the solar project are the most important criteria in residential solar construction financing.

There have been few major problems in obtaining financing for construction of HUD projects. Eighty-eight percent of the builders report that they have no problems in securing construction financing. Most of those who encountered difficulty are builders just entering the residential construction business.

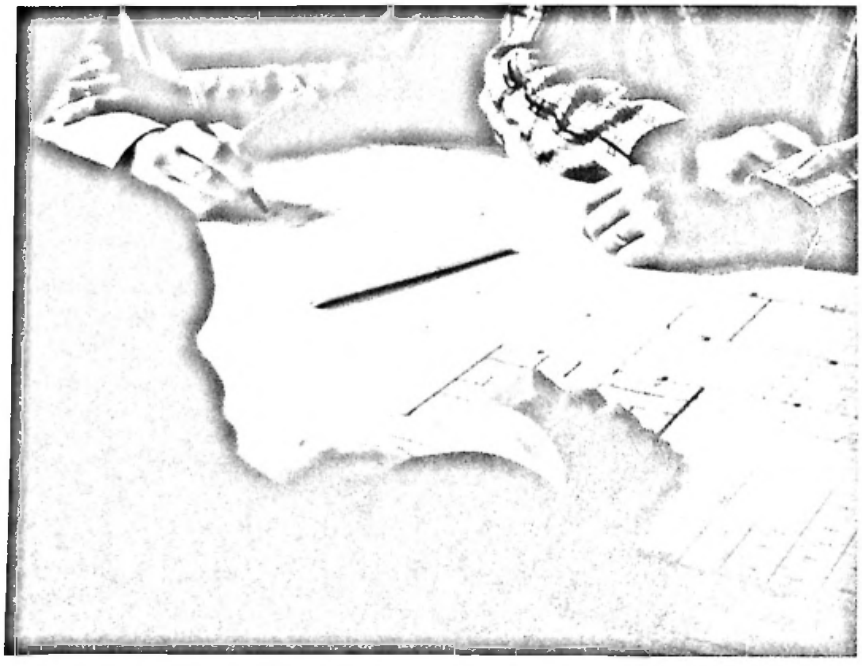
In nine out of ten cases, lenders provided solar construction loans under the same terms as loans made for conventional housing construction. Moreover, in half of the cases in which the terms of the loan differed, the terms were actually better for solar because of the favorable publicity that solar involvement provided the financial institution.

EXPERIENCE AND PRIOR RELATIONSHIPS COUNT WITH LENDERS

Percent of lenders rating item as important



Most lenders describe themselves as "interested in but not committed to" the use of residential solar energy systems. Lenders are beginning to compile information on equipment cost, performance, and reliability. Approximately 30% of the lenders made their loans, in part, because a HUD grant allowed the solar house to be price-competitive.



Meeting Local Government Requirements

Planning and Zoning

Interviews with planning and zoning officials in 96 communities indicate there have been no major problems associated with planning and zoning requirements for solar housing.

In general, solar houses fall under the standard zoning ordinances established in each community. To date, zoning provisions have not created any greater problems for the builder constructing solar homes than for the builder constructing conventional homes.

Building Code Inspection

Because solar involves different building components, such as roof-mounted structures, some builders anticipated problems in the local code inspection process. However, actual experience does not bear out these fears.

Difficulties confronting the solar builder are no greater than those routinely faced by non-solar builders in obtaining approval from building inspectors. In fact, approximately 80% of the 91 code officials surveyed feel that local codes, as currently written, pose no major barriers to the installation of solar energy systems in their jurisdiction.

Reported problems are often described as "administrative,"

requiring only extra time for processing the approval.

Several inspectors have required additional information from the builders, such as system or engineering drawings. A few inspectors have required changes in structural reinforcement of the roof prior to granting approval.

Impacts of Local Government Regulations

Local statutes have begun to reflect a concern with energy efficiency in new construction. In addition, several localities have added specific solar provisions to their codes. These provisions cover a variety of areas, such as structural soundness, health and safety standards, and requirements for all new buildings to be capable of conversion to solar energy. The codes being developed do not appear to be restrictive.

Local Agency Response to Solar

The Residential Solar Demonstration Program has afforded numerous local government officials an opportunity for hands-on experience with solar application. Building code and planning and zoning issues have generally not impeded solar construction.

Building Code Inspection

The building code official of a western community inspected a home constructed under the solar demonstration program and found a number of code requirements not specifically met. Later, the inspector learned more about solar homes at a conference on energy-conserving construction methods. When he reexamined the local code, he noted that it did not prevent the use of materials or methods not specifically mentioned. The inspector reversed his decision and approved the design differences. A clearer understanding of solar home construction, combined with a flexible attitude regarding proper construction procedures, should be developed by officials processing residential solar applications.

Zoning

Builders seldom encounter zoning laws that inhibit development of solar units. In fact some cities encourage solar application. The City of Davis, California, has adopted minimum design standards for new subdivisions which promote the use of solar energy. The provisions include (1) adequate roof overhang to allow maximum sun entry in winter and minimum sun in summer; (2) limitations of glazing to floor area ratios; (3) positioning of homes on lots to maximize southern exposures; and (4) street tree controls that regulate the type of tree used and the percentage of street shading.

These regulations are enforced through the community's housing development priority program, which allows residential construction by permit only. The generally favorable reaction by community residents to these standards has gained Davis a national reputation as being in the forefront of solar energy planning.

Other cities around the nation are taking similar steps to accommodate solar systems on new and existing homes. Planning and zoning departments report that local ordinances seldom limit energy conservation home features.

Design and Build for the Local Market

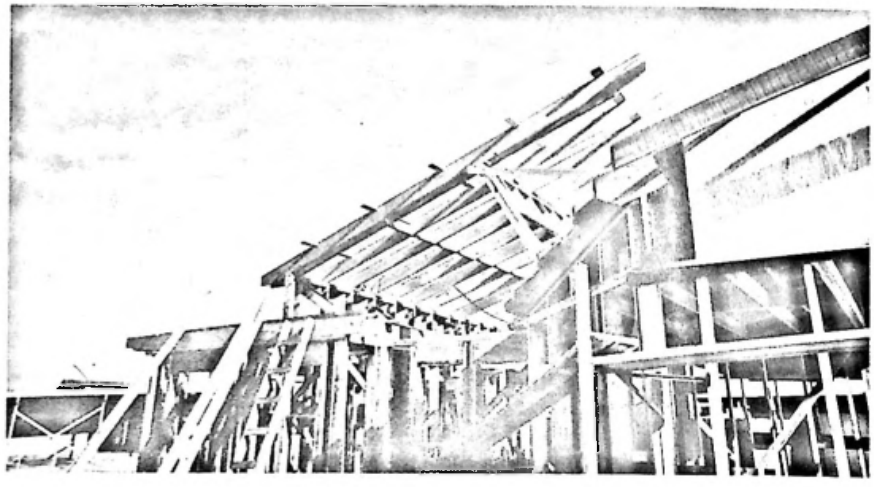
Solar homes should be designed with the same attention to market conditions and buyer preferences that the builder gives conventional housing projects. This is one of the clearest lessons emerging from the demonstration program.

Solar Home Design Experience

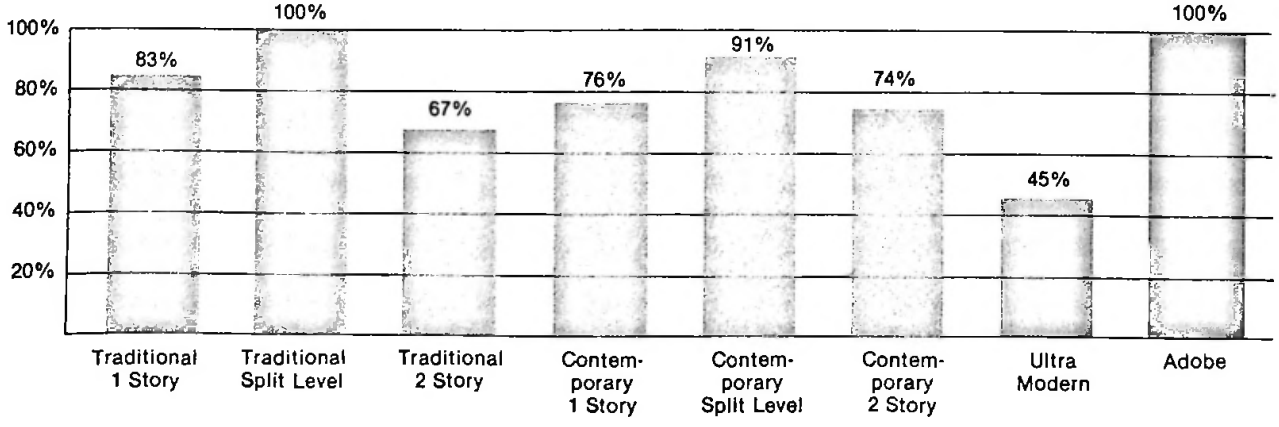
Most of the houses constructed under the demonstration program are of traditional or contemporary architecture. A house does not have to be "ultramodern" to accommodate a solar system.

Design to Sell

Style alone does not sell a house. However, solar houses sell best when they are designed to reflect the aesthetic preferences of the local market. Most homebuyers, particularly those in smaller towns and suburbs, still prefer a single-family detached home. The builder planning a solar townhouse or quadriplex project must make certain that local market conditions and consumer tastes will support such construction, especially if the units incorporate unusual design or stylistic features.



PERCENT OF SOLD HOMES BY DESIGN STYLE



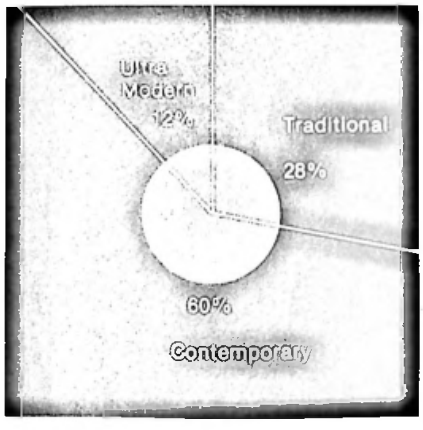
Consider Regional Style Preferences

Aesthetic considerations are very important to local homebuyers in all markets and in all locations.

Homes which have carefully integrated the solar collectors into the house design are easier to sell than those which appear to have the collector "tacked on."

Residences referred to as "ultra modern" or which "stick out in the neighborhood" do not turn over quickly. Tastes vary by area of the country—what is "contemporary" in Colorado may be an "eyesore" in Massachusetts—and developers are well advised to conform to local standards.

FEW SOLAR HOMES ARE ULTRAMODERN



Solar homes which reflect the aesthetic preferences of the local market sell best:

Top: Shawnee, Kansas
Bottom: Albuquerque, New Mexico

Top next page: Shenandoah, Georgia
Bottom: Norwell, Massachusetts

Local Market Dictates Style

Solar homes located in subdivisions should blend harmoniously with neighboring units in terms of style and size, as well as price. A contemporary split-level house with a wood exterior priced at $80,000 is going to be more difficult to sell—with or without a solar system—if it is located in a subdivision dominated by traditional brick houses with an average price of $60,000.

Design Integration Pays Off

The experiences of the solar builders show the necessity of integrating solar system components with the house in both the design

Solar Home Construction Experience

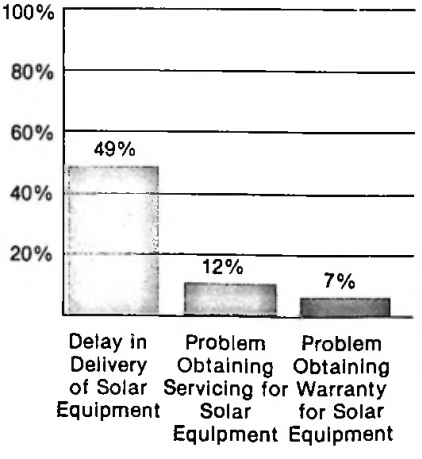
Builders participating in the demonstration program have encountered a number of problems in constructing a solar home. Many of these problems were expected with the new technology.

Delivery Delays Construction

Solar equipment delivery delays are reported by one-half of the HUD builders. In some cases, delays caused a longer-than-expected construction period and created difficulties in scheduling the work of subcontractors. In an industry where time is money, solar manufacturers will have to improve delivery schedules in order to convince builders that equipment will arrive on site in time and intact.

BUILDERS IDENTIFY SOLAR DIFFICULTIES

Percent of HUD builders reporting problems



and construction stages of homebuilding. This is as true for passive as it is for active solar application.

Similarly, consideration given to the integration of the solar energy system with the house's interior will pay off for a developer. The system that is laid out to consume as little interior space as possible, while still maintaining sufficient access for repair work, is best.

One solar builder placed the storage tanks under the garage, thereby preserving basement space for the homeowner's use. Most builders, however, locate storage tanks in the basement, often in the same area as other appliances such as washers and dryers, to create a separate utility room.

Solar Installation Requires Skilled Labor

The lack of adequately trained labor in all but the most advanced markets accounts for most of the labor problems cited by solar builders.

Although most of the installation skills needed for a solar system are only extensions of current practices in plumbing, carpentry, masonry, air conditioning and electrical work, some new techniques are necessary.

These include, for example, orienting and mounting the collectors and using special solder for solar plumbing. As solar home construction becomes more common, appropriately trained and equipped workers will become more available.

Practice Makes Perfect

Most construction-related problems are being resolved as the solar manufacturing and installing industries develop and as builders gain more experience. In fact, many of the participating builders who have constructed solar homes outside the demonstration program report that solar home construction presents no more problems to them than constructing a house with a conventional heating system.

Poor Planning: What to Avoid

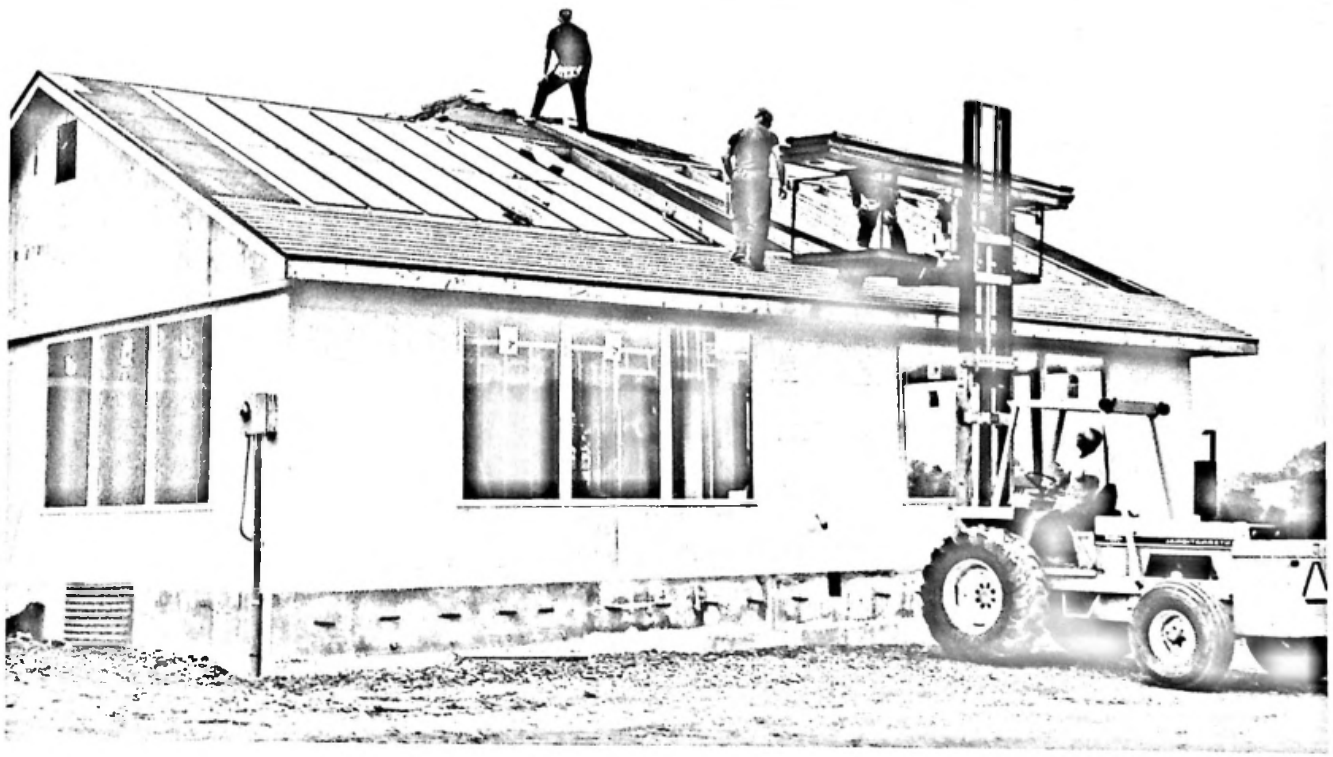
One purpose of the HUD program is to learn from mistakes.

A western builder's marketing problems illustrate what to avoid in designing a solar project.

The local community consisted of two adjacent towns: one oriented to white collar professionals and the other to wage earners of more modest means. Preferred home styles also varied, from traditional single-family detached in the first to more contemporary designs in the second town.

The builder developed a townhouse project of contemporary design in the more affluent location. Although the units were reasonably priced for the area, and would have sold immediately in the second town, they lingered on the market.

In this case, the builder thought that the solar system would sell the more contemporary townhouses, despite the fact that market demand in the affluent community was for traditionally styled dwellings. The lesson is clear: build for the market.



Buying a Solar Home: The Purchase Decision

Two key dimensions of solar homebuying experience are emerging from the HUD demonstration program.

First, the typical solar purchaser falls within the mainstream of America's homebuying public. Households in all age, income and occupational groups have purchased solar houses.

As the table shows, the solar purchaser is no more confined to one small demographic category than are the "comparative" and "typical U.S." homebuyer. All ages, income groups and occupational types buy solar homes. In many ways, solar homebuyers are similar to both their neighbors and the average U.S. homebuyer.

Second, a solar energy system—active or passive—will attract people to look at a house, but will not, by itself, sell the house. Other home features—including price, style and value—must also be present to turn prospects into purchasers.

What Buyers Are Asking About Solar Homes:

An active solar energy system is a major, visible and expensive housing innovation. Builders are asked many questions by prospective homebuyers. The most frequently asked question concerns the utility cost savings a homeowner should expect.

What are the Utility Cost Savings?

Demonstration house experience suggests that the solar system should not be "oversold." Specifically, the builder should avoid promising unrealistic utility savings.

One of the major causes of dissatisfaction with solar equipped homes is that people believe that the system does not produce the utility savings "promised" by the builder. Therefore, until there is more information on actual savings, only tentative and conservative figures should be provided to prospective homeowners.

COMPARING SOLAR AND NON-SOLAR HOME BUYERS

	Solar Purchaser	Comparative Purchaser	NAHB or League Purchaser
Age of Household Head (a)			
Under 30 years	18%	23%	32%
30-44 years	51	47	49
45-64 years	25	26	17
65 years and older	6	4	2
Household Size (b)			
One	13%	6%	13%
Two	39	35	33
Three	18	18	18
Four	22	25	22
Five or More	8	16	14
Occupation (a)			
Professional/Managerial	66%	67%	--
Sales/clerical	8	9	--
Retired	10	5	--
Other	16	19	--
Annual Household Income (a)			
Under $10,000	3%	--	4%
$10,000 - $19,000	22	26%	34
$20,000 - $29,999	37	47	38
$30,000 - $39,999	19	15	15
$40,000 - $49,999	7	7	6
$50,000 or more	12	5	3
Previous Housing Tenure (a)			
Owned	66%	68%	61%
Rented	33	30	39
Other	1	2	--
Length of Time in Metro Area (a)			
Just moved into area	11%	12%	--
Under one year	14	13	--
1 - 5 years	19	24	--
5 - 10 years	25	14	--
More than 10 years	31	37	--
Location of Previous Residence (a)			
Same Neighborhood	19%	6%	--
Same City	52	58	--
Same State	7	10	--
Other Part of U.S.	14	26	--
Outside U.S.	2	--	--

Source: (a) National Association of Home Builders, *Profile of a New Homebuyer*, 1978.

(b) U.S. League of Savings Associations, *Homeownership: Realizing the American Dream*, 1978.

Utility savings are affected by the kind of solar system used, when it is expected to operate most efficiently, the occupant's lifestyle and utility usage, and the price of conventional fuels. Relating the solar system to the overall energy efficiency of the house and showing how the house is designed and situated to take maximum advantage of the sun's energy might also help the builder explain costs and savings.

What is the Reliability of Solar?

Solar purchasers also raise questions which range beyond cost and savings. Issues include technical aspects of the system and its reliability, operating information, and maintenance and repair costs. Builders need to deal with such questions as accurately as possible, drawing on experience from constructing the solar house, the information provided by the manufacturer, and other sources.

The availability of financing for the solar system, solar performance guarantees, and warranty information, while important, are requested by prospective purchasers less frequently.

The Purchase Decision

From a marketing perspective, the purchase decision has two parts. A prospective buyer must first be attracted to or interested in the house. Second, prospects must be convinced that the unit meets their housing needs. Solar systems have a strong influence on the initial aspect of the purchase process, but are less crucial in the second and more important stage.

SOLAR SYSTEM COST IS MOST FREQUENT QUESTION ASKED BY PURCHASERS

Issue	Percent Builders Reporting Question
Cost of Solar Energy System	55
Technical Questions on Solar System	35
Reliability of Solar	30
Utility Cost Savings	30
Operating Data on Solar	28
Recapture of Investment	25
Maintenance and Repair Costs	20
House Price	15
Amenity Package	4
House Style	3
General Location	3
Availability of Financing for Solar System	3
House Size	3
Convenience to Schools	1

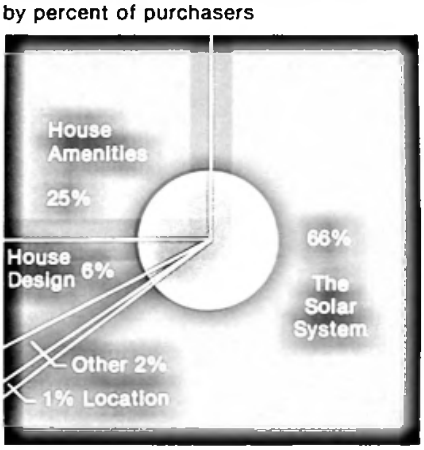
The vast majority of solar purchasers did not initially set out to find and buy a solar unit. Seventy percent of the solar homebuyers looked at other subdivisions in addition to the one in which they bought their solar home. Furthermore, two-thirds of the solar purchasers who bought homes in a development that included non-solar units also looked at these conventional homes.

Solar Arouses Interest

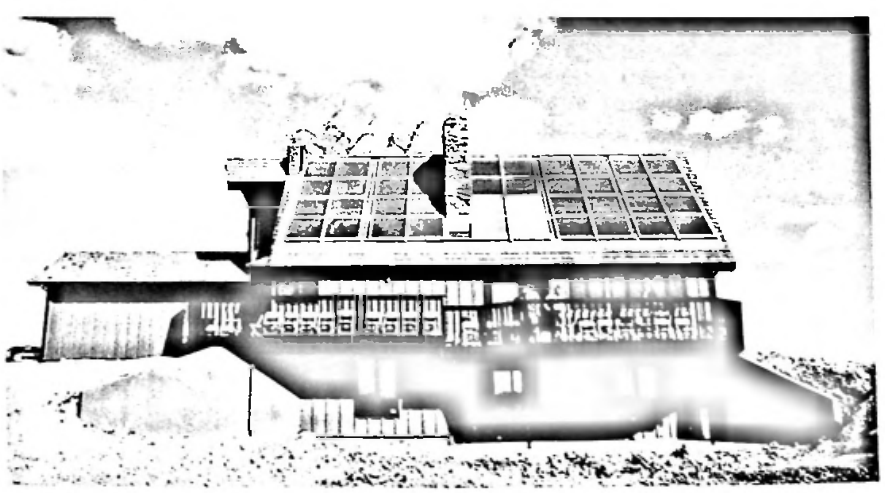
The solar system plays an important role in attracting visitors to the house. Some aspect of solar is cited by two-thirds of the purchasers when asked what particularly drew them to the solar unit.

SOLAR ENERGY SYSTEM ATTRACTS PURCHASERS

Reason for attraction to solar house by percent of purchasers



As one purchaser in New England stated, "We were initially attracted to the house by how the style and



interior layout were adapted to the solar technology. We saw that we would not have to sacrifice aesthetics for solar."

Typifying other purchasers was the comment, "We visited the solar house because we were curious about the system and wanted to learn something about it." Yet despite its high visibility and environmental appeal, solar is not the main attraction for one-third of the households.

Important Factors in Purchase Decision

While playing a major role in attracting potential purchasers to a given home, the solar system is not the overriding factor in the final **purchase** decision. The system ranks among a number of other factors of equal or greater importance to the homebuyer.

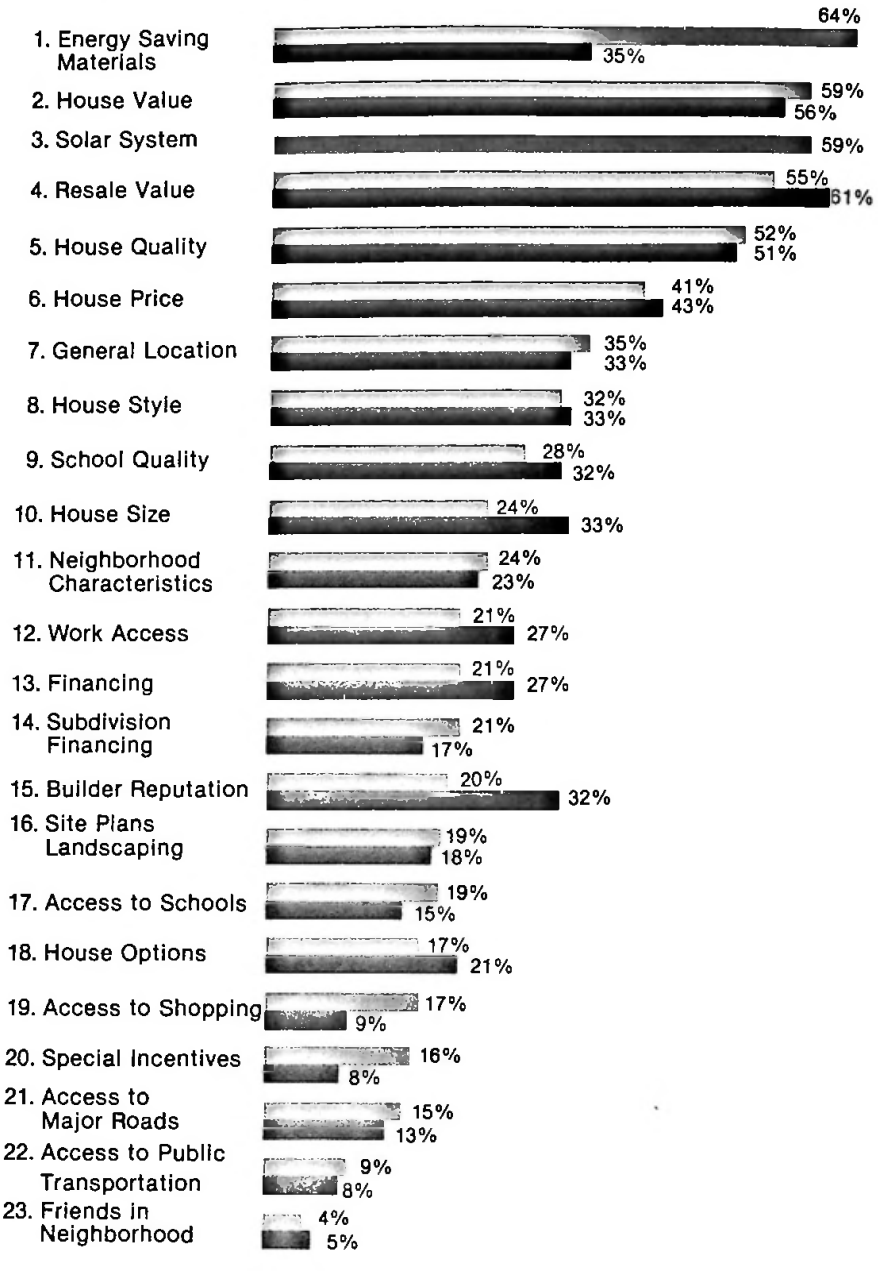
Solar purchasers rank a comprehensive list of house and subdivision characteristics which affect the decision to buy a solar home. The accompanying chart identifies the percentage who cite each feature as "very important." The "very important" purchase decision factors of comparative home purchasers are also displayed.

Energy Efficiency Tops List

Five factors are of paramount importance to the purchase of a solar house—energy saving materials, house value, the solar system, potential resale value, and house quality. The inclusion of energy saving materials in the construction of the house slightly outranks solar in importance to buyers.

SOLAR VS. CONVENTIONAL PURCHASE DECISION

Percent of purchasers ranking each item as important



Key to bar charts:

ORANGE—Solar Buyers
BLUE—Comparative Buyers

This suggests that the energy efficiency of the house "under" the solar system has an even greater draw than the solar system itself.

Purchasers Choose Value

Solar and non-solar purchasers generally consider the same factors in deciding to buy a home. "Value: This house was the best buy within our price range," explains one solar purchaser. Another states, "The price, location and style were the most important factors in our decision."

Nonetheless, the solar system itself has obvious appeal to the purchaser. As one homeowner in Colorado stated, "We believe solar energy is a sound idea and good for the future." In many cases, this belief and a commit-

ment to energy saving materials are the only issues that distinguish solar purchasers from those who prefer conventional dwellings.

How Builders Perceive Solar Buyers

Evidence is increasingly available to show that solar home purchasers are very similar in terms of background characteristics to buyers of similarly priced conventional homes.

Still, many builders participating in the demonstration program believe that prospective purchasers of solar-assisted homes are different from the average homebuyer.

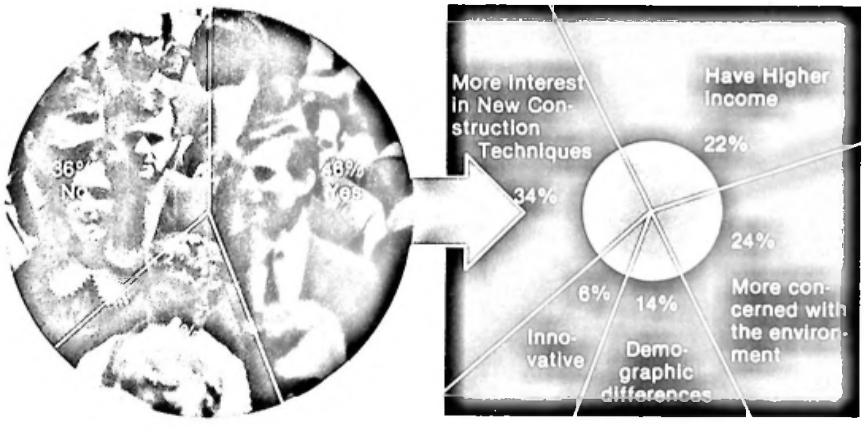
The solar buyers are perceived to be more interested in new construction technologies and more concerned with the environment and energy conservation than the average new homebuyer. A number of the developers believe the solar buyer is a higher income individual and some describe the solar purchaser as more innovative.

Apparently, these builders are "misreading" the solar market. As a result, sales opportunities may be lost or promotional techniques directed to the wrong targets. Extensive field research indicates that it is the quality and appeal of the house itself, not the solar system, that ultimately sells a solar house. Following this principle will assist builders who want to tap the solar market.

SOLAR BUILDERS SEE A DISCRETE SOLAR MARKET

Are potential purchasers of solar homes different?

Differences between solar and conventional homebuyers as perceived by builder



Solar Resale: Emerging Issue

The resale value of a home ranks high on the list of important home features for all buyers. Indeed, appreciation potential is the single most significant aspect of ownership for those Americans who move frequently.

Almost all of the solar homes constructed under the demonstration program have been occupied for less than two years. Only three units have been resold. Four other houses have been placed on the market by the original homebuyers. Actual resale experience of solar homes is therefore extremely limited.

As an example, a solar house originally purchased in the spring of 1977 resold in the fall of 1978. The initial homeowner retired and moved to another state. The house resold for 24% more than the original sale price. The second homeowner purchased the house primarily because of its energy conserving features and the utility savings he expects to realize from the solar system.

Resale data will continue to be collected to provide insight into how this market is developing in different regions of the country.

Attracting the Solar Home Buyer

Builders have targeted their advertising to the energy conscious homebuyer. They emphasize the solar system in their promotional activities.

This strategy has proven successful. But, as the novelty of solar energy wears off, marketing will need to shift focus. In particular, builders report that over the long run, successful promotion will de-emphasize solar and place stress on the basic features and amenities of the "solar house."

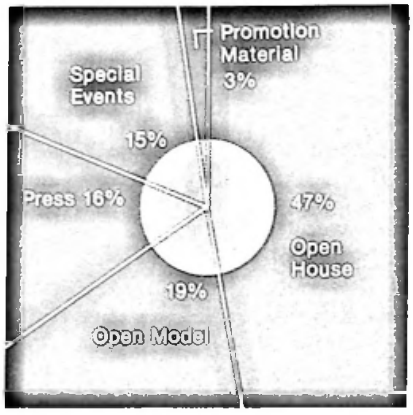
Advertising and Promoting Solar Homes

Solar purchasers become aware of the solar house or subdivision in traditional ways, as the table indicates. As a result, builders and developers can be confident that advertising measures which are successful for conventional homes will work with solar-heated homes as well.

A variety of techniques are used to provide an opportunity for potential homebuyers to view the grant homes. An open house—the most popular method—was used by 83% of the participating builders. Builders also emphasize the solar system in both their general promotional materials and their subdivision advertising. The solar house is viewed by some builders as a magnet to draw people to their non-solar homes in the same subdivision.

OPEN HOUSE SEEN AS MOST SUCCESSFUL PROMOTIONAL TECHNIQUE

Percent of builders



Open House

Although the open house is used by most builders, it does not always prove successful. These events have attracted local dignitaries and generated free and generally favorable publicity about the solar home. However, the opportunities to obtain free media exposure have declined as the "newsworthiness" of a solar house has diminished.

HUD program builders also report that wide media coverage has not materially helped to market the solar house. While the number of visitors to the house might be large, the number of serious prospective homebuyers is often limited. In addition, large numbers of curious passers-through may actually deter households interested in the house from making a purchase.

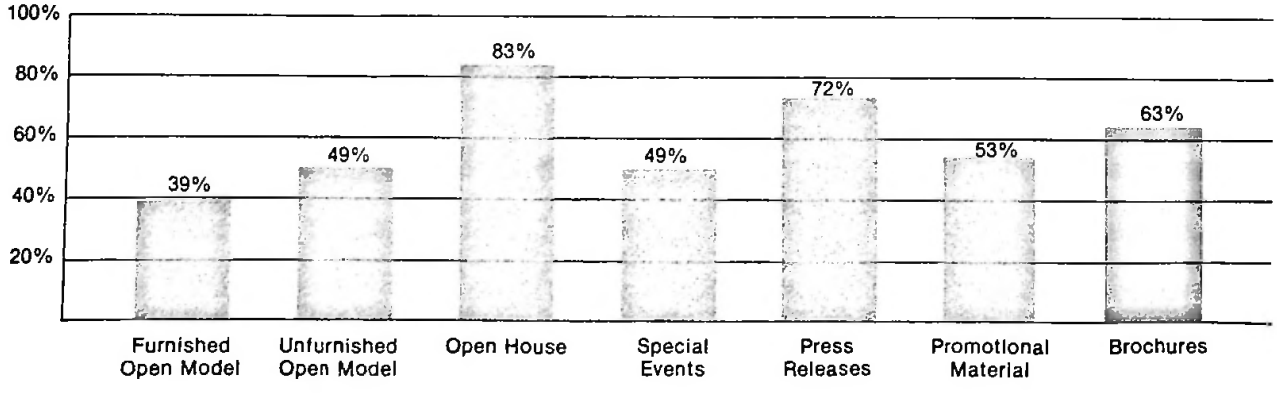
Effective Marketing Approach

An awareness of the marketing lessons yielded by the demonstration program can profit developers in the future. Most significantly, solar builders indicate that the most effective way to advertise a solar home is to promote it in the same way conventional units are advertised. In other words, stress on traditional values and features, using standard marketing approaches, works best.

This conclusion is reinforced in interviews with builders about six months after the solar houses are sold.

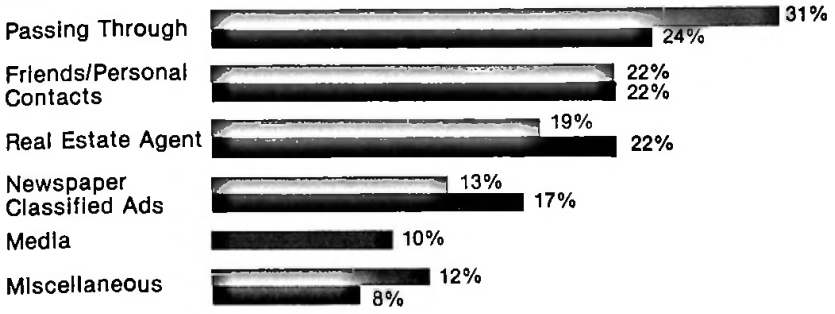
MANY TECHNIQUES ARE USED TO PROMOTE SOLAR

Percent of builders using each technique



HOW PURCHASERS FIRST LEARN OF HOUSE OR SUBDIVISION

Percent of solar and comparative purchasers by means of initial awareness of the solar unit



Builders who report that they would alter their advertising techniques for future solar homes, state that they would concentrate on traditional marketing techniques. More important, they would de-emphasize solar and promote the house more, while stressing the energy conserving features of the dwelling.

Implications for Marketing Solar Homes

The successful solar builder will locate, design, and price a solar house using the basic principles of successful conventional home building.

Because solar homes are typically somewhat more expensive than their competition, a sound marketing strategy is usually necessary for rapid sale.

The HUD program shows that promotional efforts need not be flashy or expensive. Those important to successful marketing stress the basics of location, style, and price.

Pricing the Solar Home

Ability to accurately and profitably price a solar unit is critical to builders. Comparing the ongoing "asking" and the final "selling" prices of solar units shows whether builders are able to establish marketable prices. Seventy percent of the HUD units have been sold at or above the initial asking price.

Fluctuations between asking and selling prices are not necessarily attributable to the solar system. Houses that sell for 5% to 10% below a builder's initial asking price are not uncommon in many markets.

For example, initial asking prices can be slightly inflated to see what the market will bear. A $60,000 home that sells for $57,000 exhibits a normal market situation. The reverse, a $60,000 home that sells for $63,000, indicates a very strong seller's market.

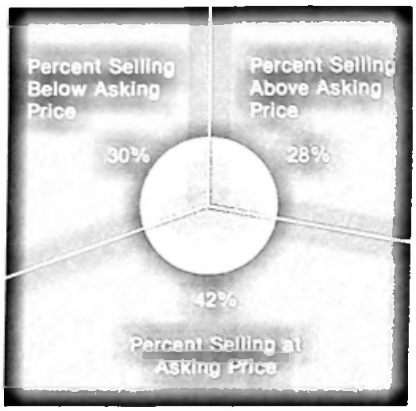
Solar System Costs

A review of solar grant homes that have not sold (or took over 20 weeks to sell) indicates that the most frequent problem is inappropriate pricing of solar houses given the prices of the competition. Thus, *it is not the absolute cost of a solar home that has inhibited sales*. It is the relative price of the solar houses as compared to other houses in the same area or subdivision.

In some cases, the cost of solar system installation caused houses to be overpriced for their market. But in most instances, the solar homes were simply larger and more luxurious than the competition.

In fact, solar homes in all price ranges—from the $35,000 townhouse to the $150,000 plus single-family residence—have evidenced good sales records. Builders must be concerned with

SELLING PRICE VS. ASKING PRICE
Percent of sold homes



the price of the competition. This is not surprising, but it is a consistent finding in the HUD program.

As reported above, buyers appear willing to accept a slightly smaller home (in square feet—not number of rooms) as long as the price is similar to neighboring units. This will permit builders to cover solar equipment costs and remain competitive.

Marketing problems have also occurred with expensive homes (often with unique designs) in rural or tourist-oriented communities. These homes are affordable to only a small segment of the market—the second-home buyer or affluent year-round residents.

In a few instances, solar townhouses or condominiums located in areas where single-family homes are more widely preferred and available at competitive prices have resulted in poor sales experience.

Attractive Design

Solar aesthetics can be of critical importance to marketability. Solar panels need not detract from the exterior beauty of a home. In the vast majority of solar applications, the collectors blend well with overall design features.

In the case of some "slow sellers," unattractive design is cited by both prospective purchasers and researchers who visit the solar sites. Similarly, the location and design of interior solar equipment, which compromises storage or closet space, detracts from a dwelling's appeal.

In many solar homes, the collectors are seen only from the backyard.

MARKETING EXPERIENCES

Case 1

A midwest builder constructed a grant home in a subdivision located on the urban fringe. The subdivision is adjacent to a major county road, providing maximum exposure for the solar unit.

The builder's primary marketing technique was newspaper advertising but he also used open models, open houses, and promotional brochures. In marketing the solar home and other units in the subdivision, the builder launched his newspaper campaign and scheduled open house events to coincide with the State Fair, which was taking place in the area.

In addition, the solar house was extensively landscaped (contrasting sharply with the rather stark lots adjacent to the property) and brochures emphasizing the solar system were distributed.

The solar house sold the first day it was on the market. However, the builder believes that the presence of a solar unit had no effect on sales of the non-solar units in the subdivision.

Case 2

The solar house was built in a subdivision that primarily attracts white collar workers moving in from out-of-state. The builder held an open house upon completion of construction. The open house attracted several thousand visitors, including some local dignitaries. However, none of those who visited the solar house that day made an offer to purchase.

The solar house was sold by a local real estate agent several weeks later.

In this situation, increased traffic generated by the solar energy system did not lead to a sale. In fact the ultimate purchaser first looked at this home without realizing it featured solar heating and hot water.

Living in a Solar Home

The daily experience of living with solar energy will be the ultimate test of solar's acceptance by homebuyers.

Energy savings—as reflected in a lower monthly utility bill—ease of operation, reasonable repair and service costs will sell solar homes. In future years, resale value of solar vs. conventional residences will be an important marketing factor.

The initial and very tentative reactions of HUD program purchasers are mixed. The majority are pleased with the solar system. However, there have been some problems.

Buyers are being contacted periodically to monitor their perception and to document the actual performance of the solar system. As more experience is gained, the findings reported below may be modified.

Early Homeowner Reactions

Asked specifically about their satisfaction with their solar home, 61% of the homeowners say that they are satisfied with their *solar systems*, that the system works well and saves money.

Ninety-four percent "like" or "like very much" the *solar home*, and 90% express similar opinions about the development or subdivision in which the solar home is located.

The fact that as many as four of ten homebuyers are not happy with the solar energy system warrants attention.

SATISFACTION WITH SOLAR: MIXED RESULTS
Percent of solar home purchasers

Many "normal" complaints voiced by any new homeowner become solar complaints even though the problem is not related to the heating or hot water system. As a result, reports of solar problems may be overstated. Still, builder and developer can learn from the preliminary experience of new solar home purchasers.

Lower than expected utility cost savings, poorer than expected temperature control and a high frequency of repair and service problems are the main reasons for displeasure with the solar system.

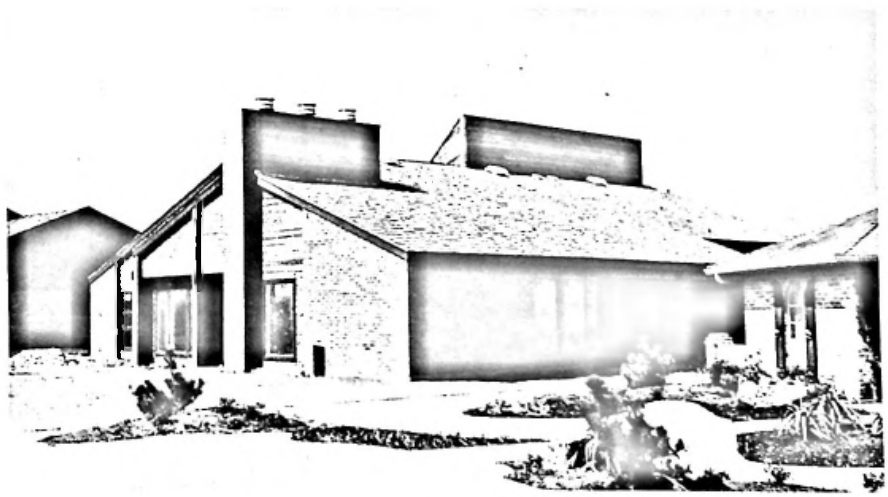
Cost Savings: The attainment of anticipated fuel cost savings is the most important factor influencing consumer satisfaction with solar energy systems.

Recognizing that utility bill savings is the ultimate test of solar acceptance, cost data are being collected. As more information is available, detailed study of costs will provide builders with a clearer understanding of what families can expect from their system.

Comfort: The ability of a homeowner to maintain a desired temperature comfort range also has a strong impact on satisfaction with a solar home. Consequently, a home's back-up heating and hot water system must be sized correctly. It should be capable of handling the entire load when solar energy is not available or during periods when the system is being serviced or repaired.

Repairs: The seriousness of repairs needed by a solar system is a third key consumer concern.

As with cost savings, the early findings are very tentative and



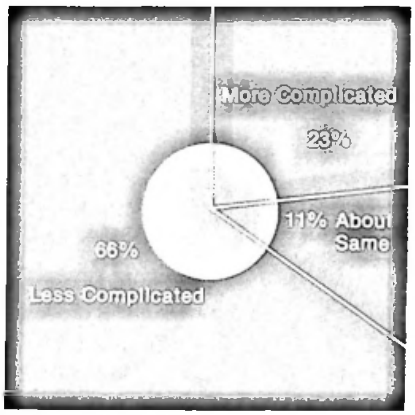
subject to change. The frequency of repair record of different types of systems is being monitored.

Operation and Maintenance of the Solar System

Living in a solar home does not appear to present substantially greater difficulty to the homeowner than living in a house with a conventional heating system.

SOLAR LESS COMPLICATED THAN CONVENTIONAL HEATING

Reported by purchasers who have lived in the solar house at least six months



Seventy-seven percent of the solar homeowners report that the operating procedures of their solar systems are about the same or less complicated than those associated with conventional heating systems.

Three-fourths of the solar dwellers report that except for conventional controls, such as thermostats, their systems require virtually no homeowner's participation or manual operation. As one owner of a solar hot water system put it, "The only control I have to operate is the faucet."

In some solar systems, however, extra controls are present, usually for changing the operating mode of the system from winter to summer settings or aligning reflector panels. Even with these additions, only one in ten solar homeowners reports having to spend more than 15 minutes a day to insure proper solar system operation. Moreover, a negligible proportion of solar purchasers term these procedures inconvenient.

While daily attention to solar equipment is not a problem, maintenance of the solar systems is reported to be complicated. Almost one-half of the solar homeowners report maintenance procedures to be more frequent or more complex than those associated with conventional heating systems.

Owner Maintenance Increases Solar Satisfaction

Three-quarters of the homeowners who are able to provide their own system maintenance are satisfied with the system. Only about 40% of those who cannot personally maintain the equipment express satisfaction

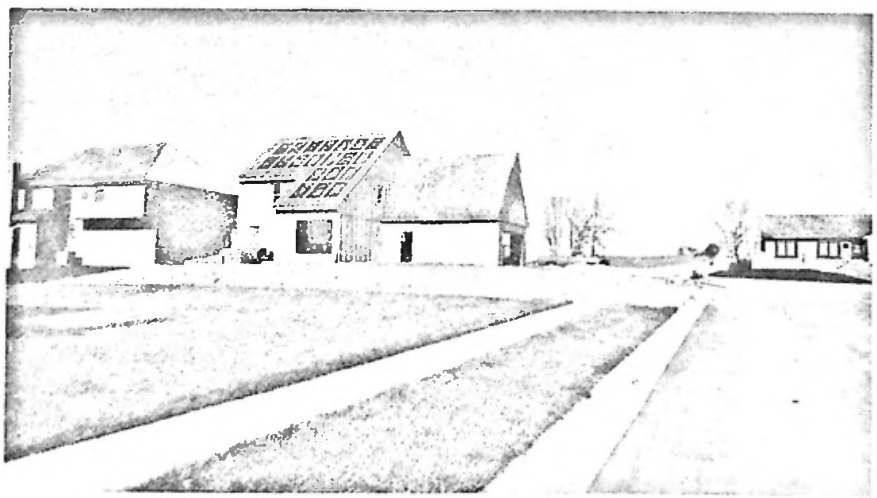
Manuals Assist Owners: Over three-fourths of the homeowners believe an owner's manual is very helpful.

TYPICAL MAINTENANCE TASKS FOR ACTIVE SOLAR ENERGY SYSTEMS

- ✓ 1. Plumbing System Check
- ✓ 2. Inspect Anti-Freeze
- ✓ 3. Wash Collectors
- ✓ 4. Lubricate Motor
- ✓ 5. Check Filters
- ✓ 6. Check for Corrosion
- ✓ 7. Open-Close Vents

The manual should explain the workings of the system, its maintenance needs, and trouble-shooting procedures. Information on what to do in emergency situations is especially important. These explanations should be backed whenever possible with operating, maintenance and repair guides written in language the homeowner can understand.

Builders Provide Service Contracts: In about one-third of the solar homes solar maintenance is



performed by outside service personnel. Typically, this work has been paid for by the builder or the solar manufacturer as part of an overall service contract. Two-thirds of the homeowners using these services report them to be prompt and reliable.

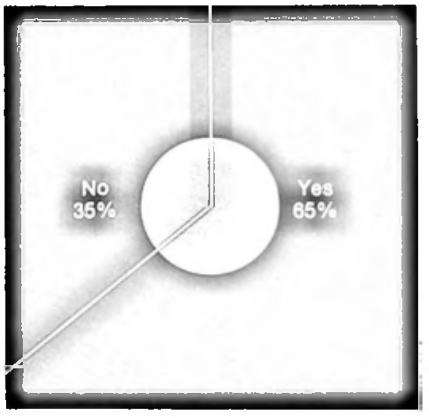
The only reservation expressed by homeowners is that some service personnel are still learning the fine points of solar, necessitating extra visits and time for the completion of their work.

Solar System Reliability and the Need for Repairs: Slightly over half of the solar systems have needed some repair work.

Preliminary homeowner interview data show that needed repairs range from minor—knocking pipes, for example—to major problems. To date, too little information is available to characterize repairs or to identify areas of special concern.

Reported repair problems include leaks, faulty or inoperable controls, poor thermal performance, inadequacies of installation workmanship, or the lack of proper solar energy control.

ARE SOLAR REPAIRS PROMPT?
Percent of solar purchasers



Almost two-thirds (65%) of the solar homeowners who have required repair services believe that the work has been completed promptly.

As in the case of maintenance personnel, solar repair organizations are becoming more sophisticated in their service techniques. Repair delays are generally attributed to the need for personnel to spend extra time acquiring necessary skills. However, 28% of the purchasers feel that reliable solar service is not yet available in their locale.

Utility Savings: No Hard Data. Most of the solar grant homes have not been occupied long enough to provide detailed information on utility usage and savings.

Despite the lack of hard data, the solar homeowner's perceptions of savings are important.

More than half the purchasers cite a reduction in utility bills as the main attraction of a solar home. Thirty-three of 62, or about half of the homeowners interviewed believe that they have experienced utility bill reductions. Nineteen believe that they have not saved, and ten are not able to determine what the system has provided.

However, these reactions are based on only 6 months of occupancy and may reflect unrealistic expectations about solar.

Builders need to be aware that solar effectiveness and the cost savings of solar systems are very difficult to measure in the real world. Purchaser's expectations —which may be too high or too low—and the extent to which the home meets them are the key factors in consumer satisfaction.

Until data is available to convincingly demonstrate utility savings, builders and manufacturers should avoid inflated performance claims. Homeowners are not tolerant of exaggerated cost savings promises which are not fulfilled.

Financing a Solar Home

Although costs, operation and repair are most important to home buyers, mortgage and insurance issues are also concerns. The property tax home owners pay—and how solar affects taxes—is also important.

BUYERS RECEIVE CONVENTIONAL FINANCING

Obtaining a Solar Home Mortgage

The vast majority of solar purchasers (85%) have no difficulty obtaining a mortgage for their homes. A conventional mortgage, with the same general terms and interest rates as those of other loans made at the same time, is typical.

Mortgage lenders stress that traditional methods are used to determine a borrower's eligibility for a home mortgage loan. Some lenders, however, are considering energy costs in addition to principal, interest, taxes and insurance when looking at a household's ability to pay for a home.

Insuring the Solar Home

Neither have purchasers of solar homes had problems obtaining homeowners insurance. The rates and coverage are comparable to those for conventional homes.

Anticipated problems—damage to the collectors from hail, high winds or vandalism—have not occurred to any great extent. And claims by homeowners for damages caused by the solar system, such as leaks in the pipes, have been honored.

Tax Assessment

Tax assessment procedures for solar homes are important to both the builder and the homeowner. For the homeowner, the issue is whether the solar system will increase the assessed value of the home, thereby affecting the amount of property taxes to be paid. The builder is concerned because taxes can affect the marketability of the unit.

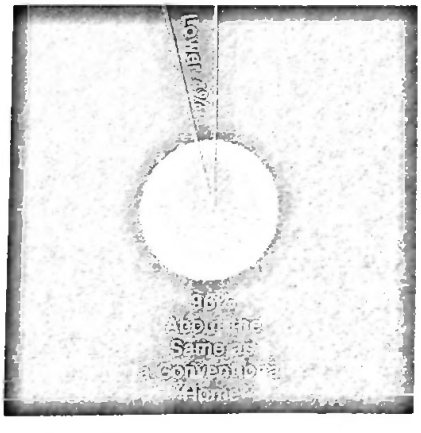
Interviews have been conducted with 45 local tax assessors to determine the effect solar energy systems have on their assessment of a house.

They report that the lack of comparable data or national standards for solar makes the assessment of solar homes more difficult. However, the vast majority (88%) believe that tax assessment practices or procedures do not serve as barriers to the widespread utilization of solar energy.

Many states and local jurisdictions have adopted taxing policies which promote solar use. In some, the value solar adds to a home is not taxed. In others, a tax credit is extended for adding a solar system.

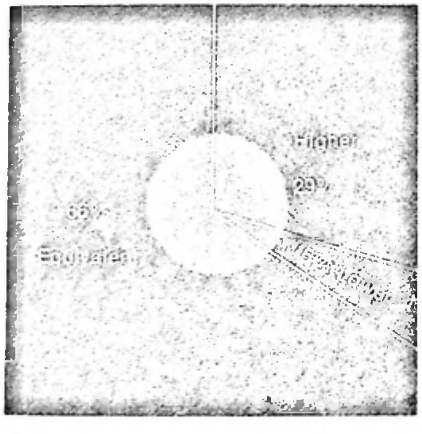
INSURING A SOLAR HOME: NO EXTRA COST

Insurance rates for solar homes as compared to conventional homes (percent of agent respondents)



SOLAR EQUIPMENT: LIMITED IMPACT ON ASSESSMENTS

Percent of tax assessors appraising solar units as equal to or higher or lower in value than conventional units



Living With a Solar System

Living with a solar system affects the lifestyle of some owners.

Respondents from various parts of the country report doing the family laundry in the afternoon when the solar system can provide the necessary hot water, rather than in the morning when back-up energy is likely to be needed. Some homeowners with large families have phased their laundry load over several days to maximize use of solar energy, rather than doing several large loads in one day.

Others report that they consciously reduce their utility bills by keeping their thermostats lowered in order to increase solar participation in meeting their energy needs.

A buyer from New Mexico describes the tasks he performs to keep his system operating efficiently: "We check the filters and pack the outside vents with insulation in the winter; on cloudy days we turn off the hot water system to direct all of the solar heat into the house. That's about all we have to do—our lifestyle really hasn't changed since we moved in."

Solar Outlook is Encouraging

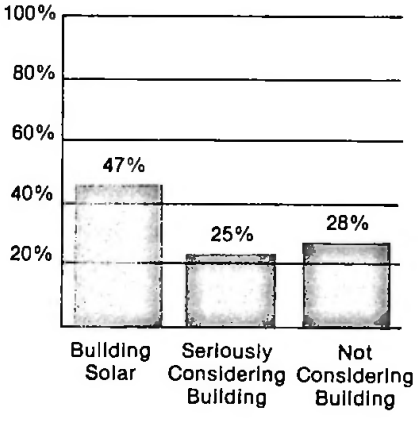
The HUD program has demonstrated that homes equipped with solar heating and hot water systems will sell.

Market Acceptance

The substantial market acceptance of solar has surprised some developers. Sales experience is largely successful—and costs recoverable. Builders are also pleased with the lack of red tape in solar construction. Finally, public relations activities connected with solar energy have improved their image in the industry and in the community.

BUILDERS ARE COMMITTED TO SOLAR

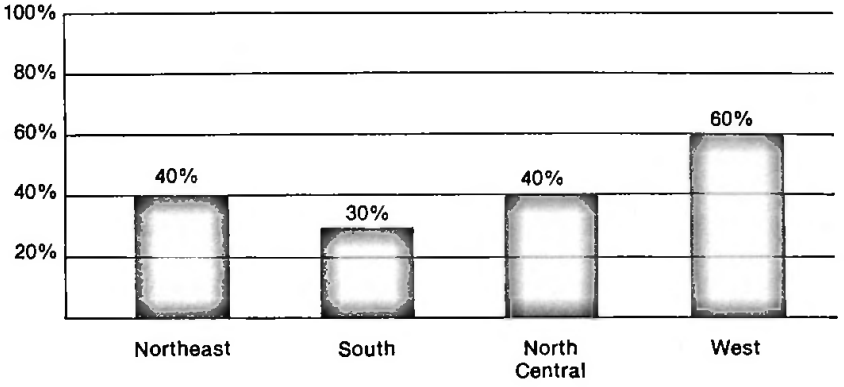
Percent of builders by willingness to build additional solar units



Builders express optimism about the future demand for solar energy in their locality. Three-quarters of them are willing to construct additional solar homes outside the HUD program. More importantly, 45% are now actually building these homes without benefit of grants.

BUILDERS COMMITTED TO SOLAR REGIONALLY

Percent of builders building solar homes without a HUD grant by region



Active and Passive Designs

The early cycles of the HUD demonstration program provided grants largely for active home heating and domestic hot water systems. Today, passive solar design and construction techniques are gaining momentum among professional builders.

As the state of the art of solar residential applications changes, builders will have more options for providing the public with energy conserving features.

Continuing Studies

Continuing research is needed to clarify the extent and depth of the solar residential market. More must be learned of consumer willingness to pay the front-end costs of solar energy systems.

And repair and service experiences will have to be traced to determine frequency and cost of repairs.

To most homeowners, however, utility bill savings are critical. For solar to capture a meaningful market share, it will be necessary to have hard data to document energy savings and relate these savings to operating expenses and the initial system cost.

HUD program homebuyers are beginning to provide insight into these issues. As additional data are collected, the building community may expect updated reports on the utility and cost saving questions. This information, in turn, can be passed on to prospective homebuyers.

ALSO AVAILABLE FROM THE RESIDENTIAL SOLAR DEMONSTRATION PROGRAM...

The Residential Solar Demonstration Program has produced a variety of other publications dealing with the construction, marketing and institutional factors affecting the building and selling of solar homes. All are available from the Government Printing Office (GPO) except where noted. GPO order numbers and prices are listed where appropriate. To order publications from the Government Printing Office write:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

GENERAL CONSTRUCTION

A Descriptive Summary of HUD Cycle 2 Solar Residential Projects.
023-000-00389-9 Price: $2.35

A Descriptive Summary of HUD Cycle 3 Solar Residential Projects.
023-000-00418-6 Price: $3.50

A Descriptive Summary of HUD Cycle 4 and 4A Solar Residential Projects.
023-000-00531-0 Price: $4.75
Each volume profiles HUD grant projects using architects' drawings and basic house and system descriptions.

Solar Dwelling Design Concepts 023-000-00334-1 Price: $2.30
An extensive introduction to the design considerations involved in the use of solar energy in residences. Basic system information is provided together with descriptions of general building and site design factors important for the use of particular systems in particular climates.

INSTALLATION

Building the Solar Home 023-000-00455-1 Price: $1.60
Addressed to builders and contractors, this document outlines basic installation mistakes that have occurred in the earlier demonstration cycles, and offers suggestions about how to avoid them.

Installation Guidelines for Solar DHW Systems in One and Two Family Dwellings
023-000-00520-4 Price: $4.00
Designed to assist professional contractors and skilled homeowners in installing DHW systems. The *Guidelines* should be used in combination with a manufacturer's manual. Also provides tips on maintenance and checkout. Extensively illustrated with drawings of construction details.

INSTITUTIONAL FACTORS

Protecting Solar Access for Residential Development: A Guidebook for Planning Officials
023-000-00523-9 Price: $4.75
Prepared by the American Planning Association, the guidebook shows various ways of incorporating solar access protection within conventional zoning or land use controls. Illustrated, with technical appendices.

Site Planning for Solar Access: A Guidebook for Residential Developers and Site Planners
023-000-00545-0 Price: $4.75
A companion to the *Guidebook for Planning Officials* but targeted to builders and developers. The document describes how solar access protection can be assured using traditional site planning or subdivision development tools. Illustrated.

Solar Access Law: Protecting Access to Sunlight for Solar Energy Systems
Prepared by the Environmental Law Institute and available from the Ballinger Publishing Company, 17 Dunster Street, Cambridge, MA 02138. Price: $18.50
This document discusses the legal options for and implications of legislatively protecting solar access at the state or local level. Intended for use by practicing attorneys or policymakers and legal researchers.

MARKETING

Marketing and Market Acceptance Data from the Residential Solar Demonstration Program: 1979, available through National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161. NTIS PB-80/115298, Price: $13, Microfiche Price: $3.50
An expanded and more detailed version of *Selling the Solar Home: 1980,* in a report format. Basically for market or policy analysts. Prepared by Real Estate Research Corporation.

PASSIVE SOLAR ENERGY

The First Passive Solar Home Awards 023-000-00571-4 Price: $5.50
Discussions of general passive design, construction and marketing concepts surround project descriptions of winning applications in HUD's Passive Design Competition. Addressed to builders and designers, the document also details potential design and construction problems involved in passive solar applications. Includes site and construction drawings, bibliography and glossary.

Regional Guidelines for Building Passive Energy Conserving Homes
003-000-00481-0 Price: $5.25
An extensive outline of potential passive design responses to various climatic contexts. Richly illustrated.

A Survey of Passive Solar Buildings 023-000-00437-2 Price: $3.75
A brief introduction to passive solar heating concepts and applications followed by descriptions of representative passive projects across the United States. Illustrated with drawings and photographs.

NATIONAL SOLAR HEATING AND COOLING INFORMATION CENTER

The Center maintains a broad variety of information useful for members of the building professions and others interested in solar heating and cooling applications. Some of the information available includes lists of solar builders and other professionals by area, specialized bibliographies and fact sheets and lists of passed or proposed legislation. To contact the Center write P.O. Box 1607, Rockville, Maryland 20850 or call toll-free (800) 523-2929. In Pennsylvania (800) 462-4983. In Alaska and Hawaii (800) 523-4700.

February 1980
HUD-PDR-514