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WORKING PAPERS ON MARKETING AND MARKET ACCEPTANCE

SPRING 1978

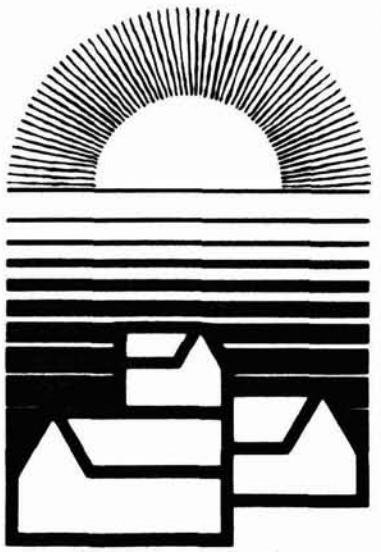
RESIDENTIAL SOLAR DEMONSTRATION PROGRAM

VOLUME I
PRELIMINARY FINDINGS AND ANALYSIS

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

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.

WORKING PAPERS ON MARKETING AND MARKET ACCEPTANCE



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PREPARED BY
RERC REAL ESTATE RESEARCH CORPORATION
MAY 1978

HUD-96 (4-72) PREVIOUS EDITION MAY BE USED

Memorandum

U.S. DEPARTMENT OF
HOUSING AND URBAN DEVELOPMENT

TO : The Reader

DATE: May 24, 1978

IN REPLY REFER TO:

FROM : David C. Moore, Division of Energy, Building Technology and Standards, TRB

SUBJECT: Working Papers on Marketing and Marketing Acceptance

These two volumes of "working papers" provide a comprehensive presentation of market response data from the first two cycles of the HUD Residential Solar Heating and Cooling Demonstration Program. As such, they supplement and expand upon the preliminary findings presented in HUD Solar Technical Report 1, Selling the Solar Home, (GPO #023-000-0444-5). The report, issued in May, 1978, was based on an earlier and smaller sample of projects in the first two demonstration cycles.

Wide-scale distribution of these two volumes of working papers is not planned, since the major findings and recommendations are not significantly different than those of "Selling the Solar Home." However, since these working papers document the methodology and statistical approach used in this analysis, they are being made available through the National Technical Information Service, and a limited number of copies are also being provided directly to organizations which have an identified interest in the data collection and evaluation procedures being used.

As data become available from the later cycles of the HUD demonstration program, additional analyses will be carried out by HUD and its support contractors, and the results published on a periodic basis. HUD expects to publish the first revision of "Selling the Solar Home," together with supporting technical reports, in the fall of 1978.

Program Manager
Solar Heating and Cooling
Demonstration Program

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Summary of Findings

This summary excerpts the key findings contained in the following chapters. It is intended to orient the reader to the major issues involved in analyzing the marketing and market acceptance of residential solar units.

These working papers focus on questions and issues which might be raised by a builder interested in constructing a solar home. As a result, practical information relevant to the construction industry and to solar manufacturers is stressed. More technical or theoretical analyses are available in other HUD documents.

The Builders

Many different types of builders are participating in the demonstration program. Their experience, size, reasons for building solar units, choice of a system, familiarity with solar energy applications, and their satisfaction with the HUD program are described below.

Experience

Participating builders range from the slightly experienced to the highly experienced. Although the average length of time in residential construction is 9 years, 42% have been building for less than 5 years. This suggests that a large minority of the builders attracted to the HUD program are relative newcomers to the industry.

Size

The demonstration program participants range from those who build one or two homes a year to very large firms constructing more than 750 units annually. Fifty-eight percent of the solar builders construct under 50 units a year. Only eight percent average more than 750 units per year.

Reasons for Participation in the Demonstration Program

Builders offer a wide variety of explanations for their decision to build a solar home in the HUD demonstration program. The most frequently cited reason is "it seemed like a good idea/the right time to try it" (28%), closely followed by "good publicity"(26%). Some see it as an interesting challenge (21%). Sixteen percent feel the program gave them an opportunity to test the solar market.

Solar System Selection

One of the features of the Residential Solar Heating and Cooling Demonstration Program is its encouragement of flexibility and innovation in the builders' selection of solar systems. Evaluation of the manufacturer's experience is the basis for choosing equipment for 48% of the participants. Thirty-eight percent followed the advice of an independent engineer, architect, university or other research organization.

Nine percent utilized solar equipment of their own design. As the HUD program has evolved, builders are relying with greater frequency on solar manufacturers in selecting their equipment.

Other Solar Experience

The HUD builders typically have not constructed a solar assisted residence prior to the program. Forty-three, or 78%, of the participants have no previous experience with solar energy. Builders having prior experience with solar are predominantly from the South and the West.

Although the majority of the grantees are new to solar construction, 50% are building solar homes outside of the demonstration program. The Western area of the country accounts for nearly half of these builders, suggesting that this regional market is particularly receptive to residential solar energy.

The Solar Grant

Fifty-three percent of the solar builders report that the HUD grant roughly equalled their equipment and installation costs. Fourteen percent are not sure. The remaining one-third feel that the grant fell short of their expenses and they would have to recover the excess costs in the sale price of the solar home. Research and development costs, the expense of accommodating features and special promotional costs are most frequently cited as the sources of this excess.

Program Satisfaction

When the solar grant house is completed or nearing completion, the participants evaluate their satisfaction with the program. A large majority (88%) express positive opinions about their participation. They are pleased with the lack of problems in construction of the units and with the promotional and publicity advantages resulting from their involvement with solar.

Solar Homes: A Profile

Size, price, amenities, subdivision characteristics and location comprise the market features of solar homes. A preliminary profile of the units built by the 58 builders discussed above has been developed. Because these units are only a small proportion of the nearly 5,000 units awarded grants through Cycle 3, the profile is not intended to represent solar units in general.

Location of Solar Grant Units

Eighty-five percent of the sampled solar dwellings are located within Standard Metropolitan Statistical Areas (SMSA's). Among the units in SMSAs, 16% are located on the SMSA's major city, 4% in a mature suburb, 47% in a developing suburb, 29% in a rural or unincorporated area. The remainder are in satellite cities.

Over 90% of the solar grant houses are built within a subdivision. Of these, over half are constructed in subdivisions developed by a single builder. The remaining units are in subdivisions in which a number of independent builders purchase lots. The median subdivision size is 81 units. Several are located in PUD's, retirement communities or other planned subdivisions.

Structural Characteristics

The majority (83%) of the solar grant houses are single family detached dwelling units. Their median size is approximately 1,580 sq. ft.

The solar units vary substantially in exterior finish, with nearly half (47%) composed primarily of wood. Stucco is the second most typical finish, appearing on 22% of the units. The remainder are finished in adobe, aluminum siding, brick or other materials.

Most grant houses are 3 bedroom, 2 bath units, with no basements (reflecting the regional distribution of the sample), and over three quarters have a garage. The typical residence has central air-conditioning, a dishwasher, a disposal, and a stove/oven combination. The house typically is not equipped with a refrigerator or a washer-dryer. Most have a patio and fireplace and are at least partially carpeted.

The Solar System

In most cases, the solar system provides space heating and domestic hot water. Sixty-four percent of the systems employ a liquid medium.

The median system cost is $11,650. The sample of participating builders passed an average of $5,000 of the solar grant through to the house purchaser. The "solar pass through" represents the portion of the cost of the solar system equipment for which the purchaser does not pay.

House Price

A wide spectrum of housing markets is suggested by the costs of the solar houses in the sample ranging in asking price from $29,900 to $169,000. Asking price per square foot ranges from $26 to $65. There are two price market concentrations: one between $50,000 and $60,000 and a second between $70,000 and $80,000. The average per square foot price is between $35 and $40.

The Development Process

The process of constructing a solar dwelling is affected by the availability of construction financing and by the policies of local zoning and planning agencies and building code departments. These institutions can cost a builder both money and time. HUD program builders thus far have not encountered significant difficulties in dealing with these institutions.

Construction Finance

Solar builders generally do not experience difficulty obtaining construction financing. For the 13% who report problems, there is no direct evidence from the financial institutions to suggest that the problems were a result of the unit's solar system. Most of the builders encountering financing difficulties do not attribute them to solar.

Lenders report that a builder's "track record" and previous relations with the institution are important in their decision to finance. Thus, acceptance of residential solar energy may be related less to a feeling that solar is a low lending risk or a highly beneficial energy source than to a belief in the credit worthiness of the solar demonstration builders.

Loan Terms

Almost all of the lending institutions (94%) provided financing for the solar unit on terms essentially the same as for conventional houses built at the same time. Because of the publicity, one lender provided financing on more favorable terms. There was only one instance in which a solar project received terms less favorable than usual.

Appraisal of Solar

The way in which the solar system is appraised can affect short-term financing. The appraisal of the solar system reflects the value the construction lender sees in the solar system. Almost two-thirds (66%) of the solar construction lenders believe that a solar system will add to the value of the home.

Forty-one percent of the solar lenders do not believe that the full costs of a solar system can be recouped in the sale price of the home in the absence of a government grant, and an additional

28% are unsure. To a related inquiry, 41% of the lenders respond that solar energy will create additional home value at time of resale while 43% are unsure.

Building Code Inspection

Some solar builders experience difficulty obtaining building inspector approval. There are nine instances (17%) of problems encountered for a solar unit and one problem with code approval for the development in which a solar house is located. Builders attribute these problems to lack of inspector knowledge about solar, which may be a short term rather than permanent problem.

In the 40 sample jurisdictions having a building code, only six required design changes in the solar unit for code approval. Changes involved the ventilation system, wall construction, valves and the separation of tanks from the potable water supply. In close to 90% of the cases, regulatory personnel handled systems approvals for grant houses in the standard manner.

Solar and the Code

Nineteen percent of the jurisdictions surveyed have provisions relating to solar system installation in their code. All of these jurisdictions are in the Southern and Western regions of the country. The code provisions incorporated a portion of the Uniform Building Code and the BOCA plumbing code.

Some types of solar systems may have problems meeting code requirements. Systems with toxic carriers are noted by 10% of the officials, systems with plastic tubing by eight percent, liquid systems and "unworkable" systems by five percent each.

Fifty-two percent (21) of the building code officials believe that the potential problems in meeting code requirements are greater for solar retrofits. This is largely because of the possibility of the residence's structural inadequacy for supporting the weight of the collectors. A third of the respondents believe there will be special considerations in using solar energy for multi-family housing.

Planning and Zoning Approval

Obtaining zoning approval has been a problem for only four percent of the solar grant units. None of the solar builders' problems is attributed to solar, rather the local "political climate" is cited as the cause of their difficulties.

Solar builders have had no problems obtaining site plan approval for the solar units. None requested zoning variances, special exceptions or modifications in subdivision standards for the solar units.

Only 2 of 44 planning and zoning officials report modification of zoning ordinances to accommodate the installation of residential solar systems.

For multi-family solar units, entire solar subdivisions and solar retrofits, the potential impact of planning and zoning regulations increases. Eleven percent of the officials report that multi-family solar housing would be regulated differently from single family, and that construction of an entire solar subdivision or PUD might raise unique issues. Almost a third of the officials believe that retrofitted units might need ordinance changes in height limitations, yard position requirements or historic district aesthetic regulations.

Marketing a Solar Home

The marketing and promotional approaches employed by demonstration program participants are not substantially different than conventional home builders, but they are more intense. Only a minority of purchases are drawn to a solar unit because it is a solar unit. Most are not "pre-sold" on buying a solar home.

Solar Marketing Techniques

One of the basic techniques used to promote solar homes is advertising, with over four-fifths of the grantees emphasizing solar in their ads. Most advertising is in newspapers with local magazines and billboards being used far less frequently. Eighty-six percent of the solar builders also use open houses in their promotion. Roughly 70% use special brochures and press releases. Special events and open models are also used.

Builders often (69%) use the arrangement of long-term mortgage finance to increase sales for homes. There is no substantial difference in the use of this technique to promote a solar home as opposed to a non-solar home. Similarly, a majority of builders (81%) provide some kind of warranty on the housing unit. (This refers to a warranty on the home, not the solar system.) In most cases, the warranty does not differ between solar and non-solar units.

It has been suggested that the attraction of a solar home may be used to generate interest in non-solar units in a subdivision. Solar builders are about evenly divided on this issue, with half believing that overall subdivision marketability is enhanced by the presence of a solar house.

Marketing from the Purchaser's Perspective

Solar and conventional home purchasers learn of the developments in which they bought homes through a variety of sources. Most often they first become aware of the development informally, such as by driving around or by getting advice from friends.

Less than one-third (29%) of the purchasers of solar homes first visited the subdivision because of the solar energy units. However, 81% of the builders stress the presence of a solar unit in their advertising. This may suggest that a more even balance in advertising might be more effective than stress on the solar feature.

The purchase decision itself reflects a complex interaction of consumer preferences in home features. In general, the solar home purchasers had not decided in advance to buy a solar house: only 18% bought a solar unit without looking at comparative, conventional homes of similar price.

Solar Purchasers

The emerging purchaser profile suggests that solar homebuyers are quite similar to purchasers of similarly priced conventional residences. The solar energy system is not the only, nor is it reported to be the most important, factor in the purchase decision.

Age, Occupation, Education

There is a close similarity between the age distributions of solar and conventional home purchasers. Nearly half of both groups are between the ages of 30 and 44. However, solar appears to appeal to a variety of age groups, ranging from under 30 to the over 65, retired population.

The vast majority of both purchaser groups have at least some college education-- 82% of the solar purchasers and 75% of the comparative purchasers. Professional and managerial occupations predominate among solar homebuyers. The sample also contains a number of retirees, possibly reflecting a concern for energy conservation on the part of this fixed income population.

Income and Household Size

Thirty-one percent of the solar purchasers earn $20,000 or less, and an equal proportion have incomes of more than $30,000 per year.

A large percentage of solar purchasers have small households compared to non-solar purchasers. Sixty-seven percent of the solar homebuyers consist of one or two member households, while 38% of comparative home buying households are of this size.

Previous Housing Experience

Comparative purchasers are more likely to be previous homeowners than are solar home purchasers. Fifty-nine percent of the solar buyers owned a home prior to the solar unit while 73% of the comparative purchasers had been previous homeowners.

Homebuyers who are new to an area or those who are highly mobile exhibit buying characteristics that differ from residents making a local move. These differences are important to the builder interested in developing a successful marketing strategy. Seventy percent of the solar purchasers moved to their new home from within the same city as opposed to relocating from another city or state.

The desire to have more room or to own a home is cited by 41% of the solar purchasers as their reason for moving. This is consistent with the fact that many solar purchasers were previously renters. A change in household size and job/work related factors and neighborhood factors are each given as reasons by 16% of the solar buyers. Only one solar purchaser mentioned utility costs as a motive for moving.

The Purchase Decision

Purchasers of solar and conventional homes are asked to rank 23 features of their home and its location in terms of their importance to the decision to buy. Factors rated as "very important" by the 58 solar purchasers (and the percent who so indicated) include house value (59%), energy saving material (53%), resale value (51%), construction quality (49%) and solar system (45%). The top five factors among comparative homebuyers are resale value (63%), construction quality (49%), house value (42%), builder reputation (31%) and house price (29%).

It is noteworthy that fewer than half (45%) of the solar homebuyers rate the solar system as very important. However, energy saving material is ranked highly by solar purchasers, and is mentioned more than twice as often as by comparative purchasers. House value, resale and construction quality are at the top of both lists.

Perhaps the most interesting finding is that a solar energy system is -- by itself -- not a determining factor in the purchase decision.

Institutional Impacts on Consumers

The availability and terms of mortgage loans for solar units, backup utility rates, insurance coverage and premiums, and tax assessments levied on solar units, all affect the costs of home

ownership. Institutions have not adopted policies or procedures in these areas which discourage solar home purchasers.

Lenders (Mortgage)

Availability of Permanent Financing

Fewer than 10% of the solar purchasers experienced difficulties in obtaining permanent financing. Problems cited include less favorable rates or delays in the loan process. The average mortgage term is 30 years. Seventy-eight percent of the loans were made at interest rates between 8.5% and 9.5%. Most are conventional loans.

Typically, the lender is either a savings and loan institution (66%), an independent mortgage bank (22%), or a commercial bank (12%).

Methods of Assessing the Value of Solar

The permanent lenders vary in their methods of determining the value of solar systems. Twenty-eight percent consider the system as an individual component while 61% include the system in the overall cost of the house on a per square foot basis. Eleven percent of the lenders use a combination of the two approaches.

When lenders assess the value of the solar unit, the solar system is not always included in the appraisal. Thirteen percent of the lenders excluded the system from valuation, 33% include part of the cost and 53% include all of the cost. Officials who believe that solar systems have features whose costs are greater than their value attribute this to high installation costs and to the costs of the required backup system.

Attitudes Toward Solar

Among the participating permanent lenders expressing an opinion on the subject, 60% believe that a builder can recover the costs of the solar system in the house sales price. A majority foresee no difficulty in reselling a solar home. Sixty-one percent of the lenders believe a solar system adds to the value of the residence.

Many permanent lenders (71%) report that they are not very knowledgeable about solar energy systems, and, therefore, had some problems determining the actual value of a solar house.

Utility Companies

Most utilities are aware of the solar houses in their service area. Among the alternative utilities (i.e., utilities that are not providing backup services to the HUD demonstration grant homes), 70% indicate that they are aware of solar units.

Typical Utility Rate

Most developers (73%) request a standard utility rate and correspondingly, most utility companies (91%) provide standard rates to solar dwellings. A majority of utility companies are of the view that existing rate structures neither encourage nor discourage the use of solar energy.

A continuing concern of electric utility representatives is the effect of solar energy on utility load factors. A substantial number (67%) express concern that solar would have an adverse impact on their company. Among the concerns expressed are the difficulty of predicting peak load demand and of recouping actual service costs to solar units.

Insurance Companies

A limited number of home insurance companies have been interviewed. Data reveal that neither the companies nor their agents have developed specific policies on insuring solar housing. Generally, agents see no difference between insuring a solar house and a conventional house, and all of the solar units investigated to date have been insured at standard residential rates.

Tax Assessment

Techniques for assessing different types of residential property vary among tax assessors. For all solar and conventional housing types (single family detached, townhouse, multi-family low rise), the most frequently employed method of appraisal is a combination of replacement value, comparable sales and reproduction value. For single family detached and townhouses, the comparable sales approach is used by 38% and 32% of the tax assessors, respectively. For low-rise, multi-family, the comparable sales method is employed only 16% of the time. Replacement value is used less frequently for single-family detached (13%), townhouse (16%) and multi-family (16%).

Two-thirds of the jurisdiction appraised the solar homes at about the same value as comparable non-solar homes. In the remaining cases, the respondents indicate that a higher appraised value was derived or that they could not recall the comparison.

Consumer Satisfaction

The ultimate measure of market acceptance of solar housing will be the satisfaction expressed by individual purchasers. Therefore, a key feature of the HUD program is the long-term monitoring of purchaser satisfaction with their house, the solar system, and the development in which they live. The findings in this area

are quite limited at this point in the project because most solar purchasers have only recently moved into their units.

Most purchasers (87%) like the development that they moved into. Solar purchasers are also enthusiastic about their home. Sixty-three percent express strong satisfaction and 29% indicate that they are generally satisfied with the solar house. Only 8% of the sample are unsure or actively dislike the solar unit they bought.

However, the solar energy system is not a key factor in the buyers' rating of their residence. Only 2 consumers mentioned the system among the features of the home that they like best. The floor plan and construction quality are most frequently noted. Twelve percent of the solar purchasers report that the solar system is the feature they like least.

Some of the purchasers of conventional homes have viewed solar houses at some time. Among these, 35% indicate that what they liked most about solar homes is the solar system while 17% report this is the feature they liked least.

Images of Solar in the Marketplace

Builder Perception of Solar

Many HUD program builders believe that consumers are ready to accept solar energy. Seventy-two percent report that they see an interest in solar housing among serious home purchasers and 74% indicate that visitor reaction to their solar units has either been favorable or very favorable.

Forty-eight percent of the builders indicate that they are building other solar units in addition to the HUD solar grant houses. More importantly, 71% indicate that they will build solar units without demonstration program financial assistance. This latter figure is even more encouraging in view of the fact that for 74% of the participating builders the HUD program represents their first experience with solar energy.

A majority of participating builders (57%) believe that they can recover the cost of a solar system in the asking price of the house. Builders who do not believe that the initial cost of solar can be recovered cite long pay-back periods and extra costs associated with solar system installation as factors shaping their opinion.

There is a growing level of confidence in solar as the demonstration program moves through successive cycles of grants. While only 43% of Cycle 1 builders believe they can recover the cost of the grant in the asking price, 63% of Cycle 2 builders feel that they can recover such costs. Smaller builders are more likely to feel that they can recover solar costs (70%), as opposed to larger builders (under 50% overall).

Lender Attitudes on Solar

Most participating financial institutions are willing to lend for the construction or permanent financing of solar units. The major exception occurs in the North Central and Western areas where a number of construction lenders indicate that they are not favorably disposed to providing construction money for solar housing.

Non-participating lending institutions also tend to look favorably upon financing solar housing units. A number of these institutions, however, express no opinion, indicating that they do not have a clear policy regarding solar housing, or that they have never had a request to finance such units and, therefore, do not know how they would review the application.

Perceptions of Solar by Utilities

Among utility officials, 91% indicate that they see a growing interest in energy conservation among their customers. Sixty-nine percent cite a growing interest in solar housing specifically, and 94% state that they have received some form of request for information about solar energy from their customers. A substantial number of utilities express concern that the widespread adoption of solar may increase their peak load factors while decreasing revenues. Eighty-five percent of the backup utilities believe solar will play a major role in their area while 47% of the non-participating utilities hold this view.

Many utilities do plan to adopt some type of rate that would impact on solar energy. Fifty-nine percent of the participating utilities and 35% of the non-participating utilities report that they have plans to adopt such rates. The most frequently mentioned rates are a "time of day rate" or a "demand rate."

When asked if they intend to lease or service solar equipment, slightly less than 30% indicate that they would get involved in servicing solar equipment, or develop some type of leasing program for solar equipment in the future.

Local Public Officials

Most local governments have yet to address themselves directly to the issue of residential solar energy and the impact local policies and regulations may have on its accelerated development.

Only 2 out of 44 local zoning ordinances have been changed to accommodate solar housing. However, about 34% of local officials in all areas of the country anticipate some modification of local ordinances in the future.

Eighteen percent of the building code officials surveyed are aware of provisions for solar installation in their building codes. In the view of 82% of these officials, the codes present no barrier to solar system installation.

Introduction

Purpose of the Report

The HUD Residential Solar Heating and Cooling Demonstration Program is designed to promote the development of a self-sustaining solar energy industry. The emergence of this industry is critically dependent upon the simultaneous development of a viable market for solar homes.

This document represents the first detailed presentation of data relating to the marketing and market acceptance of solar dwellings awarded grants under the demonstration program. It will be followed, at regular intervals, by more focused analyses of the problems and opportunities encountered by participants in the program. In effect, this report provides baseline information against which the behaviors and attitudes of key actors in the residential marketplace can be compared as solar energy applications increase in number, variety and geographic scope.

The purpose of this report is twofold. First, it describes the actual experiences of the actors and institutions involved in the market acceptance of solar units. Second, it identifies and explores emerging trends in the characteristics, opinions and actions of participants who impact the marketing of the demonstration homes. As befits exploratory research, findings are presented in a preliminary and tentative manner.

The first objective is met through the construction of "profiles" of the solar demonstration builders; the financial institutions which provide construction and mortgage loans; backup utility companies; insurance companies; local government agencies, including planning and zoning, building code and tax assessment departments; and, finally, solar home purchasers. These descriptions serve to define the types of actors involved, their attitudes and policies toward solar energy, and their assessment of the solar grant units they have dealt with. The profiles are based on the responses of persons who have "real world" experience making decisions which affect the development of solar energy in their communities.

This report also provides preliminary assessments of the special opportunities, problems and trends characterizing the marketing and sale of demonstration solar residences. Special attention is directed to differences in market acceptance among major regions of the country and over time. The treatment of solar systems by private and public sector institutions is explored, and their reactions are compared. The advertising and promotional

approaches and techniques employed by builders to market solar units are identified and matched against consumer expectations and preferences.

Conceptual Overview

The report is organized into nine chapters. Each describes a key point in the process of residential development -- from the builders' arrangement of construction financing, through site plan approval, construction, and the marketing of a solar unit -- or profiles a key actor in this process.

Market Acceptance Model

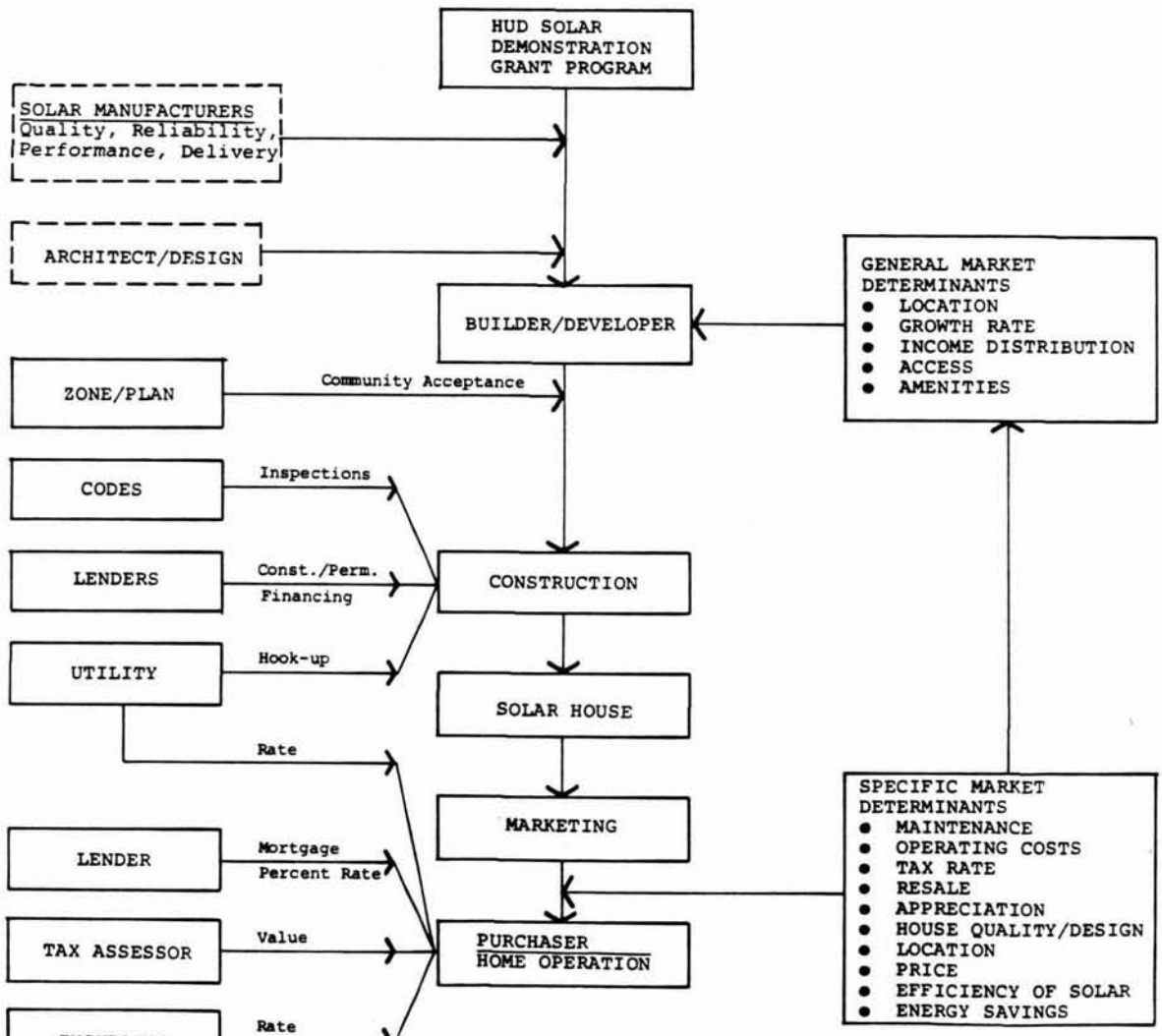
A generalized but comprehensive market acceptance model has been created to guide field research and analysis. The figure on the following page displays the main elements of the model. The central panel illustrates the chronological order of the market acceptance process from the builders' receipt of a grant award, through construction of the solar units, marketing of the solar homes, purchase of the homes and finally, the buyers' operation and maintenance of solar assisted dwellings.

This typical development process is influenced by a number of public and private actors and institutions. The left-hand side of the diagram identifies these institutions and the role they play in influencing the marketability of solar units. Local zoning and planning departments, for example, affect the builder early in the development chronology. Zoning and site plan approvals are prerequisite for construction and, often, for obtaining construction, or short term, financing. Utilities, mortgage lending institutions and insurance providers play a part in market acceptance through their impact on the prospective purchasers' ability to buy a solar home and on the occupants' monthly costs of operating and maintaining a solar assisted dwelling.

Market acceptance has a third dimension which is captured on the right-hand portion of the diagram. The building and sale of residences in a particular area is influenced by such general housing market factors as location and the socioeconomic and demographic characteristics of the home buying population. Home sales are also affected by a myriad of more specific market determinants, including the prevailing tax rate, resale and appreciation potential, and specific house location. These factors are not attributes of the residence, but of its general and immediate context or environment.

The market acceptance model supports two types, or levels, of analysis. At the participant or individual level (left side of the diagram), the types of actors involved, their policies and procedures, and their attitudes and opinions can be analyzed with reference to a particular residence or subdivision. At the

SOLAR MARKETING AND MARKET ACCEPTANCE MODEL



market, or aggregate level (right side of the diagram), the type of dwelling built and its features (both physical, structural and locational) can be analyzed in terms of the degree to which they "fit" or meet the demands of the local market.

A concrete example may be helpful. The fundamental market acceptance question is will a solar house sell. The answer is yes, if (a) the builder is able to obtain zoning and planning approvals, construction financing, prompt code inspection, and appropriate utility hook-ups; and if (b) prospective purchasers are able to obtain mortgage financing, insurance and reasonable tax assessments and utility rates; and if (c) the housing unit itself is located in a market where there is demand for that type of housing, is located in an area with buyer appeal, and provides the design and operational features preferred by purchasers in that area.

In large measure, the question and issues raised in the various chapters are those which would be raised by a builder thinking about constructing a solar home. As a result, practical information, of interest to the construction industry and to solar manufacturers, is stressed. More technical or theoretically oriented analyses of the demonstration program are available in other HUD documents. This report focuses on the local financial, regulatory and market realities which comprise the day-to-day environment in which American builders operate. The widespread adoption of solar energy systems in the residential sector will be greatly affected by the lessons learned and the success of the demonstration home builders in coping with these realities.

Finally, it should be noted that this volume of the report -- Detailed Analysis -- is intended to serve as a reference or resource document. Each chapter is devoted to a specific topic or question, and provides a comprehensive view of the relevant data collected at this point in the demonstration program. In consequence, there is some repetition of material among chapters. This repetition is intentional, and desirable, because it permits a reader with a limited interest to obtain information quickly. A detailed Table of Contents is provided to facilitate this process.

Use of Comparatives

The market acceptance process applies equally to solar and non-solar, conventional residences. The key to the solar market acceptance analysis is to determine the extent to which solar "makes a difference" in the way a dwelling is treated by participants in the process.

This analysis uses "comparatives" to explore this issue. For each builder participating in the HUD program, one or two builders who build homes of similar price in the same market area are also selected. For each solar energy unit constructed, similarly priced conventional units in the same location are selected. For each solar home purchaser, a buyer of a nearby

conventional residence is identified. These comparative builders, homes and purchasers can then be paired with the solar builders, homes and purchasers to determine if they are different and in what ways they may differ.

The importance of this technique is threefold. First, it provides the opportunity to investigate the extent to which solar participants and solar dwellings are representative of the mainstream of the building industry and the mainstream of residential construction. Second, among institutional actors, it permits an analysis of differences in policies and attitudes between those which have actually dealt with a solar application (participants) and those which have not (non-participants). Third, the use of comparative homes -- of the same price and location as the solar units -- provides a means of controlling for or holding constant locational and cost factors which may influence market acceptance.

Organization of the Report

The nine chapters of the report relate directly to the market acceptance diagram. The first two chapters, on the solar builders and the solar units, are largely descriptive. They provide basic information on the grant program participants and the types of solar units they are building. Builders are characterized in terms of their experience, size and other attributes, and by their reasons for participating in the HUD program. Their choice of a solar system and problems encountered in construction are also summarized. The solar grant units are profiled, with such important attributes as size, price, style, amenities and location identified and discussed. A capsule profile of the "typical" solar builder and "typical" solar dwelling summarizes these chapters.

Chapters 3 through 7 focus on the market acceptance process. Chapter 3 profiles participating and non-participating construction lenders, zoning and planning agencies and building code departments. Reports from these institutions on the way they treated the solar homes and their policies and attitudes towards future solar developments are examined. Contrasts between participating and non-participating lending institutions are drawn.

Chapter 4 deals with the marketing and promotional techniques and approaches utilized by solar builders to sell the units. Their activities are matched against promotional and marketing activities of comparative builders. Most importantly, purchaser preferences and responses to marketing tools are contrasted with those employed by builders in a preliminary effort to assess the effectiveness of the techniques used by solar builders.

The fifth chapter provides a detailed profile of the solar purchasers. It discusses their socioeconomic characteristics and their motivations in buying a solar residence. Solar and conventional home buyers are compared to discover if the solar

purchasers represent a narrow, or fringe segment of the home buying market.

In Chapter 6 the role of utilities, mortgage lenders, tax assessors and insurance companies are explained. Of particular interest is the impact of their policies and rate structures on the costs of operating and maintaining a solar residence. These institutions will have a critical impact on the economic feasibility of solar applications.

The following chapter addresses the question of purchaser satisfaction with the solar units. The experience of living in a solar unit is being monitored and levels of satisfaction with the residence and the solar energy system will be more completely analyzed in the future.

The final two chapters provide overviews of solar market acceptance. Chapter 8 describes the builders' perceptions of the market for solar homes. This chapter also outlines an approach to measuring the sales success of solar units funded under the demonstration program. The length of time the units stay on the market between construction and time of sale and differences between asking and selling prices are key indicators of aggregate market acceptance. Unfortunately, consistent information is not yet available to pursue this analysis in detail.

The last chapter, "Images of Solar in the Marketplace," summarizes opinions and attitudes on the applicability of and prospects for solar. Unlike the other chapters, which focus on the practical experience actors have had with solar units, the material presented here describes views on the future of residential solar energy systems. However, to the extent that these predispositions will affect or guide the widespread use of solar energy, they are important to a comprehensive understanding of market acceptance.

The Sample

The findings presented in this report derive from in-depth, personal interviews with participants in the solar market acceptance process. The interview procedures and other data collection methods are described in detail in the Appendix.

Table 1 lists the types of interviews conducted and the number of respondents available for the analysis.

Market acceptance analysis is not conducted for all of the builders who have received grants under the Residential Solar Heating and Cooling Demonstration Program. Table 2 documents this point. Over the first three cycles of the demonstration program, 296 grants have been awarded, comprising almost 5,000 units of housing. The majority of these (235) are market grants made to builders offering "for sale" housing. The remainder, or captive market grants, are awarded for the construction of public housing, dormitory, Native American tribal housing or other units which do not directly compete with conventional houses in the marketplace.

Slightly more than half of the market grants have been selected by HUD for market analysis. Of the 132 chosen for analysis, 58 (44%) have been completed and are included in this report. Table 2 also displays the market, sample and surveyed grant sites by award cycle and by region of the country. Approximately 75% (22) of lst cycle grant sites and 68% (27) of Cycle 2 sites are available for this report. Very few (9 of 63) 3rd cycle grants have been surveyed. The sites are relatively evenly distributed by region. The accompanying map shows the location of the 58 surveyed grant sites.

Methodology and Limitations

The number of respondents available for this analysis is very small. As shown in Table 1, only in the case of builders have more than 50 interviews been conducted as of January 1, 1978. In addition, the respondents do not comprise a random sample of the participants in the solar demonstration program or of the larger populations which they represent. Accordingly, great care must be taken not to overinterpret the results reported here. They constitute valid information, but are not generalizable.

Table 1

INTERVIEWS BY ACTOR

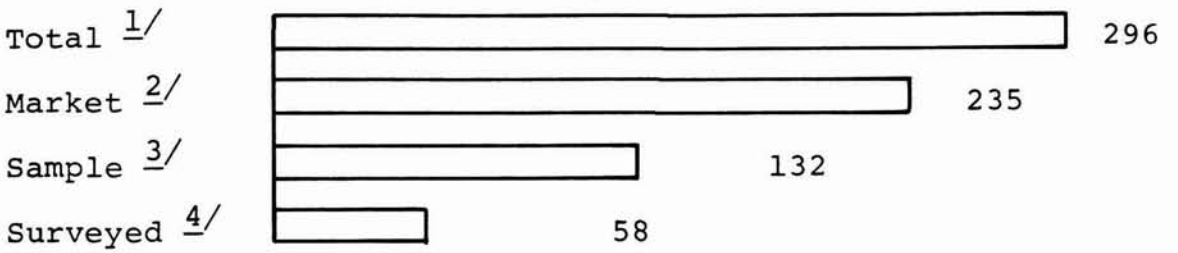
Actor	Number of Participant Interviews	Number of Comparative Interviews
Builder	58	131
Purchaser	49	45
Construction Lender	32	21
Permanent Lender	34	32
Utility	33	20
Insurance	28	*
Tax Assessor	32	*
Planning/Zoning Official	44	*
Building Code Official	43	*

*No comparative actors.

Table 2

MARKET ACCEPTANCE DATA BASE

Grants



Market Sites and Sample Sites by Grant Cycle

	Market Sites	Sample Sites	Surveyed Sites
Total	235	132	58
Cycle 1	37	29	22
Cycle 2	59	40	27
Cycle 3	139	63	9

Market Sites and Sample Sites by Region

Region	Market Sites	Sample Sites	Surveyed Sites
Total	235	132	58
Northeast	52	25	11
South	56	26	15
North Central	61	38	15
West	66	43	17

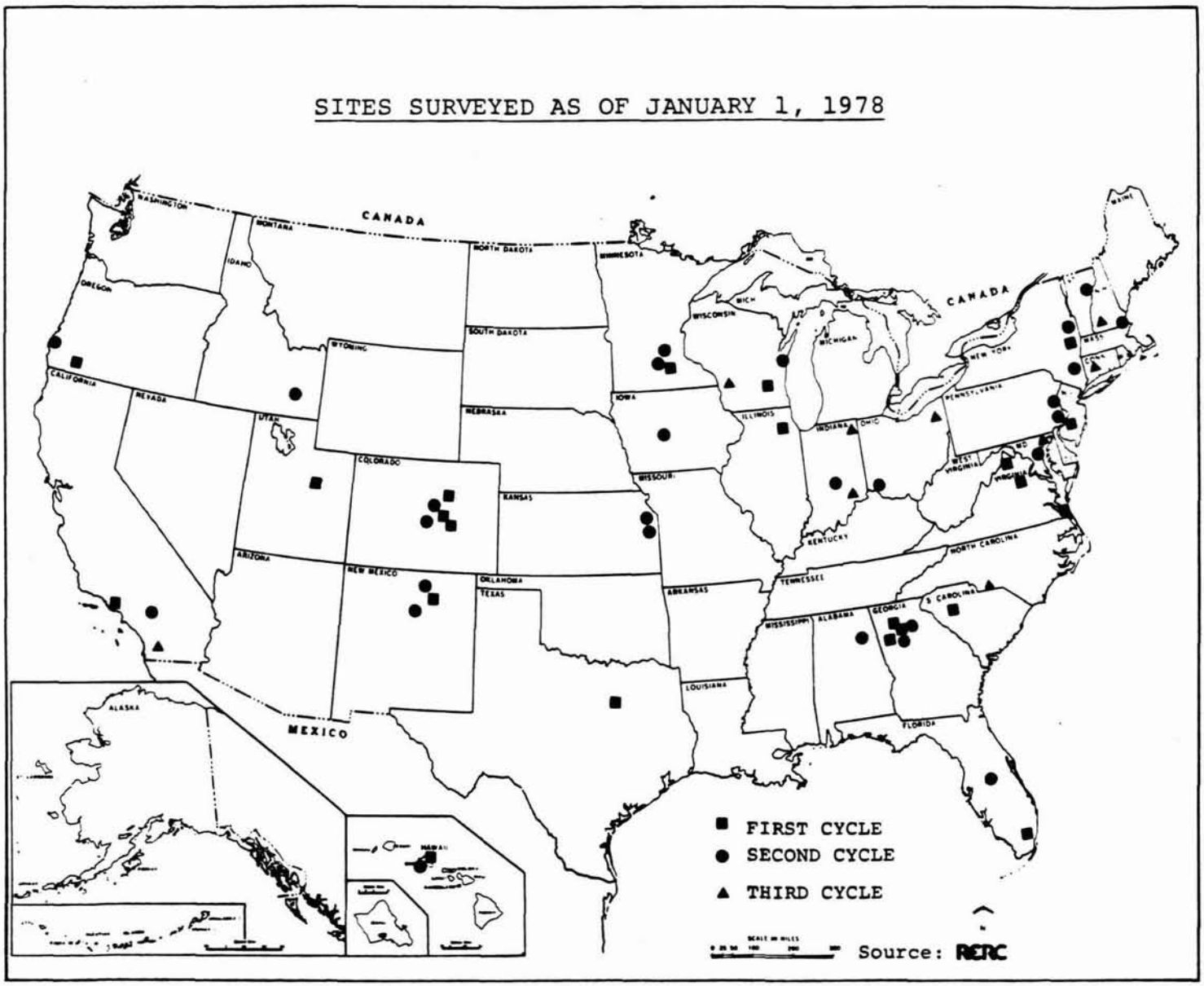
1. Total number of grants remaining in demonstration program.
2. Excludes public housing, dormitories, and Native American tribal housing.
3. Grants selected for market acceptance study.
4. Field surveys conducted as of January 1, 1978.

Simple frequency distributions and cross tabulations are employed throughout as the methods for displaying and exploring the data. Statistical measures of central tendency are used in instances where continuous data are available. However, statistical measures of association lend a spurious specificity to the findings and are, therefore, not employed.

A standard practice is to report percentages only when more than 50 cases are available. This convention has been modified in this report, and percentage figures are reported because they are more readily interpreted visually. However, care has been taken to report the number of cases for each table and the number of cases for each category for cross-tabulations. This will allow the reader to compare percentages to the base from which they are derived. For all tables, only valid responses are reported. The issue of missing data is dealt with in the Appendix.

The small sample size has a final implication for the format of this report. Many of the questionnaire items provide for several response categories. Where appropriate to the issue under investigation, categories have been collapsed. As a result different categorizations of the same variable may appear in different chapters. For example, builder experience in construction may be seen as "less than 5 years/5 years or more" in one chapter, and as "1-4 years/5-14 years/15 years or more" in another. Reasons for these differences are in all cases explained, and the reader may refer to the original distribution contained in the Appendix.

SITES SURVEYED AS OF JANUARY 1, 1978



1

Builder Characteristics

Housing construction is a decentralized industry dominated by a large number of relatively small, local entrepreneurs. Studies conducted by the Bureau of Building Marketing Research indicate that small builders (averaging fewer than 75 units annually) account for approximately 80% of active builders. High volume construction companies -- both publicly and privately held -- which operate on regional, national and even international scales comprise the remaining one-fifth of the residential building industry.

Builders participating in the HUD demonstration program do not constitute a rigorously selected sample of American builders. However, the question of the extent to which the solar builders are representative of builders in general is critical. There are two reasons for this. First, from an analytic perspective, the closer the participants "match" the characteristics of the industry as a whole, the greater the likelihood that findings based on participant interviews can be employed to make inferences about the entire population of American builders.

More importantly, the characteristics of the participating solar builders can have an effect on the demonstration program's success in accelerating the acceptance of solar energy. If a variety of different types of builders in a variety of markets gain practical knowledge about constructing and marketing solar homes, their experience can rapidly and effectively be communicated to other builders of similar type and size. If, on the other hand, involvement is limited to a small or narrow segment of the building industry, the diffusion of solar may be impeded.

This chapter describes such relevant builder characteristics as experience, size, scope of operations and type of residential construction activity. Comparisons between conventional and solar home builders are drawn to assess the representativeness of the participants in the HUD program. Differences in builder attributes by grant cycle and by region are examined in a preliminary attempt to identify trends in program participation. A composite profile of the "modal" or typical solar demonstration participant summarizes these findings.

Following upon the description of builder characteristics, attention is directed to reasons given by builders for participating in the demonstration program, the factors affecting their choice of a solar system, their experience with solar construction (both

prior to and coincident with construction of the grant units), and their satisfaction with the HUD Residential Solar Heating and Cooling Demonstration Program. A survey of problems encountered in the development of the solar units as reported by the builders themselves concludes the chapter.

The Sample

Fifty-eight grant recipients have been interviewed. The solar builders are relatively evenly distributed geographically.

Table 1-1

SOLAR BUILDERS BY REGION

	Northeast	South	North Central	West	Total
Total Market Sites	52	61	56	66	235
Builders Surveyed	11	15	15	17	58
Percent of Total	(19%)	(26%)	(26%)	(29%)	(100%)

Approximately 25% of the builders of market housing awarded grants over the first three cycles of the program are represented in the sample upon which this report is based. The majority of the sample builders were awarded grants in the 1st and 2nd cycles of the program. Seventy-six percent of Cycle 1 surveys have been completed and 68% of the Cycle 2 interviews are included in this analysis. Only a small number (14%) of the 3rd cycle grantees are represented. Third cycle data are reported only as possible clues to emerging trends, not as hard evidence of patterns in the findings.

Table 1-2

SOLAR BUILDERS BY GRANT CYCLE

Grant Cycle	To Be Surveyed	Completed Surveys
Cycle 1	29	22 (76%)
Cycle 2	40	27 (68%)
Cycle 3	63	9 (14%)
	(N=132)	(N=58)

Tne interaction of cycle and region is a key indicator of diffusion of interest in solar over time. Table 1-3 displays regional trends over the first two cycles. Builder participation appears to have increased in the Northeastern and North Central regions of the country, while the South contributed fewer builders in the 2nd cycle.

Table 1-3

REGIONAL TRENDS BY GRANT CYCLE

	Region			
Grant Cycle	Northeast	South	North Central	West
Cycle 1	2 (9%)	9 (41%)	3 (14%)	8 (36%)
Cycle 2	7 (26%)	4 (14%)	8 (30%)	8 (30%)
Cycle 3	2	2	4	1
	(N=11)	(N=15)	(N=15)	(N=17)

Builder Characteristics

Analysis of the range and type of builders involved in the demonstration program provides insight into the extent of interest in solar within the residential construction industry. Emerging patterns in builder experience, size and type of construction are investigated in this section. Of particular interest is the question of the degree to which solar program participants resemble builders of similarly priced conventional housing units. This contrast is drawn for each builder characteristic. In addition, regional and grant cycle differences are displayed and analyzed.

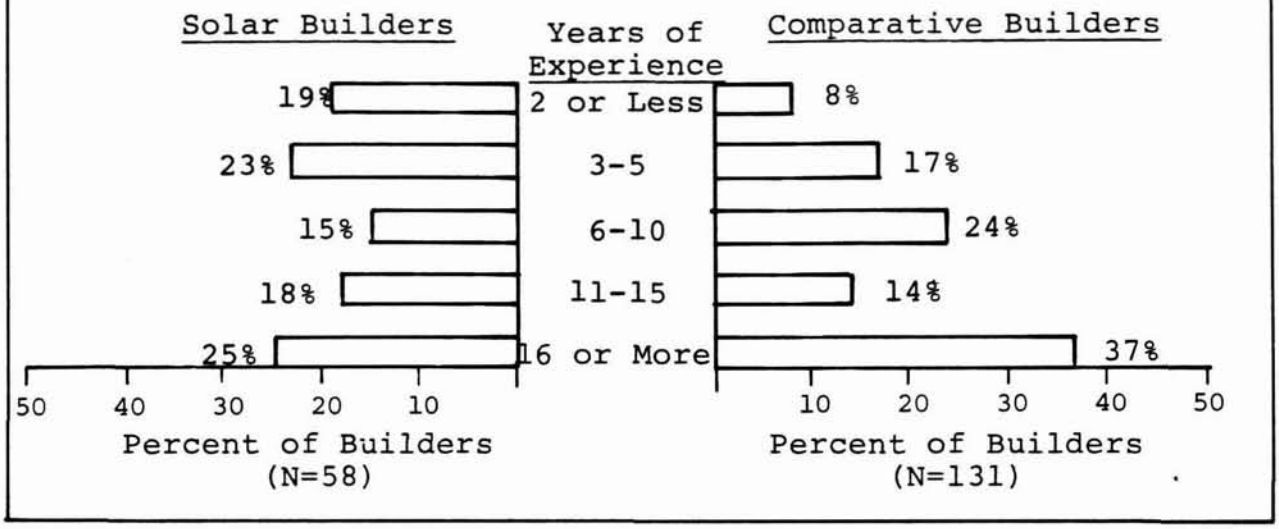
Experience

Solar builders, as indicated in Table 1-4, range from the inexperienced -- nearly one-fifth have been in business for less than two years -- to the highly experienced. If 10 years in the industry is taken as an arbitrary measure of builder "experience," it is seen that more than half, 58%, of the solar program participants can be characterized in this manner.

Although the average length of time in residential construction is 9 years for the participants, 42% have been building for less than 5 years. This suggests that the HUD program is attracting a large proportion of "newcomers" to the industry. This assessment is confirmed when the home building experience of solar and conventional builders is compared. Table 1-4 clearly shows that the proportion of less experienced builders in the demonstration program is greater than among comparative builders and that the conventional builders are more likely than the participants to have been in construction for over 15 years.

Table 1-4

EXPERIENCE IN RESIDENTIAL CONSTRUCTION



Trends in builder experience over grant cycles provide an indicator of the direction solar interest is taking among builders. Table 1-5 indicates that fewer than one-fifth of the Cycle 1 builders have been actively engaged in residential construction for less than 5 years. Participants awarded Cycle 2 grants are almost evenly divided between the experienced and inexperienced categories, while 3rd cycle builders reflect the distribution prevailing in the 1st cycle. In absolute numbers, however, 14 of the 21 inexperienced builders are 2nd cycle grantees.

Table 1-5

BUILDER EXPERIENCE BY GRANT CYCLE

Experience	Grant Cycle		
	Cycle 1	Cycle 2	Cycle 3
Less than 5 years	18%	52%	33%
More than 5 years	72	48	67
	(N=22)	(N=27)	(N=9)

There do not appear to be concentrations of experienced builders in any one part of the country. Table 1-6 shows that experienced builders are just as likely to be found in each of the four regions. Similarly, the split between established and new builders is approximately the same within each geographic area.

Table 1-6

BUILDER EXPERIENCE BY REGION

Experience	Region			
	Northeast	South	North Central	West
Less than 5 years	4	6	5	6
More than 5 years	7	9	10	11
	(N=11)	(N=15)	(N=15)	(N=17)

Builder experience, or track record, is discussed further in Chapter 3 in the context of obtaining short term construction financing for solar dwellings.

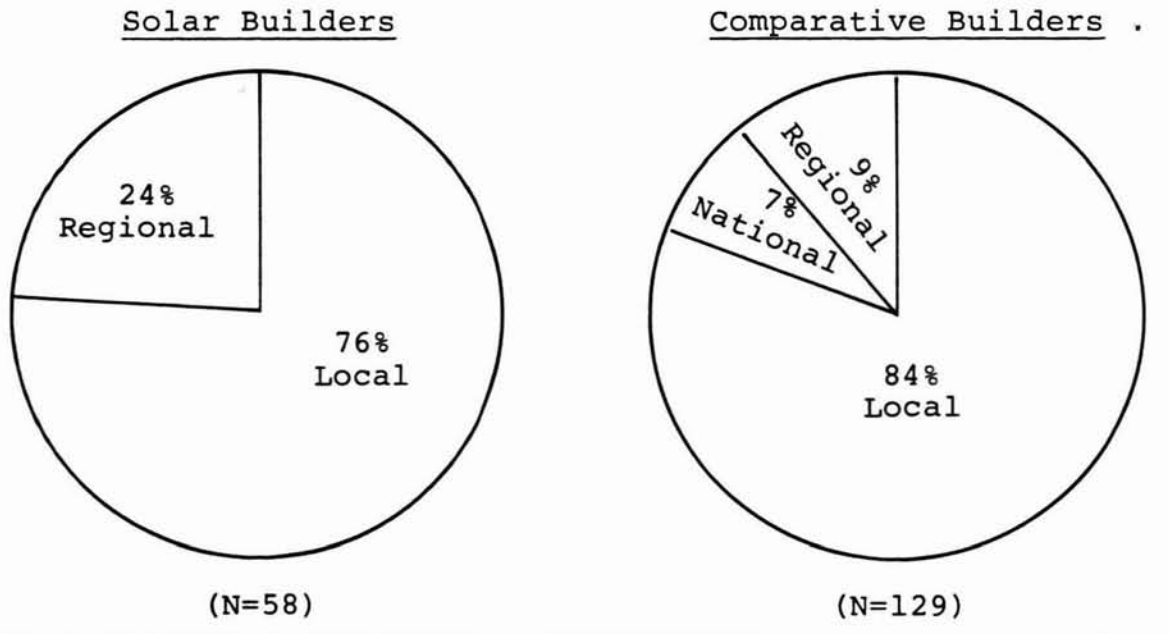
Type and Scope of Activity

The solar builders overwhelmingly (94%) concentrate on residential construction. Only 4 participants (6%) focus on commercial construction or a mixture of residential and commercial. The comparative builders are similarly almost exclusively oriented to the residential sector.

Both groups of builders tend to operate on a local scale. Table 1-7 displays the market scope of demonstration program and comparative builders.

Table 1-7

SCOPE OF CONSTRUCTION ACTIVITY



Within the residential sector, single-family detached units comprise the largest share of the builders' production housing.

Table 1-8

PREDOMINANT HOUSING TYPE

	Solar Builders	Comparative Builders
Single-Family Detached (SFD)	69%	94%
Single-Family Attached (SFA)	21	2
Mixed SFD and SFA	5	4
Multi-Family	5	0
	100%	100%
	(N=58)	(N=126)

Slightly more solar participants appear likely to specialize in townhouse or quadriplex construction than the comparative builders. In part, this finding is a function of the fact that several grantees are constructing townhouse developments in areas where a comparative townhouse developer could not be located.

Builder Size

The demonstration program participants range from the very small to very large as measured by their average yearly unit output.

Table 1-9

BUILDER SIZE
(Average Number of Housing Units per Year)

Units	Solar Builders	Comparative Builders
9 or Less	28%	15%
10 - 24	21	23
25 - 49	9	19
50 - 99	8	9
100 - 249	14	20
250 - 749	12	9
750 or More	8	5
	100%	100%
	(N=58)	(N=128)

Table 1-9 presents average unit volume for both participants and comparatives. The distributions are quite similar. The solar builders appear slightly more likely than the comparatives to be "small" (9 units or less) or "large" (250 units or more). Nearly one-half of the solar participants (49%) construct fewer than 25 homes a year and 34% average more than 100 dwellings. Few are medium-sized entrepreneurs constructing between 25 and 100 annually.

Builder experience and unit volume are associated in the following table. Using 5 years of involvement in residential construction as the threshold between low and high experience and 25 units as the cut point between a small and a large operation yields the findings contained in Table 1-10.

Table 1-10

BUILDER EXPERIENCE BY SIZE

Builder Size	Builder Experience: Less Than 5 Years	Builder Experience: More Than 5 Years
Less than 25 units	66%	38%
More than 25 units	34	62
	100%	100%
	(N=21)	(N=37)

Builder size does not vary systematically by region of the country. Table 1-11 arrays the 58 solar builders by region and size. It shows a relatively even distribution of builders of small and large size both across and within the four geographic areas.

Table 1-11

BUILDER SIZE BY REGION
(Number of Builders)

Size	Region: Northeast	South	North Central	West
Less than 25 units	6	5	6	9
More than 25 units	5	10	9	8
	(N=11)	(N=15)	(N=15)	(N=17)

Participants are approximately evenly divided between small and large unit volumes. However, there is evidence that builder size has changed between Cycle 1 and Cycle 2. Table 1-12 shows that two-thirds of the 1st cycle grantees build more than 25 units, while in Cycle 2 this proportion decreases to 37%. Too few Cycle 3 builders have been interviewed to determine the direction the builder size mix will take as the program evolves.

Table 1-12

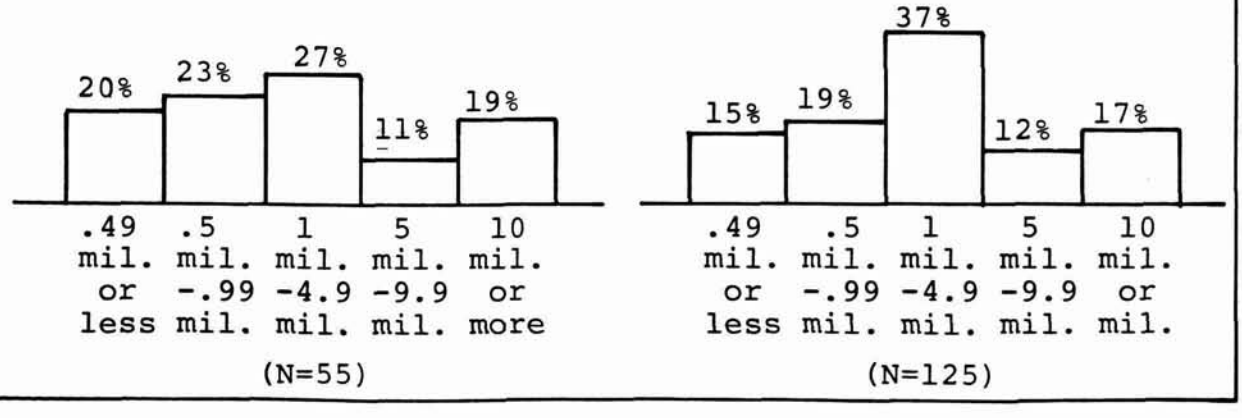
BUILDER SIZE BY CYCLE

Size	Cycle 1	Cycle 2	Cycle 3
Less than 25 units	32%	63%	44%
More than 25 units	68	37	56
	100%	100%	100%
	(N=22)	(N=27)	(N=9)

Dollar volume is a second measure of a builder's size. Volume may include gross income other than that earned in residential construction. This is especially true of the very large firms which may also sell land or receive management or other non-construction income. Five dollar volume categories are provided in Table 1-13 for solar and comparative builders. There is a relatively even distribution of builders across dollar volume categories among the demonstration program participants. As seen in the frequencies for unit volume (Table 1-9 above), the solar builders are also slightly more likely to fall into the low and high categories of dollar volume than are the builders of conventional homes.

Table 1-13

AVERAGE ANNUAL DOLLAR VOLUME
(Percent of Builders)



Reasons for Participation in the Demonstration Program

Builders offer a wide variety of explanations for their decision to build a solar home under the auspices of the HUD demonstration program. Typical motives include the following:

Table 1-14

REASONS FOR PARTICIPATION IN SOLAR DEMONSTRATION PROGRAM

"It seemed like a good idea/ the right time to try it"	28%
"An interesting challenge/ see if I could do it"	21
"Good publicity"	26
"Opportunity to test the market"	16
"Concern about energy availability/ conservation"	9
	100% (N=58)

This pattern of response does not vary systematically by grant cycle or by region of the country. Large and small builders, experienced and inexperienced participants all give the full array of responses, indicating that the program appeals to diverse interests and objectives.

A majority (73%) of the solar builders have been involved with government housing programs prior to the demonstration effort. The level of previous experience with federal or state supported housing programs is similar in each part of the nation and in both Cycle 1 and Cycle 2.

Choice of a Solar System

The Residential Solar Heating and Cooling Demonstration Program is expressly designed to permit flexibility and innovation in system selection by participants. Seven of the 58 builders have developed their own solar systems. Most, however, employ a manufactured unit. Table 1-15 lists the responses builders give when asked why they decided on a particular system for use in the grant residence.

Table 1-15

REASONS FOR SELECTING A SOLAR SYSTEM

Recommendation of Engineer, Architect or University	39%
Manufacturers' Experience	50
Other	11
	100%
	(N=56)

Half of the participants made their equipment selection decision based on their evaluation of the experience of the manufacturer. Thirty-nine percent followed the advice of an independent engineer, architect, university or other research organization. The remainder (11%) custom designed their own solar equipment.

Table 1-16

SELECTING A SOLAR SYSTEM

	By Region			
	Northeast	South	North Central	West
Recommendation of Engineer, Architect or University	27%	60%	40%	27%
Manufacturers' Experience	55	27	60	60
Other	18	13	-	13
	100%	100%	100%	100%
	(N=11)	(N=15)	(N=15)	(N=17)

	By Cycle		
	Cycle 1	Cycle 2	Cycle 3
Recommendation of Engineer, Architector University	43%	37%	33%
Manufacturers' Experience	43	52	67
Other	14	11	-
	100%	100%	100%
	(N=22)	(N=27)	(N=9)

Patterns of reliance on proprietary manufacturers for advice on solar equipment are emerging from the data, as indicated in Table 1-16. These data show that the manufacturer is the key to system selection in every region except the South. It also appears that the role of solar manufacturers is increasing. In the

1st cycle of the program, 43% of the builders decided on a system on the basis of manufacturer experience. In Cycle 2 this proportion increases to 52%. Although Cycle 3 data are currently incomplete, the trend toward increasing reliance on manufacturers as opposed to technical sources appears to continue.

There is limited evidence that more experienced builders are more likely to rely on a solar manufacturer in choosing a system than are less experienced program participants. Fifty-four percent of grantees who have been building homes for more than 5 years state that manufacturer experience was the reason for their equipment choice. Among less experienced builders, 38% looked to the equipment producer for advice.

Other Solar Experience

The HUD program is attracting builders who typically have not constructed a solar assisted residence prior to the program. Forty-three, or 78% of the participants, have had no previous experience with solar energy. Of the 15 who are experienced in solar applications, 13 have built a dwelling heated with solar equipment and two have installed domestic hot water systems.

Builders in the South and in the West account, respectively, for 5 and 8 of the participants with prior exposure to building a solar home. These builders tend to be long term members of the construction industry. Twelve of the 15 have been in business more than 5 years and 8 have been involved in residential construction for more than 10 years. In addition to being relatively well established as home builders, they tend to operate on a small scale. Thus, 10 of the 15 build fewer than 25 units a year, and 7 build fewer than 9 units annually.

Table 1-17

PERCENT OF PARTICIPANTS BUILDING OTHER SOLAR UNITS

By Region	Northeast	South	North Central	West	N=28
	14%	18%	21%	47%	
By Grant Cycle	Cycle 1	Cycle 2	Cycle 3		N=28
	32%	50%	18%		
By Experience	Less Than 5 Years		More Than 5 Years		N=28
	32%		68%		
By Size	Less Than 25 Units		More Than 25 Units		N=28
	54%		46%		

Although the majority of the solar grantees are new to solar construction, 50% are building solar homes outside of the demonstration program. Table 1-17 explores some of the variables which may be associated with building solar without a HUD grant. These data indicate that the Western area of the country accounts for nearly half of these builders. This finding may mean that this regional market is perceived as being particularly receptive to residential solar energy. Of the 17 Western builders, 13 are constructing unsubsidized units in addition to the grant units.

Table 1-17 also indicates that experienced builders are more likely than inexperienced builders to be involved with solar construction outside of the HUD program. Underlying this association is the finding, discussed above, that experienced builders are also more likely than their less experienced counterparts to have had solar experience prior to HUD's effort. It should also be noted that there is an apparent increase in the percentage of participants building non-grant solar units between Cycle 1 and Cycle 2. If this trend persists (it is not corroborated by the small number of Cycle 3 respondents) it may provide encouraging evidence on the stimulus value of the demonstration program.

The Solar Grant

The HUD program is intended to stimulate the use of solar energy in the residential sector. The grant award may or may not cover the full costs of the solar system, and these costs may or may not be recovered in the sales price of the homes built under the auspices of the program. These issues are discussed in detail in Chapters 2, 8 and 9.

The size of the HUD grant awards, as reported by participating builders, is displayed below. The average grant is $9,250.

Table 1-18

THE SOLAR GRANT

Range of Grant	Percent of Builders
Less than $5,000	15%
$ 5,000 - $ 9,999	41
$10,000 - $14,999	34
$15,000 - $19,999	6
$20,000 and Over	4
	100%
	(N=53)

Fifty-three percent of the solar builders report that the HUD award has been sufficient to cover all of their costs. Fourteen percent were unsure at the time they were interviewed. One-third believe that they encountered expenses relating to the solar installation which were not covered by the government grant and would have to be recovered in the sale price of the solar unit. Research and development costs, the expense of accommodating features and the added burden of promoting the solar unit are the most frequently mentioned sources of additional financial exposure.

Problems Confronting Solar Builders

All residential builders face a myriad of difficulties in successfully constructing homes at a profit. The analysis of solar market acceptance focuses on institutional constraints and opportunities for the widespread development of solar heating and cooling. Other members of the HUD research team are directing attention to the special problems of constructing a solar unit and to the solar systems themselves. Market acceptance interviews query participating and non-participating builders on problems in obtaining construction loans, zoning approval, site plan approval and building code certification. In addition, solar builders are asked if they have had difficulty in obtaining solar equipment, and obtaining service assistance and warranties for the systems. Responses to these questions are displayed in Table 1-19.

Table 1-19

PROBLEMS CONFRONTING SOLAR BUILDERS

	Problems for Solar Builders			Problems for Comparative Builders		
	Yes	No		Yes	No	
Construction	16%	84%	(N=56)	6%	94%	(N=127)
Zoning	9	91	(N=57)	14	86	(N=129)
Site Plans	2	98	(N=57)	11	89	(N=129)
Building Inspection	15	85	(N=58)	5	95	(N=129)
Solar Equipment	41	59	(N=58)	-	-	
Service for Solar	14	86	(N=56)	-	-	
Solar Warranties	9	91	(N=58)	-	-	

These data are discussed in Chapter 3, where the problems are analyzed in detail. For the purposes of this overview chapter, it is sufficient to note that with the exception of obtaining solar equipment -- where 41% of the builders report difficulties -- problems are reported by only a small minority of the participants. Builders of conventional homes cite financing and institutional difficulties in approximately the same proportions as do the solar builders.

Satisfaction with the Program

Questioned at the time when construction of the solar grant homes is completed or nearing completion, a large majority of the participants express positive opinions on the HUD demonstration program.

Table 1-20

SATISFACTION WITH THE PROGRAM

Very Satisfied	48%
Satisfied	40
Dissatisfied	7
Very Dissatisfied	2
No Opinion	3
	100%
	(N=58)

Among the major positive aspects of the program, builders cite the lack of problems in construction of the solar units and the promotional and publicity advantages of solar energy. Negative impressions center on "bureaucratic problems" and uncertainty about the state of the art of solar equipment. However, the overwhelming satisfaction expressed by participants outweighs these concerns.

Capsule Profile of the Solar Builder

Following is a preliminary profile of the typical solar builder. As the data presented in this chapter indicate, differences among builders and variations by region and by grant cycle are beginning to emerge. However, the capsule profile captures and summarizes the basic findings presented in this chapter.

CAPSULE PROFILE OF THE
TYPICAL SOLAR BUILDER
/Based on the median value or most frequent response for each item/

Builder Characteristics	
Experience in Residential Construction	9 years
Scope of Construction	Local
Type of Construction	Single-Family Detached
Size - Unit Volume	20 Units/Year
Size - $ Volume	$1,000,000/Year
Reason for Participation in Demonstration Program	"An interesting challenge" "Time was right"
Reason for Selecting a Solar System	"Manufacturers' experience in the field"
The Solar Grant	Average = $9,250 Covered all costs for 53% of builders
Other Solar Experience	First experience for 75%
Special Problems	Few institutional difficulties, 40% report solar equipment problems
Satisfaction with the Program	88% satisfied

2

Solar Homes: A Profile

The Residential Solar Heating and Cooling Demonstration Program provides substantial freedom of choice to the builders of solar homes. Grantees build homes which they perceive will meet the demands of the local market in which they operate. In effect, the characteristics of solar homes -- their location, price, size, amenities -- reflect the builders' perception of what will sell best in their area.

Other members of the HUD research team are investigating the architectural design of solar units and the technical attributes and performance of the solar systems themselves. The purpose of this chapter is to profile relevant features of the demonstration homes which affect their marketability. Ninety-four solar residences (constructed by the 58 builders described in the preceding chapter) are employed in this preliminary analysis. Unfortunately, complete data on the market features of comparative, non-solar units are not available at this time. As a result, contrasts between the characteristics of solar and competitive units cannot be made. Future reports will include such comparisons.

However, the emerging profile of solar residences is, itself, of interest. In particular, it illustrates the variety and range of solar construction activity within the demonstration program. House location, subdivision characteristics, structural attributes, amenities, solar system type and house price are described. As in the previous chapter, a capsule profile is developed which highlights features of a "typical" solar unit.

This chapter employs data on solar housing units; and solar houses, as opposed to participants, are the units of analysis. Information on the homes has been collected from a number of different sources. While other chapters in the data analysis are based entirely on survey interviews, this profile of solar homes draws upon data collated from builder interviews, from subdivision and site evaluation forms and from other HUD research team members. The process of consolidating information from varied sources introduces problems of comparability. For example, the solar home prices reported below are not the same as those detailed in Chapter 5. In the latter case, prices are those reported by the purchaser, while figures presented here are based on builder responses at the time construction of the solar unit was completed. Such discrepancies are acknowledged at the outset and the data presented with the understanding that they are subject to further refinement and change.

The 58 grantee builders have in some cases constructed more than one solar unit in a given project. One project site contains 16 identical units. With a small sample, this concentration of units can seriously distort findings. As an interim control for this bias some distributions have also been calculated using only one of the 16 units. This has been done to prevent one site from swamping the marginal frequencies. As data collection expands the sample, the impact of these 16 units on measures of central tendency will be reduced.

Location

The regional distribution of solar grant homes and the size and type of the locale in which they are built are indicators of the extent to which the location of solar units reflects the mainstream of new residential construction.

Table 2-1 shows the regional distribution of the sample of solar grant houses and the percentage distribution of all housing starts in the years 1975 and 1976 and the first three quarters of 1977.

Table 2-1

REGIONAL DISTRIBUTION OF SOLAR GRANT HOUSES VERSUS DISTRIBUTION OF NATIONAL HOUSING STARTS

Region	Solar Grant Houses	National Housing Starts
Northeast	14%	11%
North Central	22	25
South	20	38
West	44	26
	100%	100%
	(N=94)	(N=4,207,900)

Among the solar units, the largest number is located in the West, and the fewest in the Northeast. Comparing the distribution of the solar grant units to the distribution of national housing starts reveals that the South contains a lower share of the solar grant houses than its share of total new construction, while the Western region contains a larger share. In part, this distribution results from the presence in the sample of one solar grant site which contains 16 identical solar grant units. If this distortion is corrected by removing 15 of these and recalculating the shares, the new percentages are 18, 25, 24, and 33 respectively. While the difference in the percentages in the West -- 33 versus 26 -- becomes much smaller, the "corrected" Southern share of the sample of solar grant houses still remains substantially less than the Southern share of total construction.

This suggests that participation in the program by Southern builders lags behind that of builders in other parts of the country.

Table 2-2

REGIONAL DISTRIBUTION OF SOLAR GRANT HOUSES BY CYCLE

Region	Grant Cycle 1	2	(2*)	3	Total
Northeast	11%	14%	(19%)	27%	15%
North Central	14	16	(22)	47	20
South	39	14	(19)	13	21
West	36	56	(40)	13	44
Total	100% (N=28)	100% (N=51)	(100%) (N=36)	100% (N=15)	100% (N=94)

*Corrected distribution excludes 15 of the 16 identical units contained in one grant site.

Table 2-2 shows how these percentages vary over the three HUD grant cycles. The sample size for Cycle 3 is too small to allow valid inferences to be drawn, but it is noteworthy that the lower Southern share in Cycle 2 is so far replicated in Cycle 3. At the same time, there seems to be a greater frequency of solar construction in the northern climates as the cycles progress. Once again, the high percentage for the Western region in Cycle 2 is accounted for, in part, by the 16 identical grant houses. A distribution correcting for this distortion is also presented.

The state in which each of the solar grant houses discussed in this chapter is located is shown in Table 2-3 along with the respective number of houses in each state.

Table 2-4 indicates that the overwhelming majority of the solar grant houses are constructed within Standard Metropolitan Statistical Areas, to even a greater degree than for total national construction. Of all grant units surveyed, 16% were constructed in the SMSA's major city, 4% in a mature suburb, 47% in a developing suburb, and 29% in a rural or unincorporated area within the SMSA. Three units are located in a satellite city, an economically independent jurisdiction. The typical community population was 40,000 in 1975 (up from 20,000 in 1970) indicating that solar homes tend to be located in high growth areas. The population (1975 estimate) of the typical SMSA in which solar grant houses are built is 1.2 million.

Table 2-3

DISTRIBUTION OF SOLAR GRANT HOUSES BY STATE

State	Number of Houses	State	Number of Houses
Alabama	1	New Hampshire	3
California	3	New Jersey	2
Colorado	8	New Mexico	5
Connecticut	1	New York	3
Florida	3	North Carolina	1
Georgia	5	Ohio	5
Hawaii	6	Oregon	2
Idaho	1	Pennsylvania	3
Illinois	1	South Carolina	1
Indiana	3	Texas	2
Iowa	2	Utah	1
Kansas	2	Vermont	1
Maryland	5	Virginia	3
Minnesota	3	Wisconsin	3
		Total	79

Table 2-4

DISTRIBUTION OF SOLAR GRANT HOUSES AND NATIONAL HOUSING STARTS BETWEEN METROPOLITAN AND NON-METROPOLITAN AREAS

	Solar Grant Houses	National Housing Starts
In SMSA	81%	68%
Outside SMSA	19	32
	100%	100%
	(N=99)	(N=4,207,900)

Table 2-5

LOCATION BY TYPE OF COMMUNITY WITHIN AN SMSA

Community Type				
SMSA's Major City	Mature Suburb	Developing Suburb	Rural or Unincorporated	Satellite City
16%	4%	47%	29%	4%

(N=75)

Subdivision Characteristics

Over 90% (87) of the solar grant houses are built within a subdivision. Of these, over half (57%) were built in subdivisions developed by a single builder. The remaining units are located in subdivisions in which a number of independent builders purchase lots. The median subdivision size in the sample is 81 units. (If 15 of the 16 identical houses are removed from the sample, the median size is 175 units.) The typical subdivision is comprised of single-family detached units of modern design.

Several of the grant houses are part of planned unit developments (PUDs), retirement villages or new communities. Fourteen of the 58 grant sites provide an outdoor swimming pool as a subdivision feature. Other amenities offered as a standard feature include: a clubhouse or recreation center (13 sites); tennis courts (13 sites); bike trails (12 sites); and a golf course (3 sites). Ten developments include either office or retail space as well as single-family residences.

Over half, or 57%, of the units in subdivisions are constructed on interior lots; 43% on corner lots. The median lot size for all units is approximately one quarter of an acre. The distribution of lot sizes is highly skewed, however, with three houses in the sample occupying lots of 6 acres or more in size.

Structural Characteristics

The vast majority -- 83% -- of the solar grant houses are single-family detached dwelling units. Their median size is approximately 1,600 square feet. A more complete description of the variation in house sizes is given in the relative frequency distribution shown in Table 2-6. As in the regional distribution of location by Census Region, the large concentration in the 1,000 to 1,499 sq. ft. range is an artifact of the 16 identical houses. The removal of 15 of these units increases the median size to 1,800 sq. ft.

The design of two-thirds of the sample of solar houses can be characterized as "modern," with another 3% characterized as "ultra-modern," and the remainder as "traditional." Design styles are difficult to define in specific terms. In general, field staff consider traditional homes to include Tudor, Georgian, Colonial, salt box and other similar designs. Modern homes include ranches, ramblers, and split-levels. Ultra-modern refers to structures with unusual design.

As important from a market acceptance perspective as individual unit design is the question of whether the solar home style is the same as or similar to other units in the same subdivision. A home that "sticks out" may be more difficult to sell. Data to support such comparisons are being collected but are not available in complete form at this time.

Table 2-6

DISTRIBUTION OF NUMBER OF SQUARE FEET IN SOLAR GRANT HOUSES

Number of Square Feet	Percent of Full Sample of Solar Grant Houses	Percent of Sample of Solar Grant Houses Less 15 of Identical Group of 16 Houses
500- 999	2%	3%
1,000-1,499	39	28
1,500-1,999	27	30
2,000-2,499	22	26
2,500-2,999	7	9
3,000 +	3	4
	100% (N=94)	100% (N=79)
Mean	1,700	1,786
Median	1,580	1,796

The solar units vary substantially in exterior finish. Nearly half (47%) are predominantly wood. Brick exteriors are found on 4% of the homes, and wood-brick combination on 14%. Stucco is the second most typical finish, appearing on 22% of the units. The remainder of the units (13%) are finished with adobe, aluminum siding or other materials.

Commonly, solar grant houses feature 3 bedrooms and 2 bathrooms. Nearly 75% of the houses have 3 bedrooms, while slightly over 50% include 2 bathrooms. Approximately 42% of the houses have a three bedroom-two bathroom combination. The next most frequent combination is 3 bedrooms and one-and-a-half bathrooms. The majority of the houses have no basement, and of those that do 68% of basements are primarily unfinished. Over three-quarters of the houses in the sample contained a garage. Regional variation may explain these findings and will be analyzed in future reports as more units are made available for analysis.

Amenities

Table 2-7 provides a capsule description of the appliances and amenities provided by solar builders. The typical house in the sample comes with central air conditioning, a dishwasher, a disposal, and a stove and oven. The houses typically lack a refrigerator and a washer-dryer for laundry. Most houses also contain a patio and fireplace and are at least partially carpeted.

Data from the participating and comparative builder interviews permit a limited comparison between the amenities and appliances included in conventional and solar units. Table 2-7 displays the standard amenities for the two groups. It should be stressed that these aggregate data cannot be used to make a direct comparison. However, it appears that amenities do not vary greatly. Solar units are slightly more likely to include an attic fan. And comparative residences appear marginally more likely to feature a family room or a self-cleaning oven.

Table 2-7

STANDARD AMENITIES

	Solar Units	Comparative Units
Air Conditioning	53%	53%
Carpeting	90	88
Draperies	2	2
Self-Cleaning Oven	59	67
Refrigerator	10	12
Dishwasher	86	85
Disposal	79	79
Trash Compactor	3	9
Washer/Dryer	3	2
Powder Room/Half Bath	69	71
Recreation/Family Room	62	73
Porch/Patio/Deck	81	82
Fireplace	64	70
Attic Fan	38	28
Central Vacuum	2	4
	(N=58)	(N=131)

The Solar System

The typical solar system in the sample provides for space heating and the supply of domestic hot water. The most frequent solar system medium used is liquid, accounting for 64% of the sample. Almost all of the solar units employ an active, as opposed to a passive or hybrid, system. The median solar system cost is $11,650.

Typically, the sample of participating builders passed approximately $5,000 of the solar grant through to the house purchaser. The "solar pass through" represents the amount of the cost of the solar system equipment which the purchaser does not pay for. The HUD program does not specify how the builder should treat the grant award. In effect, the grantee may give the consumer a "free" system (a 100% pass through) or recoup the entire system cost in the sale price (a zero pass through). Data presented here -- based on asking price as opposed to sale price -- indicate that, on average, 43% of the solar grant is passed through to consumers.

The costs of the solar houses in the sample cover a wide spectrum of housing markets, ranging in asking price from $29,900 to $169,000. The asking price per square foot ranges between $26 and $65. The distribution of these two variables is shown in more detail in Tables 2-8 and 2-9.

Table 2-8

ASKING PRICES OF SOLAR GRANT UNITS

Price Range (in thousands)	Percent of Units Falling in Range Asking (1)	Asking (2)
$ 20- 29.9	1%	1%
30- 39.9	3	4
40- 49.9	23	8
50- 59.9	19	22
60- 69.9	7	8
70- 79.9	21	25
80- 89.9	9	11
90- 99.9	7	8
100-109.9	2	3
110-119.9	4	5
120+	4	5
	100% (N=91)	100% (N=76)
Mean	$68,849	$74,359
Median	$64,000	$73,950

Asking (1) - Includes full sample.
Asking (2) - Excludes 15 houses of identical group of 16.

Table 2-9

ASKING PRICE PER SQUARE FOOT

Price Range	Percent of Houses Falling in Range
$20- 24.9	0%
25- 29.9	3
30- 34.9	11
35- 39.9	43
40- 44.9	13
45- 49.9	11
50- 54.9	9
55- 59.9	8
60+	2
	100% (N=90)
Mean	$41.4
Median	$38.0

The distribution of asking prices has two peaks or "modes." The first falls within the $40,000 to $49,999 range; the second within the $70,000 to $79,999 range. The lower mode is due in large part to the concentration of sixteen identical houses with an asking price of $47,000. Removal of 15 of these sixteen houses moves the second mode to the $50,000 to $59,999 range. The existence of two modes suggests that the sample may be comprised of one group of houses targeted toward middle-income buyers and another for upper-income buyers.

The distribution of asking prices per square foot shows a strong concentration in the $35 to $39.9 range, which indicates that the variation in house size is probably the major determinant of the variation of gross asking prices.

Table 2-10 shows how the median statistics for the financial variables considered in this chapter vary by HUD grant cycle. The medians for the asking prices for Cycle 2 do not include 15 of the 16 identical units. Because the sample size for Cycle 3 is so small, comparing it with the other two cycles is unwarranted. Clearly, asking price has increased over each award cycle. But on a per-square-foot basis, asking prices do not appear to have changed substantially over the three cycles. The apparent drop in the amount of the solar grant that the builder has "passed through" to the consumer should also be noted. This may be due to house buyers' placing a higher value on solar energy systems and therefore becoming more willing to pay a higher price for houses that contain them.

Table 2-10

PRICE STATISTICS BY CYCLE

	1		2		3	
		N		N		N
Asking Price	$63,965	26	$78,500	35	$74,825	15
Asking Price per Square Foot	$38.6	26	$40.0	35	$40.2	14
Solar Cost	$11,000	23	$12,000	31	$11,000	6
Solar Grant Pass Through	$ 5,000	17	$ 5,057	29	$ 1,125	6
	(N=26)		(N=50)		(N=15)	

Capsule Profile of Solar Grant Houses

A brief summary of the "typical" solar grant house is presented below. It should be understood that this profile accurately represents only the solar units investigated to date. It is expected that the profile will change as more Cycle 3 units are constructed and as Cycles 4 and 5 are added. The size of the sample does not permit separate, regional profiles to be constructed.

CAPSULE PROFILE OF THE
TYPICAL SOLAR GRANT HOUSE
/Based on the median value or most frequent response for each item/

LOCATIONAL CHARACTERISTICS

In SMSA?	Yes
SMSA Population, 1975	1,200,000
Community Type	Developing Suburb
Community Population	
1970	20,000
1975	40,000

SUBDIVISION CHARACTERISTICS

In Subdivision?	Yes
Mix of Housing	Predominantly Single-Family Detached
Number of Units	175
Architectural Style	Modern

STRUCTURAL CHARACTERISTICS

House Type	Single-Family Detached
Size	1,700 to 1,800 sq. ft.
Style	Modern
Exterior	Wood
Number of Bedrooms	3
Number of Bathrooms	2
Basement	None
Parking Facility	Garage

SITE CHARACTERISTICS

Lot Size	.25 Acres
Lot Type	Interior

APPLIANCES	
Air Conditioning?	Yes, Central
Dishwasher	Yes
Disposal	Yes
Range and Oven	Yes
Refrigerator	No
Washer/Dryer	No

AMENITIES	
Patio-Balcony	Yes
Carpeting	Partial
Fireplace	Yes

SOLAR SYSTEM	
Function	Space Heating and Supply of Domestic Hot Water
Type	Active
Medium	Liquid
Cost	$10,000-$15,000
Solar Grant Pass Through	$5,000
Backup Service	Electric

PRICING	
Asking Price	Two Ranges (Modes) a) $50,000-$60,000 b) $70,000-$80,000
Asking Price per Sq. Ft.	$35 to $40

3

The Development Process

As shown in the solar marketing and market acceptance model, several institutions play a part in the development of a solar house. Chronologically, they impact the home building process in its earliest stages; and are, therefore, critical to the entire market acceptance process.

The lender providing construction financing to the solar home, for example, by imposing more stringent loan terms on a solar home, or more basically, by refusing to finance a solar heated or cooled dwelling, can slow the widespread development of residential solar energy. Planning, zoning, and subdivision ordinances which regulate the siting of solar units can prevent the use of solar in some instances or increase the cost of building a solar unit. Building code regulations may, similarly, increase the cost of installing solar and thereby affect the market acceptance of solar energy for residential heating and cooling.

Alternatively, the policies of these same institutions can encourage solar development. A lending institution might grant more favorable construction loan terms to the builder of a solar house in order to help promote the development of alternative energy sources. Zoning regulations might include bonuses or special variances for solar construction. Greater flexibility in the administration of the building code for solar houses might stimulate the adoption of residential solar systems by builders.

This chapter examines the effect of these three institutions--the construction lender, planning and zoning agency, and the building code department on the development of solar homes. The following questions are addressed. First, is there evidence that these actors have, in fact, influenced solar development to date? Second, if these institutions have influenced the construction of the solar units, have their effects been positive, facilitating the market acceptance of residential solar energy, or negative, in some way hindering solar development.

In addition to a description of the impact these institutions have had on the demonstration units--as reported by the builder as well as by the agencies--their attitudes toward solar energy in general are analyzed. While attitudes and opinions are not perfect predictors of future behavior, they shed light on the probable direction these institutions will take in dealing with solar applications.

Construction Financing

Lending institutions that provide construction financing impact the development of solar energy in three primary ways: 1)the general willingness to provide construction financing for solar equipped units, 2) the terms under which construction loans on solar houses are made relative to similar non-solar units, and 3) the valuation of solar units in the institution's appraisal process.

Data on the role of construction lenders are derived from four of the questionnaires used in this study. The 58 builders of solar grant homes provide information on their experiences obtaining construction financing, and comparative data are available from 131 non-participating comparative builders. In addition, 32 lending institutions, which provided construction financing to solar builders, and 36 non-participating lenders have been interviewed.

Profile of the Solar Lender

The financial institutions providing construction loans to the solar builders represent a wide variety of lender types and sizes. As shown in Table 3-1, savings institutions and banks are approximately equally represented among the solar construction lenders surveyed.

Table 3-1

TYPE OF LENDING INSTITUTION

	Solar Lender Area					Non-Participating Lender
	Northeast	North Central	South	West	Total	Total
Savings Institution	100%	50%	50%	27%	50%	67%
Bank	0	50	50	73	50	30
Other	0	0	0	0	0	3
	100% (N=5)	100% (N=8)	100% (N=8)	100% (N=11)	100% (N=32)	100% (N=36)

The North Central and Southern regions replicate the national distribution of lender types, but all those institutions financing solar in the Northeast are savings institutions. This variation may be partially a result of the small number of lenders surveyed in the Northeast. The West has a greater proportion of banks as opposed to savings institutions than does the sample as a whole.

As reflected by total deposits or assets in 1976, the size of the solar lenders varies widely, as is illustrated in Table 3-2

Table 3-2

SIZE OF LENDER

Assets	Solar Lender Area: Northeast	North Central	South	West	Total	Non-Participating Lender: Total
$24 Million or Less	0%	0%	14%	10%	7%	0%
$25-99 Million	40	25	14	30	27	25
$100-999 Million	60	62	58	40	53	64
$1 Billion or More	0	13	14	20	13	11
	100% (N=5)	100% (N=8)	100% (N=6)	100% (N=9)	100% (N=28)	100% (N=36)

The annual volume of residential construction loans of the solar lenders and the non-participating lenders is shown in Table 3-3. In general, builders appear to have arranged construction loans with a representative cross section of the financial community.

Table 3-3

ANNUAL VOLUME OF RESIDENTIAL CONSTRUCTION LENDING

	Solar Lender	Non-Participating Lender
$4 Million or Less	24%	33%
$5-24 Million	48	39
$25 Million or More	28	28
	100% (N=29)	100% (N=18)

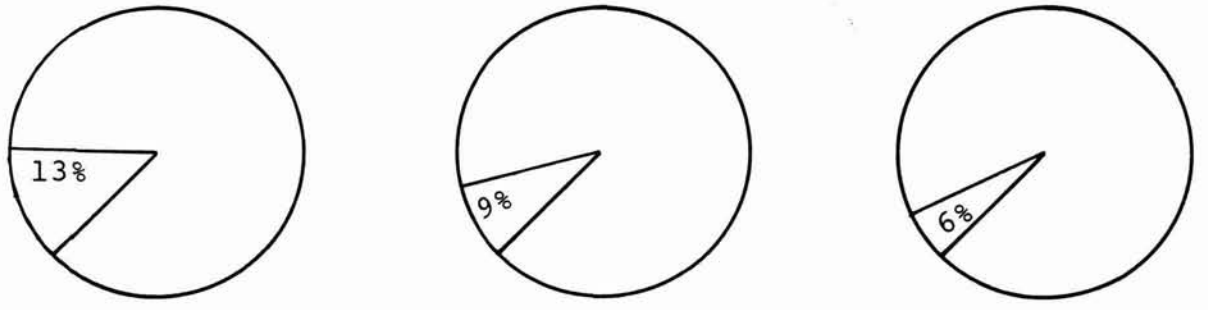
Willingness to Provide Construction Loans

The first major issue with regard to the impact of construction lenders on the market acceptance of solar energy is whether or not financial institutions will lend money for the development of solar residences. The data collected to date do not indicate that obtaining construction financing is a serious problem for

the solar builders. As shown in Table 3-4, 13% of the solar builders report having problems obtaining construction loans for the solar unit.

Table 3-4

PERCENT OF BUILDERS HAVING PROBLEMS OBTAINING CONSTRUCTION LOANS



Solar Builder- For Solar House (N=53)	Solar Builder- For Development (N=53)	Comparative Builder- For Development (N=127)

This only slightly exceeds the 9% indicating problems securing construction financing for the subdivisions in which the solar houses are located and the 6% of comparative builders reporting difficulty procuring construction loans for their developments.

Financing difficulties for both the solar unit and its development appear more pronounced in the Northeast and the West, as displayed in Table 3-5. No financing problems of any kind have occurred among the sample units located in the South.

Table 3-5

PERCENTAGE OF SOLAR BUILDERS EXPERIENCING PROBLEMS OBTAINING CONSTRUCTION LOANS BY REGION

	Region			
	Northeast	North Central	South	West
For Solar House	33%	7%	0%	20%
For Development	22%	8%	0%	13%
	(N=9)	(N=15)	(N=13)	(N=15)

A trend may be emerging in the proportion of builders having problems obtaining solar-unit construction loans. Table 3-6 illustrates that difficulties in development financing have increased slightly over time. The percentage of builders having problems with financing of the solar units has increased between Cycle 1 and Cycle 2 from 10% to 21%. There are too few Cycle 3 grants at this time to ascertain if the apparent increase in construction finance difficulty will continue.

Table 3-6

PERCENTAGE OF SOLAR BUILDERS EXPERIENCING PROBLEMS OBTAINING CONSTRUCTION LOANS: BY CYCLE

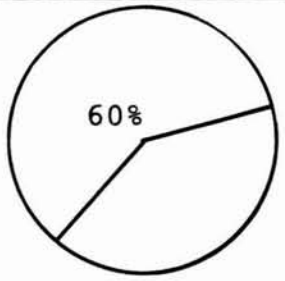
	Cycle		
	Cycle 1	Cycle 2	Cycle 3
For Solar House	10%	21%	0%
For Development	5%	8%	13%
	(N=20)	(N=24)	(N=8)

There is no direct evidence to suggest that it is the solar system which caused the loan problems. However, comparative builders report that construction financing for their developments (obviously they didn't build solar units) has not been more difficult in the 2nd cycle than in the first. In addition, comparative builders in the same location as the solar builders reporting problems have not reported problems of their own. Because the absolute number is so small (2 builders with problems in Cycle 1 and 5 in Cycle 2) inferences on this question must be limited. But this is an area which will be investigated thoroughly as the sample of Cycle 3 builders increases.

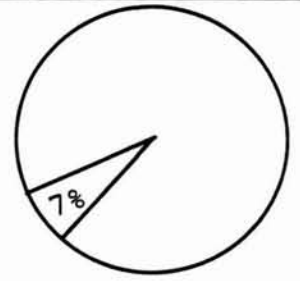
Table 3-7 reveals that, of those solar builders having problems in acquiring construction loans for the development in which the solar house is located, 60% also had difficulty obtaining financing for the solar house, while only 7% of those builders not having problems financing the development had difficulties gaining financing for the solar unit. Again the numbers involved are too small to justify interpretation.

Table 3-7

PERCENTAGE OF BUILDERS HAVING PROBLEMS OBTAINING CONSTRUCTION LOANS FOR THE SOLAR HOUSE



Those Having Difficulty Financing Development (N=5)



Those Having No Difficulty Financing Development (N=46)

When asked to explain their problems in obtaining financing, the solar builders cite restrictions on loan availability and generally conservative lenders as the cause of their difficulties. None mentioned solar. These reasons are similar to those described by the comparative builders with problems securing construction financing.

There are indications within the financial community of a general willingness to provide construction financing for solar dwelling units. More than one-third (38%) of the 32 solar construction lenders have furnished construction loans for other solar units. Only 6% have denied requests for construction loans on solar units. Five of 36 (14%) non-participating lenders have also provided construction financing for solar residences while only one has denied a solar construction loan. However, this denial was attributed to the home's functional obsolescence and not to the unit's solar system.

Of the 25 solar construction lenders that make home improvement loans, only one reports an unwillingness to make such a loan for a solar energy installation or retrofit. Three of these lenders received actual requests for home loans for solar installations and two of these requests were granted. The lender refusing the loan attributed this refusal to a lack of FHA support for home improvement loans for solar system installation.

A final, although somewhat indirect, indication of willingness to finance solar houses is whether or not an institution has placed any limits on the number of solar units it would finance in a particular development. At the present time, none of the 32 solar lenders have introduced such limitations. Of the 36 non-participating lenders surveyed, only three have placed limits on the number of units they would provide with construction or permanent loans.

Overall, there is little evidence to indicate that construction financing has been an obstacle to solar development. Few solar builders in the grant program have experienced problems securing loans for their solar units. Of those having difficulty, most see the cause of the problem as something other than solar. Finally, a number of the surveyed lenders have financed other non-grant solar residences and few have denied requests for financing solar houses.

On the whole, however, construction lender acceptance of residential solar energy appears to be related less to the studied conclusion that solar is a low lending risk or a highly beneficial energy source than to a general belief in the credit worthiness of the solar builder.

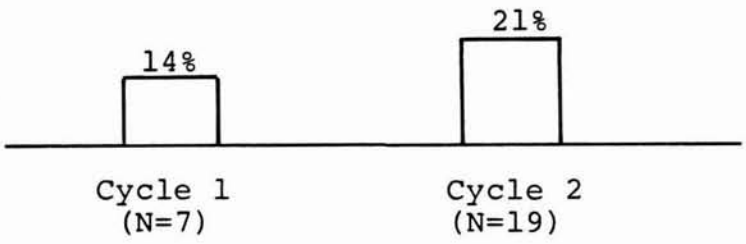
Less than half (42%) of the lenders made any special requests for information plans or data on the solar unit or had any specific concerns regarding the application for financing of the solar unit. Of these, 12 requested brochures on the solar system.

The remaining lenders had concerns about the cost of solar equipment and about the market acceptability of a solar-equipped house. Finally, less than one-fourth (23%) of the institutions requested to examine the solar system to be used prior to authorizing financing.

The proportion of those lenders making this request has increased over the first two grant cycles as shown in Table 3-8.

Table 3-8

PERCENTAGE OF CONSTRUCTION LENDERS REQUESTING TO EXAMINE SOLAR SYSTEM: BY CYCLE



Of much greater consequence in the decision to finance the solar house is an institution's knowledge about the builder constructing the solar unit. The builder's experience, or track record, and prior relationship with the lending institution are key lending criteria. As illustrated in Table 3-9, 91% of the solar lenders stated that a builder's experience is either important or very important in their willingness to provide construction financing. Eighty-four percent of the solar lenders report that the builder's prior relationship with their institution is important or very important.

The similar emphasis placed on these factors by the comparative construction lenders indicates that the primary considerations for loan approval are similar for both conventional and solar construction loans.

The builder's size is of importance to some of the solar lenders, although this factor is much less of a concern than the builder's experience and prior relationship with the lending institution. Forty-five percent of the solar lenders cite this as a factor of importance. Twenty-nine percent of the comparative construction lenders also mentioned the importance of builder size (see Table 3-10).

Table 3-9

IMPORTANCE OF BUILDER'S EXPERIENCE AND PRIOR RELATIONSHIP WITH LENDING INSTITUTION IN OBTAINING CONSTRUCTION LOAN

	Builder Experience		Prior Relationship With Lending Institution	
	Solar Lender to Solar Builder	Comparative Construction Lender: General Policy	Solar Lender to Solar Builder	Comparative Construction Lender: General Policy
Very Important	71%	62%	68%	52%
Important	20	38	16	14
Relatively Unimportant	3	-	6	29
Not At All Important	6	-	10	5
	100%	100%	100%	100%
	(N=31)	(N=21)	(N=31)	(N=21)

Table 3-10

IMPORTANCE OF BUILDER SIZE IN OBTAINING CONSTRUCTION LOAN

	Solar Lender to Solar Builder	Comparative Construction Lender: General Policy
Very Important	10%	-
Important	35	29%
Relatively Unimportant	49	47
Not At All Important	6	24
	100%	100%
	(N=31)	(N=21)

Table 3-11 indicates that builder size, measured by average number of units built per year, may have an effect on the problems experienced obtaining construction financing. Those firms constructing 250 housing units per year or more have had no problems securing financing for either their solar units or their developments.

Builder experience and size (in terms of units and dollar volume) are described in Chapter 1 of this report. The solar program participants are relatively evenly distributed between large scale and small scale operations and represent varying degrees of longevity in the construction industry.

Table 3-11

PERCENTAGE OF SOLAR BUILDERS EXPERIENCING PROBLEMS OBTAINING CONSTRUCTION LOANS: BY BUILDER SIZE

	Average Units Built Per Year			
	9 or Less	10-49	50-249	250 or More
For Solar House	14%	13%	17%	0%
For Development	0%	20%	8%	0%
	(N=14)	(N=15)	(N=12)	(N=10)

Table 3-11 indicates that with the exception of very large builders (250 units or more), participants of moderate and small scale are approximately equally likely to encounter loan difficulty. Categorizing builders encountering problems by their experience in residential construction yields the results displayed in Table 3-12.

Table 3-12

CONSTRUCTION FINANCE PROBLEMS BY BUILDER EXPERIENCE

	Nature of Problem	
Builder Experience	Problem with Solar House	Problem with Development
Less than 5 years	4	3
5 - 9.9 years	-	3
Over 10 years	1	1

These data on the number of builders reporting problems are distorted by the fact that all three of those with less than five years construction experience reporting problems with financing the development also had problems with the solar unit. However, 10 of the 12 problems are among builders with less than 10 years experience. Because financial institutions apparently place high priority on experience, these relationships demand further attention as the grant program evolves.

A final factor which may contribute to the relative ease evident to date in obtaining construction financing for solar equipped units is the innovativeness of the institutions providing financing. The data suggest that the solar construction lenders may be somewhat more innovative than the typical financial institution. While the financial institutions providing solar construction loans cover the spectrum of institutional types and sizes, they are more likely than the comparative construction lenders to approve financing requests for projects using experimental equipment or construction techniques. While 86% (21) of the solar

construction lenders receiving such requests generally approve them, only 25% (8) of the comparable construction lenders did so. A further indication of the greater innovativeness of the solar lender is that many more of these institutions are asked to provide construction financing on experimental projects. Sixty-nine percent of the solar lenders report such requests.

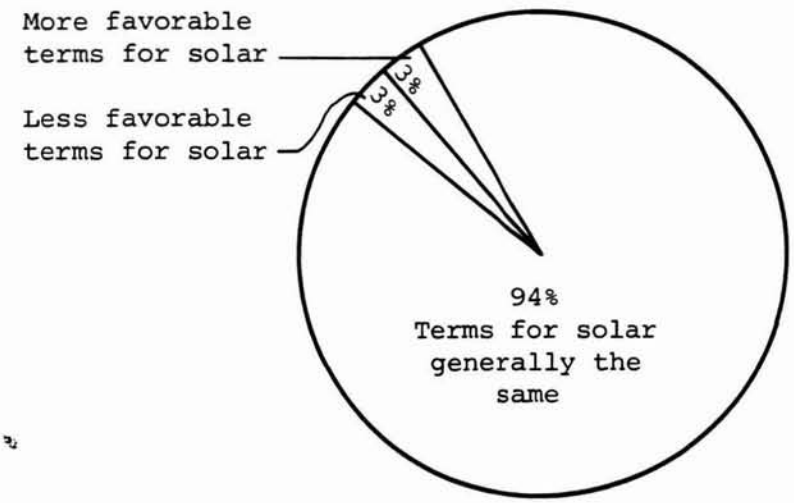
Loan Terms

The second major issue with regard to the effect of the construction financing process on the market acceptance of solar energy involves the terms granted on the loan, relative to those given on comparable projects.

Table 3-13 shows that 94% of the construction lenders granted the solar unit construction financing on terms generally the same as those for similar projects built at the same time. Of those two cases in which terms differed, one had more favorable terms for solar due to the publicity generated for the financial institution. In only one case were terms less favorable. The less favorable terms were attributed to the fact that it was the builder's first project and not to the unit's solar system. Thus, in no instance did the existence of the solar system result in less favorable terms.

Table 3-13

TERMS OF THE SOLAR CONSTRUCTION LOANS



(N=31)

Twelve of the solar lenders have also provided construction financing to other solar units. All made the loans on terms comparable to those given similar projects granted loans during that period. Only one of the 23 solar lenders willing to finance a solar home improvement loan stated that it would give the solar loan different terms than those for comparable projects. The solar loan would be made at a lower rate. Five comparative lenders have provided construction financing for solar houses and all made these loans at the terms prevailing at the time of the loan.

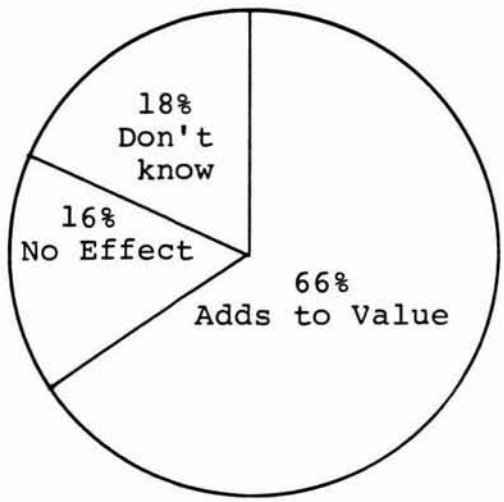
Thus, there is virtually no evidence that the terms of construction loans for solar equipped homes have differed from those given to comparable projects.

Appraisal of Solar

The way in which the solar system is appraised is the third major issue in assessing the effect of the construction lender on the market acceptance of solar energy. The appraisal of the solar system is based on the value which the construction lender sees in the solar system. Table 3-14 illustrates lender perception of solar's effect on value. Almost two-thirds (66%) of the solar construction lenders believe that a solar system will add to the value of the home. None of the lenders interviewed believes that solar will reduce home value, but 18% are not sure and 16% maintain that the system will have no effect.

Table 3-14

HOW WILL SOLAR AFFECT HOME VALUE?



Solar Construction Lender
(N=31)

An examination of lender attitudes by region in Table 3-15 shows that the greatest proportion of lenders believing that solar will add to the value of the unit are in the South and the West.

Table 3-15

EFFECT OF SOLAR ON HOME VALUE: BY REGION

	Region			
	Northeast	North Central	South	West
Add to Value	40%	38%	87%	82%
No Effect	-	25	13	18
Reduce Value	-	-	-	-
Don't Know	60	37	-	-
	100%	100%	100%	100%
	(N=5)	(N=8)	(N=8)	(N=11)

Table 3-16 summarizes the solar construction lenders' beliefs about the effect of solar on the value of the home by type of institution.

Table 3-16

EFFECT OF SOLAR ON HOME VALUE: BY TYPE OF INSTITUTION

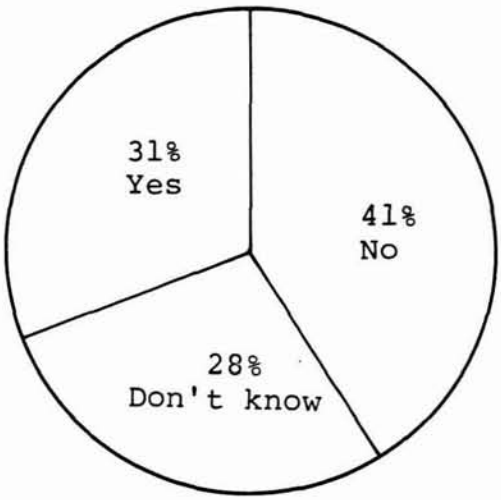
	Type	
	Savings Institution	Bank
Add to Value	56%	75%
No Effect	6	25
Reduce Value	-	-
Don't Know	38	-
	100%	100%
	(N=16)	(N=16)

Approximately half of those solar construction lenders believing that a solar system will add value to a house believe that the solar builder will be able to fully recover the cost of the solar system in the price of the house without a government grant. Table 3-17 depicts the full breakdown of attitudes.

Forty-one percent of the lenders do not believe that the full costs can be recouped and 28% do not know. These responses suggest that the financial community is conservative in their assessment of the profitability of solar construction.

Table 3-17

CAN BUILDER RECOVER COST OF SOLAR IN HOUSE PRICE WITHOUT GRANT



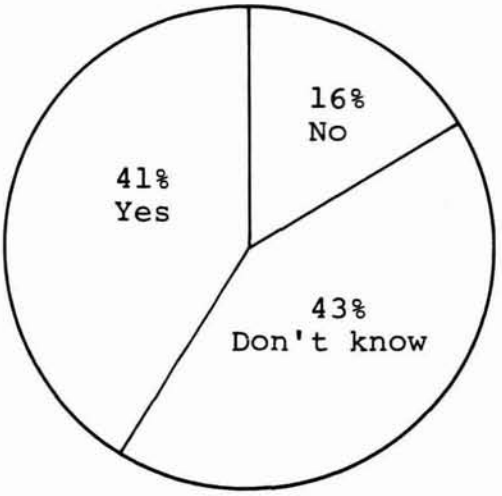
Solar Construction Lender
(N=32)

Finally, the lenders are asked whether they believe that solar will create additional value for the seller at time of resale. As shown in Table 3-18, 43% do not have an opinion, 41% believe that additional value will be created at time of resale and 16% do not. Solar construction lenders in the South and West show the greatest proportion of positive attitudes. Fifty percent of southern lenders and 64% of institutions in the West believe that solar will add to home resale value. These proportions decrease to 20% and 13%, respectively, for the Northeast and North Central region of the country. There are no discernible trends among cycles or differences by type of lending institution in these evaluations.

Two-thirds (68%) of the solar construction lenders did not conduct a special appraisal of the solar unit prior to the approval of construction financing. Thus, in the majority of cases the solar system was treated separately from the rest of the house for appraisal purposes. Forty-four percent of the savings institutions and 20% of the banks made special appraisals. There is no clear relationship between the size of the institution and whether a special appraisal was conducted. Neither is there any clear trend in the proportion of institutions requiring special appraisals over time. The regional breakdown of lenders making a special appraisal is given in Table 3-19.

Table 3-18

WILL SOLAR CREATE ADDITIONAL VALUE IN RESALE?



Solar Construction Lender
(N=32)

Table 3-19

PERCENTAGE OF CONSTRUCTION LENDERS MAKING SPECIAL APPRAISAL OF SOLAR UNIT BY REGION

Region			
Northeast	North Central	South	West
20% (N=5)	43% (N=7)	25% (N=8)	36% (N=11)

Those institutions making a special appraisal of the solar unit handled the cost of the solar system differently. About half included the entire additional solar equipment cost in the value of the home, and the other half excluded the cost entirely. One institution included part of the cost. Clearly, this issue remains to be resolved within financial institutions. Exclusion of the entire cost of the solar system will be a barrier to widespread market acceptance.

Conclusion

Overall, the data collected to date indicate that the construction lender has had only a minimal effect on the development of solar energy. Few impediments were found in the availability of loans or the appraisal of the solar units, and virtually none in the terms on which solar loans are made relative to comparable construction loans. Several scattered instances were found in which the policy of a construction lender would be an encouragement to solar development.

Financial institutions seem to focus more heavily on the characteristics of the builder, particularly experience and prior relationship with the lender, than on the specific characteristics of the unit being financed in their loan-making decisions.

Building Code Inspection

Local building codes and the inspection processes by which code approval is obtained have the potential for hindering or encouraging the residential use of solar energy. Direct regulation of solar systems, the inadvertent impact of the general code requirements, and the way in which the code is administered may all affect solar development. Building code provisions can influence the types of solar equipment that can be used in a locality. Code administration may result in delays in a builder's construction schedule. Inspectors may require costly or time consuming structural modifications in the residence or in the solar system installation. To date, 43 local building code officials having jurisdiction over the sample solar grant units have been surveyed.

Profile of the Building Code Department

Building code officials operate from a number of different positions within local government organizational structures, as is shown in Table 3-20.

Table 3-20

POSITION OF DEPARTMENT IN GOVERNMENT ORGANIZATIONAL STRUCTURE

Housing and Urban Rehabilitation/Development	5%
Department of Community Development	7
Planning and Zoning Department	2
Public Works	2
Responsible to City	12
Town Board	14
County Executive Board	25
Independent Department	33
	100%
	(N=43)

The department is located in a variety of different levels of government as depicted in Table 3-21.

Table 3-21

DEPARTMENT'S LEVEL OF GOVERNMENT

City	49%
Town/Village	7
City-County	44
	100%
	(N=43)

Forty of the 43 building code departments have an established building code. Evaluation of building health and safety in the remaining three departments is accomplished through either health department and zoning regulation or minimum lot size and floor area regulation.

Many different model building codes serve as the bases of local codes. Table 3-22 shows those codes used as models in the surveyed jurisdictions.

Table 3-22

USE OF MODEL CODES

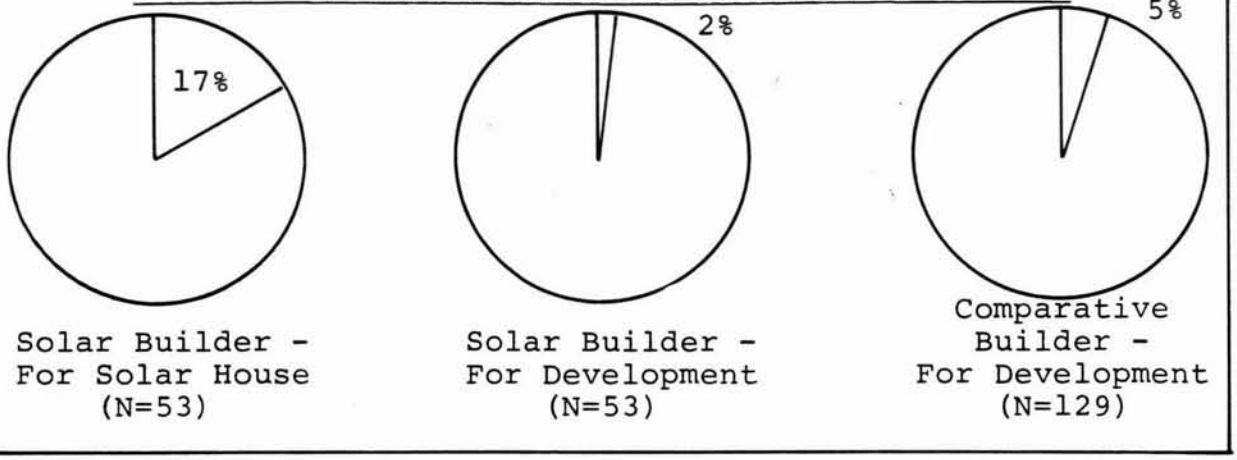
BOCA -- Basic	22%
AIA -- National	3
SBCC -- Southern	16
ICBO -- Uniform	50
IAPMO -- Uniform Plumbing	6
NFPA -- NEC and Life Safety	3
	100%
	(N=32)

The Approval Process

The most direct source of information on the effect of building code regulation on the development of solar energy is the solar builder. Table 3-23 displays the percentage of builders experiencing difficulty obtaining building inspector approval. There are nine instances (17%) of problems gaining approval for a solar unit and one problem with code approval for the development in which the solar house is located. Five percent of the comparative builders reported difficulty in gaining code approval.

Table 3-23

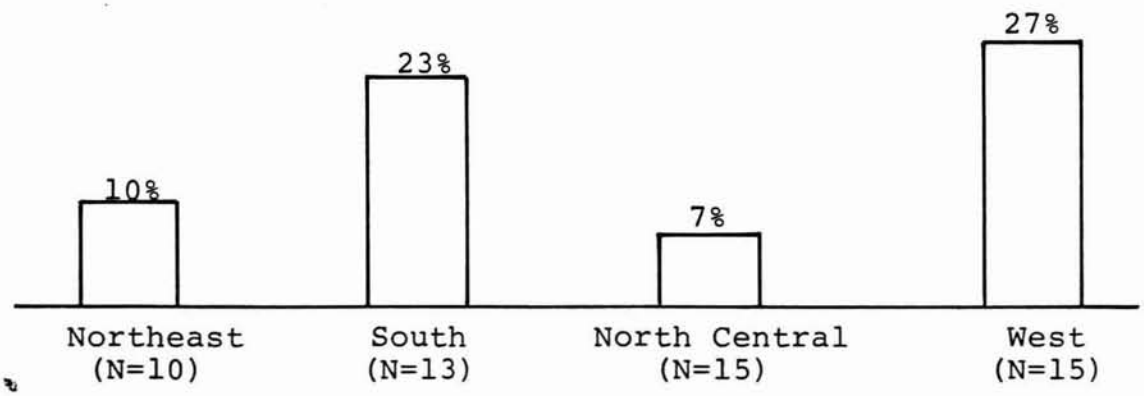
PERCENTAGE OF BUILDERS HAVING PROBLEMS OBTAINING BUILDING INSPECTOR APPROVAL



The proportion of builders reporting difficulty in each region is shown in Table 3-24. There is no clear trend in the proportion of builders experiencing code approval problems between grant cycles.

Table 3-24

SOLAR BUILDERS EXPERIENCING PROBLEMS OBTAINING APPROVAL FROM BUILDING INSPECTORS FOR SOLAR HOUSE



Although the majority of builders report no difficulty obtaining code approval for their solar units, the trouble in virtually all cases where problems were encountered is related to the solar system itself. Only one of the builders having problems with code approval for the solar unit also had code problems for the subdivision in which the solar home is located. Furthermore, while comparative builders attribute their difficulties to strict

inspectors, the solar builders tend to attribute their problems to a lack of inspector knowledge of solar. While this is not necessarily a permanent hindrance to the adoption of solar energy, it can be a short-run impediment.

The code officials provide another perspective to this issue. None of the officials stated that waivers were requested to accommodate the grant units' solar system. Of the 40 jurisdictions having a building code, only six required design changes for the solar unit for code approval. These changes were changes in the ventilation system, wall construction modification, valve changes and the separation of tanks from the potable water supply. Those jurisdictions having codes modeled after the ICBO-Uniform, the AIA-National, the SBCC-Southern, and the IAPMO-Uniform Plumbing were those in which changes were required.

System approvals for the grant homes are handled in the normal manner by regulatory personnel in almost 90% of the cases. In two cases new methods were tested. The solar collectors were reviewed in one instance and the state plumbing inspector viewed one unit.

Solar grant home job site inspections are handled in the normal manner in 90% of those jurisdictions which have building codes. In 8% of the grant sites no inspection is necessary. Only one inspection is reported to have differed from routine procedures. In this case, special training was given to the inspector.

Additional job site inspections were necessary in 26% of the jurisdictions with building codes. The additional examinations were performed in order to understand the solar system operation, conduct structural inspection for liquid systems and conduct electrical and plumbing inspections. Additional inspections were required in two of the five jurisdictions with codes modeled after the SBCC-Southern code and in one of the 11 jurisdictions with codes modeled after the ICBO-Uniform code.

The processing time for code approval for the grant units exceeded normal standards in nine (23%) jurisdictions. In three cases plans were formally reviewed and in two instances there was a stringent mechanical review of the solar system. Unconventional plumbing and frame systems also increased the processing time as did a general desire to understand the system. Four of the nine officials requiring additional processing time believe that future solar unit approvals will not require this extra effort and delay.

Other non-grant solar units have been constructed in the majority of the study areas. In fact, almost three-fourths (72%) of the code departments have reviewed building permit applications for other solar units. Three of these units required waivers for engineering and design approval of their solar systems and all three were granted. Just over one-fourth (26%) of these non-grant

solar units needed some design change to meet code approval. In three cases the change was required by a historic design ordinance. Other changes involved insulation, tank capacity and a separation of water tanks.

Solar system approvals for grant units are handled in a normal fashion in 97% of the cases. The one case which was out of the ordinary involved the building code official reviewing and discussing the solar system with the builder.

Job inspections are handled expeditiously in all cases, but additional job site inspections were necessary at 16% of the solar locations. These were a result of the officials' unfamiliarity with solar.

Approximately one-fifth (19%) of the solar applications took longer to process than the normal inspection. The extra time was attributed to a need for additional plumbing inspections and a need to closely inspect the first solar system in the jurisdiction.

Ten percent of the jurisdictions report development of special training for field inspectors. This training consists of generally familiarizing the inspectors with solar energy.

Solar and the Code

Code provisions for solar systems installation exist in 19% of the jurisdictions studied. All codes with such provisions are in the South and West as shown in Table 3-25. The provisions include a section of the Uniform building code and the BOCA plumbing code.

Table 3-25

CODE PROVISIONS FOR SOLAR INSTALLATION BY REGION

	Region			
	Northeast	North Central	South	West
Yes	-	-	42%	23%
No	100%	93%	50	77
Don't Know/ Not Applicable	-	7	8	-
	100%	100%	100%	100%
	(N=4)	(N=14)	(N=12)	(N=13)

There are a number of specific circumstances in which solar systems and building codes are reported to conflict. Questioned about the types of solar systems which would have problems meeting code requirements, toxic carriers are mentioned by 10% of the respondents, systems with plastic tubing by 8%, liquid and unworkable systems by 5% each, and liquid systems using antifreeze and systems operating at less than 70% efficiency by 3% each.

Fifty-two percent (21) of the building code officials believe that potential problems in meeting code requirements are greater for solar retrofits, largely because of the possibility of structural inadequacy of the residence for supporting the solar system. Finally, 30% of the respondents believe that there will be special health hazards in the use of solar energy in multi-family construction.

Overall, the building code has not been a major impediment nor encouragement to the development of solar energy. However, in a small but significant number of instances the solar system has created some changes or difficulties in the code approval process. Design changes in the solar systems, additional inspections, inspector training in solar and added processing time were required in some instances. Similar experiences with the non-grant solar homes, which have been built in the surveyed jurisdictions, confirm this conclusion.

One primary cause of the difficulties with code approval is the lack of expertise in the solar field among building code officials and their staffs. A substantial proportion of building code department personnel report some knowledge of solar energy, as shown in Table 3-26. Less than one-fifth claim to be very knowledgeable, while an additional 39% believe they are somewhat knowledgeable. However, direct hands on involvement with solar systems is infrequent.

Table 3-26

STAFF KNOWLEDGE ABOUT RESIDENTIAL SOLAR SYSTEMS

Very Knowledgeable	17%
Somewhat Knowledgeable	39
Slightly Knowledgeable	27
Not At All Knowledgeable	17
	100%
	(N=41)

The need for building code officials to be better informed about solar is highlighted by the solar builders, many of whom attribute their problems gaining building code approval to the inspectors' lack of familiarity with solar energy systems. A desire for further information is expressed by 33% of the code officials.

Planning and Zoning Approval

Planning, zoning and subdivision regulations can impede or encourage the ultimate market acceptance of solar energy. Forty-four local planning and zoning officials in the jurisdictions of the solar grant homes have been interviewed. Data from the previously cited solar grant builders and comparative builders are also used to explore the impact of these officials on solar development.

Profile of the Planning and Zoning Department

The majority of the planning and zoning officials are located in planning departments, as shown in Table 3-27. Most of the rest of the officials operate from executive, zoning, or community development offices.

Table 3-27

POSITION OF DEPARTMENT IN GOVERNMENT ORGANIZATIONAL STRUCTURE

Executive/Mayor's Office	11%
Planning Office	60
Community Development Office	11
Zoning Office	11
Other	7
	100%
	(N=44)

The departments responsible for planning and zoning regulation are most often at the municipal level of government. However, a substantial proportion are county agencies (see Table 3-28).

Table 3-28

LEVEL OF GOVERNMENT

Municipal or Township	59%
County	27
Semi-Independent County	7
Other	7
	100%
	(N=44)

All of the jurisdictions have zoning ordinances. Eighty-one percent have the responsibility for day-to-day zoning regulation and administration, and in 86% of the localities the department has the responsibility for subdivision regulation.

Zoning Approval

Obtaining zoning approval has been a problem for only two, or 4%, of the solar grant units, according to the solar builders. This percentage is less than the proportion of solar builders reporting difficulties gaining approval for their developments and less than the percentage of comparative builders having

similar problems with their developments. None of the solar builders' problems can be attributed to solar. The solar builders cite the local "political climate" as the cause of their difficulties.

The solar builders have had no problems obtaining site plan approval for solar units. Again, there was less difficulty securing approval for the solar units than there was gaining approval for the development in which the solar home was located or for the comparative development.

The planning and zoning officials offer additional evidence to substantiate the lack of impact which planning, zoning and subdivision regulations have had on the solar grant units. Twenty percent of the officials were not even aware that a solar grant unit was located within their jurisdiction.

Requests for zoning actions or subdivision modifications have been received in four of the jurisdictions surveyed. Solar was a factor in only one of these requests and all requests that were formally made were granted. Thus, planning, zoning and subdivision regulations have posed no barriers to the use of residential solar systems. The positive impact of planning and zoning departments on residential solar development has also been limited. Only two of 44 jurisdictions have modified their zoning ordinance to accommodate the installation of residential solar systems.

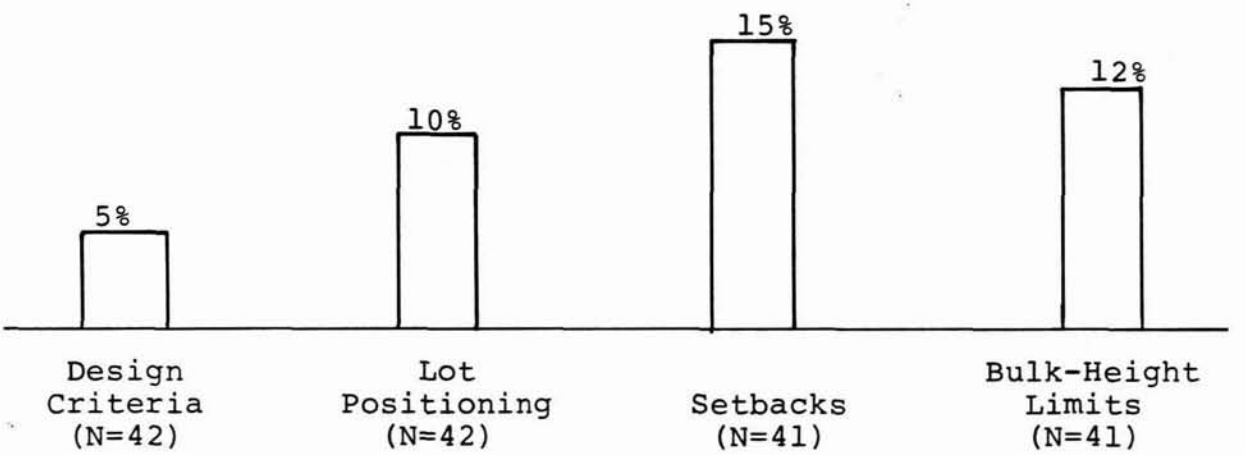
The Potential Impact

Although planning, zoning, and subdivision regulations have had almost no impact to date on solar development, the potential impact is somewhat greater. Small percentages of the zoning ordinances in the surveyed jurisdictions contain provisions which could impact widespread utilization of solar energy. The types of provisions are shown in Table 3-29.

When asked to identify any legislative, administrative or other existing impediments to resident solar energy systems in their jurisdictions' zoning and subdivision controls, two officials cited lot coverage restrictions and one a historic district zoning ordinance. Two of the three stated that the flexibility in administration of these provisions would ease their impact, however. No other impediments have been suggested.

Table 3-29

EXISTENCE OF SOLAR-RELATED PROVISIONS IN ZONING ORDINANCE



The potential impact of zoning and planning regulations on solar units increases for multi-family units, entire solar subdivisions and solar retrofits. Five of the 44 officials stated that there would be significant differences in the regulation of multi-family as opposed to single-family solar units. Multi-family units may need changes in design criteria and height requirements. Five officials also thought that unique issues would be raised with the construction of an entire solar subdivision or PUD. Finally, 14 of the 44 officials said that ordinance changes in height limitations, yard position requirements, and historic district aesthetic regulations might be required for retrofitted units.

The role of zoning and planning requirements remains in a state of flux. Eleven percent of the officials interviewed know of proposed state or local legislation dealing with solar energy that would directly impact their operations. Thirty-four percent of the officials anticipate further changes in their zoning ordinance or its administration which could facilitate the use of solar energy systems in residential development.

4

Marketing a Solar House

One of the most important aspects of the solar demonstration program lies in the area of the marketing and marketing techniques that are used to promote sales of solar homes. The purpose of this chapter is to provide a summary of the marketing experience of the demonstration program participants.

Marketing may be referred to as the processes and techniques employed by builders or developers to attract buyers to solar homes. It must be recognized, however, that two types of outcomes are possible with a marketing program. At the first or minimal level, marketing should result in some greater awareness on the part of the prospective homeowner population of the possibilities and advantages of solar. At this level, there may not be a specific decision to purchase a solar unit, but the marketing program has succeeded in generating interest in solar as an option to be considered in future purchase decisions. On the second level, however, there is a conscious decision to purchase, implying a deliberate action, as a result of the marketing program. In this case, the result of the marketing program is to actually motivate a prospective purchaser to buy and occupy a solar unit.

There is another dimension to assessing the effectiveness of a solar marketing program. It is necessary to determine the extent to which a decision to purchase a solar home is due to the marketing efforts by the developer or builder, and how much is due to other factors--such as overall investment climate, characteristics of the local housing market, institutional support, and other factors that are not under the direct control or influence of the builder. These "externalities," which must be considered along with the specific marketing program, are addressed in Chapters 3 and 8 of the report. This chapter is limited to the summary and evaluation of marketing techniques used by builders and developers.

For clarity and convenience, the organization of the data differs from the other chapters of the report. The first section contains a detailed presentation of the marketing approaches employed by solar program participants. Differences by region, grant cycles, and builder size and experience are explored where distributions and sample size permit. The second section draws contrasts between the marketing techniques of comparative and solar builders. Finally, in the third section an attempt is made to integrate builder and purchaser data in order to determine the extent to which marketing efforts are

reaching their intended audience. Several instances where builder and purchaser response do not "match" are pointed out as potential areas where marketing efforts may be refined or strengthened.

Fifty-eight builders have been surveyed, and 131 comparative builders questioned on marketing activity. In many instances the number of reported respondents is less than these totals due to removal from the sample of cases in which there was no response or the question did not apply.

Marketing from the Participating Builder's Perspective

One of the basic techniques used to promote solar units is advertising. Table 4-1 shows that among solar builders over four-fifths emphasize solar in their advertising efforts.

Table 4-1

USE SPECIAL EMPHASIS ON SOLAR IN ADVERTISING

Yes	81%
No	19
	100%
	(N=43)

The advertising effort is largely concentrated in newspaper ads, as shown in Table 4-2. The major medium employed for solar promotion is the newspaper, with television, local magazines, and billboards used far less frequently. Television is employed in almost all cases only by the very largest builders, those constructing more than 750 units annually.

Table 4-2

MEDIA ON WHICH MOST OF ADVERTISING BUDGET IS SPENT

Newspaper	92%
Television	4
Local Magazine	2
Billboards	2
	100%
	(N=49)

Other techniques that are used by the solar builders are summarized in Table 4-3. The techniques that are used most often include: open houses, press releases, and brochures developed specifically for the solar unit.

Table 4-3

TECHNIQUES USED TO PROMOTE SUBDIVISION

Techniques	Used	Not Used
Open House	86%	14%
Press Releases	72	28
Special Brochures	71	29
Special Events	55	45
Furnished Open Model	45	55
Unfurnished Open Model	45	55
(N=58)		

It is noteworthy that furnished or unfurnished models are used for promotional purposes in less than half the cases. The use of models and special events warrants future attention because their utilization is approximately evenly divided among participants. The other promotional techniques are employed by a large majority of the builders. Table 4-4 displays use of a furnished model by region of the country, grant cycle and builder size and experience.

These data do not admit to ready interpretation. There do not appear to be great differences in the use of open models by region, although they are less likely to be employed in the Northeast than in any other geographic area. Utilization by grant cycle is virtually identical. However, larger builders--those constructing more than 25 units per year--are more likely than small entrepreneurs to use models. This pattern is replicated for the use of unfurnished open models and special events as promotional techniques.

Table 4-4

USE OF FURNISHED MODEL HOMES

	By Region			
	Northeast	South	North Central	West
Yes	27%	40%	60%	47%
No	63	60	40	53
	100%	100%	100%	100%
	(N=11)	(N=15)	(n=15)	(N=17)

	By Grant Cycle		
	Cycle 1	Cycle 2	Cycle 3
Yes	46%	44%	44%
No	54	56	56
	100%	100%	100%
	(N=22)	(N=27)	(N=9)

	By Builder Size (Units)	
	Less than 25	More than 25
Yes	25%	63%
No	75	37
	100%	100%
	(N=28)	(N=30)

	By Builder Experience	
	Less than 5 years	More than 5 years
Yes	33%	51%
No	67	49
	100%	100%
	(N=21)	(N=37)

Builders themselves are asked to rank the effectiveness of their marketing techniques. Table 4-5 displays the builders' judgment of the success of each type of promotional activity.

Table 4-5

MOST SUCCESSFUL PROMOTIONAL ACTIVITY

Techniques	
Open House	41%
Special Events	20
Press Release	20
Open Models	15
Promotional Material	2
None	2
	100%
	(N=41)

The techniques that are more favored for marketing (open houses, press release, special brochure) are the same techniques that are judged most successful in promoting solar homes.

A promotional technique used by some solar builders is the provision of on-site sales personnel, to answer questions and to point out the features of solar units. Table 4-6 reveals that there is roughly an even split among builders employing this technique. Furthermore, among those builders that supply on-site sales personnel for marketing, there is a wide variation in actual knowledge about solar systems, as is also demonstrated in the table.

Table 4-6

ON-SITE SALES STAFF

On-site sales staff	52%
No on-site sales staff	48
	100%
	(N=58)

KNOWLEDGE ABOUT SOLAR AMONG ON-SITE SALES STAFF

Very knowledgeable	33%
Knowledgeable	60
Not at all knowledgeable	7
	100%
	(N=30)

The role of the sales force in marketing solar units is particularly important. This is confirmed by the limited evidence available on the role of special incentives provided to the sales force for marketing solar units. As seen in Table 4-7, although incentives or bonuses are provided in only relatively few cases, where such sales incentives are given considerably more reported sales activity is perceived.

Table 4-7

ROLE OF SALES INCENTIVES OR BONUSES IN SOLAR MARKETING

Incentives offered to sales staff	24%
Incentives not offered to sales staff	21
Don't know or does not apply	55
	100%
	(N=58)
Have incentives improved sales?	
Yes	60%
No	7
Do not know	33
	100%
	(N=14)

As with the use of promotional techniques, there are no clear relationships between an on-site sales staff and either the region in which the participant builds or grant cycle. There is, as would be expected, a greater likelihood that large builders--particularly those averaging more than 100 units annually--will employ on-site staff than will smaller builders.

Builders sometimes use the arrangement of long-term mortgage finance as a promotional technique to increase sales for homes, and this technique has been applied to solar marketing as well. As may be seen in Table 4-8, a substantial number of builders, 40 out of 58 or 69%, assist in arranging financing for the units they construct. There is no substantial difference in the financing assistance that is used to promote a solar home as opposed to a non-solar home.

Table 4-8

USE OF FINANCING IN MARKETING SOLAR HOMES

Use of assistance in financing in marketing homes; provided for	
all homes	95%
only non-solar homes	3
only solar homes	2
	100%
	(N=40)
If financial assistance is provided, are terms the same for solar and non-solar homes?	
Yes	95%
No	5
	100%
	(N=36)

Another marketing approach to promote solar residential units is the provision of a home owners warranty by the builder on the unit that is sold. A home warranty is not the same as the guarantee or warranty that may accompany the solar system. The data indicate that a clear majority of builders provide some kind of warranty on the housing unit. Further, in most cases the warranty does not differ between solar and non-solar units. These findings are presented in Table 4-9.

Table 4-9

USE OF HOME OWNER'S WARRANTY IN MARKETING SOLAR HOMES

Use of homeowner's warranty by solar builder (for all units in subdivision, including non-solar units)

Yes *	81%
No	19
	100%
	(N=58)

* It should be noted that out of the 81% (47 builders) almost one-fifth (8) provided a standard "1-2-10" (HOW) warranty.

Are warranty terms different for solar versus non-solar units?

Terms are the same	59%
Terms are not the same	41
	100%
	(N-44)

Provision of a homeowner's warranty is related to both the size and level of experience of the solar builders. Generally, increasing size and increasing experience are associated with making warranties available as a marketing technique. All of the participants constructing more than 50 units a year provide warranties on their residences, while 63% of the smaller builders do so. Similarly, 55% of builders who have been in business fewer than 5 years provide warranties, while close to 90% of the more experienced builders (and all of those with more than 20 years experience) provide them.

There is one final aspect to the marketing approaches that are used by solar builders. It relates to the use of solar units to enhance the marketing of other homes in a subdivision. In other words, some builders may use the attraction of a solar home as a means of generating interest not only in the solar home, but also in non-solar units that may be located near the solar unit. The sales traffic and interest that is generated for solar is felt to have a direct impact on the sales potential for all other units. Table 4-10 documents this marketing effect. Builders are practically evenly divided between those who believe a solar home enhances general home sales and those who are of the opinion that solar homes provide no positive impact to promoting sales of other homes in the subdivision.

Table 4-10

IMPACT OF SOLAR UNITS ON OTHER UNITS IN SUBDIVISIONS

Improved marketability	49%
Reduced marketability	2
No effect	49
	100%
	(N=53)

Marketing from the Comparative Builder's Perspective

The juxtaposition of the marketing techniques employed by solar builders to sell solar homes and the comparative builders to sell conventional units shows that there are no great differences in approach between the two groups. Following are detailed comparisons which elaborate on the findings presented in the first section of this chapter.

The advertising efforts of comparative builders are largely concentrated in newspapers, as shown in Table 4-11. The participating solar builders display a similar tendency towards reliance on print media. Newspaper advertisements dominate the promotion budgets of builders in all four regions of the nation and in each cycle of the demonstration program.

Table 4-11

MEDIA ON WHICH MOST ADVERTISING BUDGET IS SPENT

	Comparative Builders	Solar Builders
Newspaper	86%	92%
Television	4	4
Radio	2	-
Local Magazines	1	2
New Home Guide	1	-
Billboards	6	2
	100%	100%
	(N=100)	(N=49)

Promotional techniques other than advertising that are employed by comparative builders are summarized in Table 4-12. The techniques utilized most frequently include brochures, open houses and unfurnished open model homes.

Table 4-12

PROMOTIONAL TECHNIQUES

	Comparative Builders	Solar Builders
Special Brochures	55%	71%
Open House	48	86
Unfurnished Open Model	41	45
Press Releases	34	72
Furnished Open Models	30	45
Special Events	25	55
	(N=128)	(N=58)

The proportions of conventional home builders using each of these marketing techniques are consistently smaller than those reported by the solar builders. In only one case (brochures) do as many as half of the comparatives cite reliance on any promotional technique. In other words, the solar units are promoted more heavily than are comparative homes.

In addition, several clear differences in emphasis emerge from these data. The use of press releases, for example, is the second most common marketing technique reported by solar builders, while it is the fourth most frequent approach employed by the comparative builders. Special events and open houses tend to be more often featured by program participants than by their counterparts.

When the promotional techniques used by comparative builders are arrayed in the order of how successful they are felt to be, the results included in Table 4-13 are obtained. The success rankings of the conventional home builders can be contrasted to those reported by the HUD program participants. Although the comparatives actually employ models slightly less frequently than the solar builders (see Table 4-12, above) 42% believe they are a successful marketing tool. Only 15% of the solar builders share this view. Techniques such as the open house, press releases and special events are favored by demonstration program grantees.

Table 4-13

MOST SUCCESSFUL PROMOTIONAL TECHNIQUES

	Comparative Builders	Solar Builders
Open Models	42%	15%
Open House	20	41
Promotional Material	9	-
Press Releases	7	2
Special Events	7	20
Brochures	4	20
None	11	2
	100%	100%
	(N=55)	(N=41)

The provision of on-site sales personnel is a marketing technique which is employed by approximately half of both the solar and comparative builders. Among the comparative builders, however, there are differences in the use of this technique by region of the country and among builders of different unit volumes. Table 4-14 indicates that on-site staff are more frequently employed in the South and the North Central areas. Moreover, there is a direct association between builder size and use of sales staff. None of the smallest builders has this marketing force available while almost 90% of large builders employ sales staff.

Table 4-14

ON-SITE SALES STAFF

	By Region			
	Northeast	South	North Central	West
Yes	44%	68%	59%	32%
No	56	32	41	68
	100%	100%	100%	100%
	(N=18)	(N=34)	(N=32)	(N=34)

	By Builder Size (Units)			
	9 or Less	10-49	50-249	250 or More
Yes	-	34%	74%	89%
No	100%	66	26	11
	100%	100%	100%	100%
	(N=13)	(N=53)	(N=34)	(N=18)

As seen in the previous section, the role of the sales staff is important in marketing solar homes. This finding is confirmed by the limited evidence available on the use of special incentives for the sales force among the comparative builders. Table 4-15 shows that while incentives are provided by only a portion of the comparative builders (25% as opposed to 24% of solar builders), they are perceived as improving sales. This perception is mirrored by the solar builders.

Table 4-15

INCENTIVES IMPROVE SALES

	Comparative Builders	Solar Builders
Yes	59%	60%
No	22	7
Not Sure	19	33
	100%	100%
	(N=32)	(N=14)

Table 4-16 shows that similar proportions of both solar and comparative builders provide assistance to purchasers in arranging permanent (mortgage) financing for their units. The inability of small builders to employ this marketing tool is documented in Table 4-17 where arrangement of financing is crosstabulated by builder size. As in instances discussed above, the larger builders are more likely to utilize this marketing technique than are small builders.

Table 4-16

ARRANGE FINANCING FOR PURCHASERS

	Comparative Builders	Solar Builders
Yes	63%	69%
No	37	31
	100%	100%
	(N=123)	(N=58)

Table 4-17

ARRANGEMENT OF FINANCING BY BUILDER SIZE

	9 or Less	10-49	50-249	250 or More
Yes	12%	58%	73%	94%
No	88	42	27	6
	100%	100%	100%	100%
	(N=16)	(N=53)	(N=33)	(N=18)

A final comparison between the solar and the comparative builders involves their perceptions of the impact solar units have on the marketability of other residences in the subdivisions in which they are located. Table 4-18 illustrates the uniformity of opinion between the two groups. Half the builders believe that the presence of a solar home has a positive effect on the sale of other units, and half feel that the solar unit does not make any difference. While these data reflect the opinions of builders and not empirical evidence, they raise a question about the employment of the attractive power of solar to generate home sales as opposed to subdivision traffic.

Table 4-18

IMPACT OF SOLAR HOUSES ON MARKETING OTHER UNITS IN SUBDIVISIONS

	Solar Builders	Comparative Builders
Improved marketability	49%	47%
Reduced marketability	2	2
No effect	49	51
	100%	100%
	(N=53)	(N=108)

Marketing from the Purchaser's Perspective

The previous sections of this chapter outlined the marketing techniques and tools employed by the solar demonstration program builders. Remaining to be explored is the degree to which these efforts to "sell" solar homes match the purchasers' explanations of what "sold" them on the solar unit.

Data are presented describing the purchasers' initial sources of information about the solar home, and their reasons for visiting the units. The importance of solar energy in attracting buyers to the subdivision is evaluated. Finally, home and subdivision characteristics, which purchasers report influenced their decision to buy a solar home, are briefly outlined. (Chapter 5 describes the purchase decision in further detail and profiles the solar home buyer.) A tentative evaluation of the impact of marketing techniques is also provided.

Attraction to Solar

Purchasers of both solar and conventional homes report becoming aware of the development in which they bought their home through a wide variety of sources. Table 4-19 summarizes these responses. Initial awareness appears to relate most strongly to informal informational sources such as advice from friends or driving around and learning of the development by chance. The comparative purchasers cite learning of the development from a real estate agent

more frequently than the solar home buyers. These data suggest that formal advertising techniques--billboards, newspaper advertisement, radio and television--play a modest role as informational sources for the solar purchasers. About one-third of this group first learned of the solar subdivision from these advertising media.

Table 4-19

SOURCE OF INFORMATION ABOUT DEVELOPMENT

	Solar Purchasers	Comparative Purchasers
Friends	25%	18%
Just Passing Through	23	20
Newspaper-Classified	14	11
Newspaper/Magazine Article	12	2
Builder's Reputation	10	7
Real Estate Agent	10	27
Billboard	4	2
Other	2	13
	100%	100%
	(N=49)	(N=45)

Most purchasers state that their initial information is received from friends or from personal discovery ("Just passing through")--factors which are beyond the control of the builder. A minority of purchasers report that their awareness of the subdivision was a result of more formal marketing efforts. Table 4-20 displays the formal sources of information reported by purchasers and the proportions of the builders' advertising budgets devoted to these media. The data are clearly limited: only 16 purchasers mention formal advertising as their primary source of information. However, the percentages suggest that to the extent formal advertising is employed by builders, and relied on by purchasers, it is targeted to the most effective medium.

Table 4-20

MARKETING MEDIA: PURCHASERS VS. BUILDERS

	Purchasers' Source of Initial Information	Builders' Advertising Budget
Newspapers/Magazines	82%	94%
Billboards	12	2
Television	6	4
	100%	100%
	(N=16)	(N=49)

Of importance to builders is the question of the extent to which purchasers are attracted to a development by the solar unit. Table 4-21 indicates that less than one-third (29%) of the ultimate purchasers of solar homes report that they first visited the subdivision because of the solar energy units. The second part of Table 4-21 shows that in their advertising, builders in most cases (81%) stress the presence of a solar unit. While not offering final proof, these data imply that emphasis on solar may be misdirected. That purchasers visit a subdivision for reasons other than the solar unit suggests that a more even balance in advertising might be more effective than stress on the solar feature. In effect, the "draw" of solar may be overrated.

Table 4-21

IMPACT OF SOLAR ON PURCHASER ATTRACTION
WAS VISIT DUE TO THE SOLAR SYSTEM?

	Solar Purchasers	Comparative Purchasers
Yes	29%	18%
No	71	82
	100%	100%
	(N=49)	(N=40)

BUILDER EMPHASIS ON SOLAR IN ADVERTISING

Yes	81%
No	19
	100%
	(N=43)

Even if the presence of a solar unit may not be a universal magnet, it may be a selective draw which attracts identifiable segments of the home buying market. If this is shown to be the case, builders might effectively target solar advertising to specific groups and direct advertising promoting other non-solar features of their homes to other market segments.

Unfortunately, the sample of purchasers is too small to properly address this issue. Table 4-22 illustrates an exploratory approach to determining the composition of the group of purchasers who are most affected by solar-specific promotional techniques. There are too few purchasers in most of the occupation, age, education and household size and income categories to allow interpretation. However, as the sample of purchasers increases attention will be directed to elaborating these relationships.

Table 4-22

SUBDIVISION VISIT DUE TO SOLAR

Occupation	Yes	No
Professional/Technical (N=33)	24 %	76 %
Managers (N=3)	-	100
Clerical (N=3)	67	33
Craftsmen (N=10)	40	60
Age		
Under 30 (N=8)	38	62
30-44 (N=23)	26	74
45-64 (N=13)	31	69
65+ (N=5)	20	80
Education Level		
High School (N=9)	56	44
Some College (N=8)	25	75
College Grad. (N=16)	19	81
Grad. School (N=16)	25	75
Household Size		
1 (N=10)	40	60
2 (N=23)	22	78
3 (N=8)	25	75
4 (N=5)	60	40
5+ (N=3)	-	100
Household Income		
Under 10,000 (N=3)	67	33
$10,000-$19,999 (N=12)	17	83
$20,000-$29,999 (N=17)	47	53
$30,000-$39,999 (N=6)	-	100
$40,000-$49,999 (N=4)	25	75
$50,000+ (N=5)	20	80
Refused (N=2)	-	100

Recognizing that only 29% (14) of the solar purchasers report they were attracted to the builders' subdivisions by the presence of a solar unit, it would be useful to identify more precisely if specific aspects of solar energy account for this attraction. Of the 14 purchasers who visited the development because of the solar home, 7 were attracted by the promise of savings on utility bills, 3 by a concern for the environment, 3 by a personal interest in solar technology and one was attracted by a desire to try out something new. Again, as more purchasers are interviewed, it may be possible to draw implications for effective marketing from these responses.

Purchaser Reaction to Solar Units

Advertising and promotional efforts may attract prospective purchasers to visit a solar home and the subdivision in which it is located, but the purchase decision itself reflects a complex interaction of purchaser preferences, home features and the features of competitive homes. The solar purchasers are, in general, not "pre-sold" on a solar unit. As discussed above, only a minority of the purchasers visited the development because of the solar unit. In addition, 62% of the purchasers looked at conventional homes in the same subdivision before they bought a solar unit, and only 18% of the purchasers bought a solar unit without looking at comparative, conventional homes of similar price.

The fact that few purchasers buy a solar house just because it is a solar house has two marketing implications. First, builders may have to market their units in a manner which promotes other features of the home in addition to the solar energy system. And, second, most purchasers must be informed of and convinced that a solar system is a housing advantage.

Data on the factors which purchasers consider very important in their decision to buy are discussed in the following chapter and in Chapter 8. These data indicate that the solar energy system is not perceived as the only or even the most important house feature by the purchasers. Such factors as value, construction quality and resale potential are mentioned more frequently than the solar system as factors in the purchase decision. Table 4-23 displays a list of various home and locational factors ranked in order of the proportion of purchasers rating them as "very important" to their purchase decision. The table also includes the percentages of purchasers rating the solar energy system on a 5-point scale ranging from "very important" to "not at all important." These figures serve to document the need for marketing efforts to be balanced between emphasis on solar energy and other home and locational features.

Table 4-23

FACTORS IN DECISION TO BUY

	Ranking of Factors
Housing Value	59%
Energy-Saving Materials	53
Resale Value	51
Housing Quality	49
Solar System	47
Housing Price	37
General Location	35
Access to Work	26
Neighborhood	26
Housing Style	24
Site Plans	24

IMPORTANCE OF SOLAR SYSTEM

Very Important	Important	Neutral	Not Important	Not at all Important
47%	30%	17%	2%	4%

Successful marketing may also be affected by the builders' ability to provide information on solar energy to purchasers. Seventy-one percent of the purchasers report that information about the solar units was made available when they visited the subdivision. The solar system (as opposed to other home features) was emphasized in 24 (70%) of the 34 cases where information was provided. In effect, about half (24 of 49) of the purchasers were provided with specific information about the solar equipment when they looked at the house.

The content and methods employed by builders to inform purchasers about the solar system are displayed in Table 4-24. Pamphlets and brochures are the most frequently used means of providing information on the solar system. Potential cost savings were emphasized in 88% of the presentations.

Table 4-24

INFORMATION ABOUT SOLAR SYSTEMS

Presentation Medium

Pamphlets/Brochures	35%
Special Lecture	8
Model Home	4
Model Solar System	2
Technical Representative	2
No Information Available	49
	100%
	(N=49)

Presentation Emphasis

Potential Cost Savings	88%
Environmental Protection	4
National Fuel Conservation	4
New Technology	4
	100%
	(N=24)

Both solar home and comparative purchasers are asked to rate the adequacy of the information that was made available about the solar units. Solar builders are asked to rate their sales staffs in terms of their knowledge of solar energy and the specific solar system employed in the home. As shown in Table 4-25, nearly all of the builders believe that their staffs are knowledgeable about solar energy.

Table 4-25

ADEQUACY OF INFORMATION

Builders' Perspective

Sales staff is knowledgeable	93%
Sales staff not knowledgeable	7
	100%
	(N=30)

Purchasers' Perspective

Information Adequate	Solar Purchasers	Comparative Purchasers
Yes	45%	29%
No	27	5
Don't know	28	66
	100%	100%
	(N=49)	(N=45)

Table 4-25 also indicates that purchasers are not completely satisfied with the information they receive when visiting the solar units. Fewer than half (45%) of the solar purchasers and only 29% of the comparative purchasers feel that the information was adequate for their needs. Clearly, "adequate" is a term without precise meaning. However, there appears to be a discrepancy between the builders' opinions of their sales staffs and the purchasers' opinion of the information that is offered. Purchasers single out the lack of technical data on solar systems and the lack of written material as the major reasons for dissatisfaction with the information provided.

Assistance by the builder in obtaining mortgage financing for purchasers is discussed above as a marketing tool. Ninety-five percent of the solar builders report that they assist buyers in arranging permanent finance. Indirect evidence suggesting that this service is of modest importance is provided in Table 4-26.

Table 4-26

AVAILABILITY OF FINANCING

Very Important	Important	Neutral	Not Important	Not at all Important	
18%	33%	12%	15%	22%	(N=45)

These data show that the availability of financing is very important to only 18% of the solar home buyers. Half of the purchasers state that available financing was neutral or not important to their purchase decision. These findings do not mean that a builder's help in arranging a mortgage is not a valuable marketing tool. But they do imply that other factors are more important to the solar purchasers. It may be that adequate financing is a necessary, but not a sufficient, factor in the purchase decision.

Summary

The paucity of data makes a summary of marketing approaches and techniques employed to sell solar homes difficult. Findings that are beginning to emerge include a relatively clear pattern of marketing and promotional techniques. Most solar builders emphasize solar energy in the advertising efforts. Newspapers are the most common advertising medium. The open house, press releases and special events are frequently used promotional techniques. On-site sales staffs are employed by about one half of the participants in the demonstration program. Almost all assist purchasers in arranging mortgage financing for the units they construct, and most builders provide home warranties. With the exception of the use of open houses, press releases and special events, these activities are similar to those undertaken by comparative builders.

Purchasers, on the other hand, report that their initial information about the solar units was gained through friends or "just driving around"--not through advertising or formal communication channels. Only one-third of the solar buyers visited the solar home just because it was a solar home, and few purchasers were "pre-sold" on a solar unit. Indeed, the solar energy system is perceived to be less important than several other home features in the purchase decision. Approximately half of the purchasers received specific information on the solar system when they visited the solar home, and many believe the information was inadequate.

5

Solar Purchasers

Of continuing interest to the demonstration program is the question of whether or not solar purchasers are somehow "different" from their immediate neighbors who purchase conventional housing units. The primary concern is that if solar only attracts a limited or fringe segment of the new home buying population it will be difficult to develop a sustained, broad-based marketing effort. As a result, a key objective of this research has been to develop an accurate profile of solar purchasers -- who they are and what kind of housing they want -- and to compare these purchasers with a comparative group of conventional home buyers.

This section is based on interviews with 49 purchasers and 51 comparative purchasers. The sample of solar home purchasers is still limited, but an encouraging profile of solar home purchasers is beginning to emerge. The data presented below describe a strong similarity between solar and comparative consumers, indicating that solar purchasers do not represent a discrete, specialized market.

While other chapters in this report feature analysis of regional differences and attempt to isolate trends among grant cycles (the dynamic element of the demonstration program) this chapter does not. Thirty-seven of the 49 purchasers bought homes awarded grants in the 2nd cycle. As a result, there are too few cases to even begin to evaluate differences between cycles. Similarly, 32 (65%) of the purchasers are in the Western region and an additional 20% (10) bought solar units in the South. As seen in Chapter 1, the solar builders are relatively evenly distributed across the country. Purchasers may be concentrated in the West and South because homes in these areas can be constructed quickly or because they have sold more rapidly than in other parts of the nation. In any event, the skewed marginal distribution precludes an investigation of regional variation or similarities.

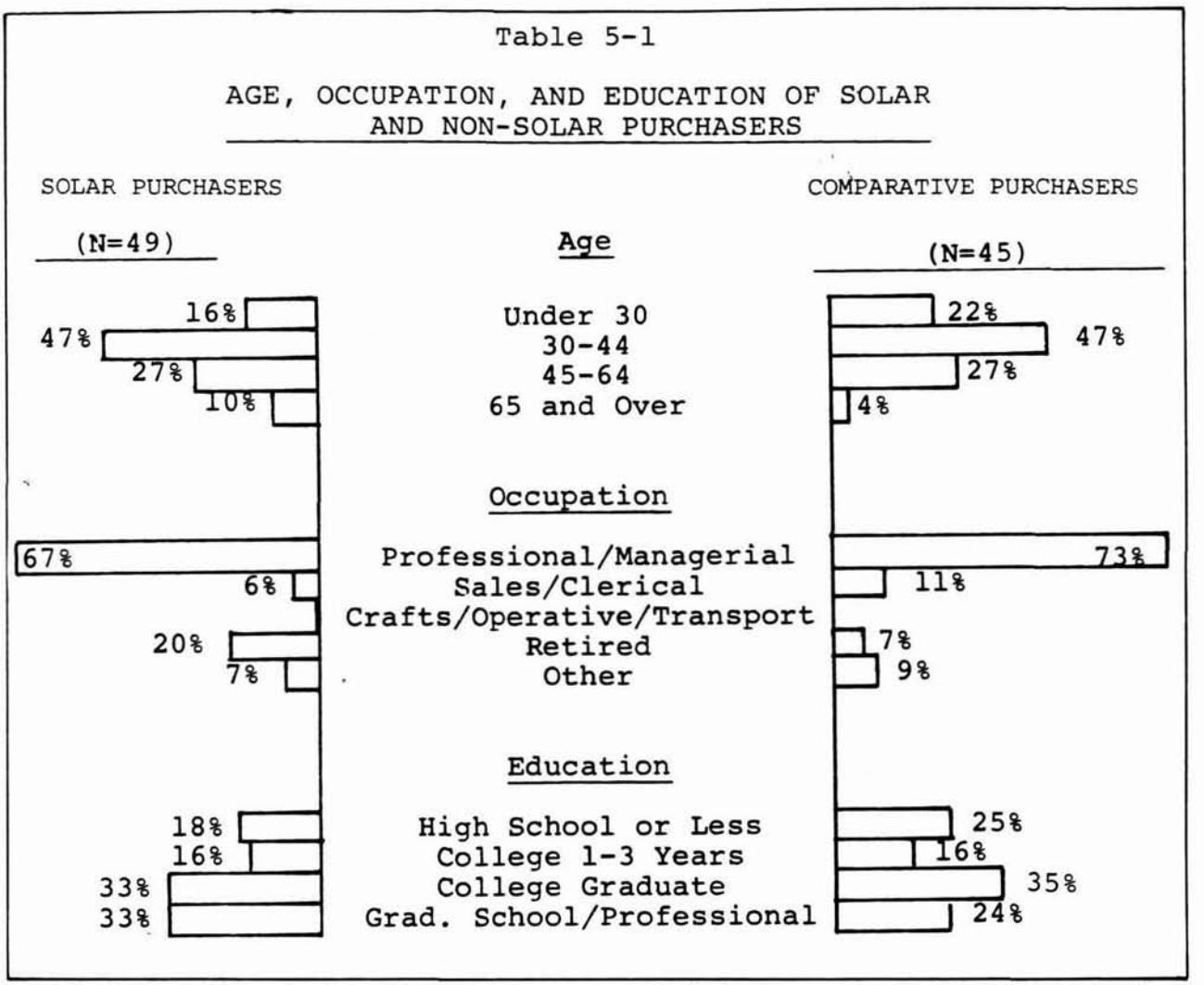
Age, Occupation, Education

The age distribution of heads of household in the sample is presented in Table 5-1. The key finding that emerges is the close similarity between the age distribution of solar purchasers and comparative purchasers. The majority of both groups tend to be between the ages of 30 and 65, with the same percentage of purchasers in the 30 to 44 age group and the 45 to 65 age group.

In short, solar is not attracting only young home purchasers. On the contrary, the appeal of solar appears to be to a variety of age groups, ranging from the under 30 population to the over 65, retired population.

Table 5-1

AGE, OCCUPATION, AND EDUCATION OF SOLAR AND NON-SOLAR PURCHASERS



A similar profile emerges when purchasers are compared in terms of their level of education. The majority of both solar and comparative purchasers have at least some college or a professional degree (82% of the solar purchasers and 75% of the comparative purchasers). The only variation between the age groups is that solar purchasers are more likely to have advanced degrees, and comparative purchasers are more likely to have only a high school education.

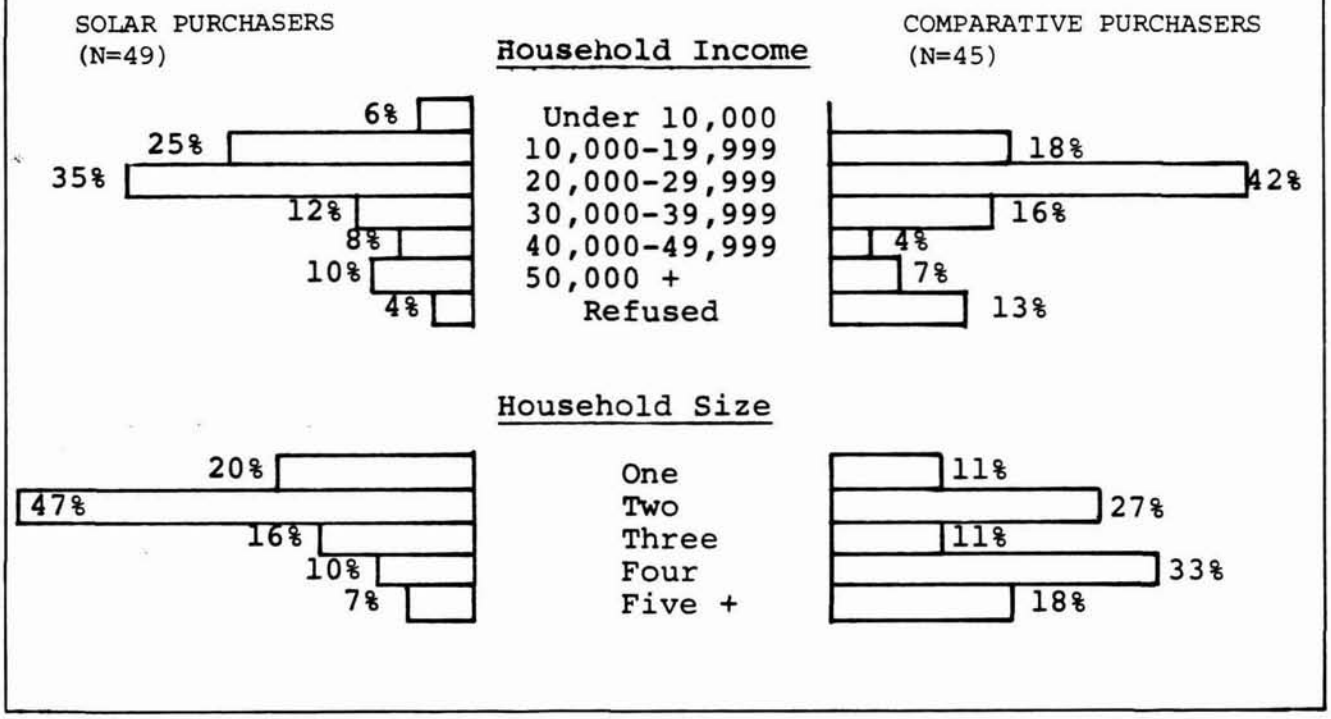
Solar purchasers and the comparative conventional home buyers are most likely to hold professional or managerial jobs. One important variation is the number of retired respondents among the solar sample. This percentage is higher than might be anticipated and may reflect interest in energy conservation on the part of this fixed income group.

Income and Household Size

The income distribution of the two samples is presented in the table below. The majority of purchasers, whether solar or comparatives, are either in the middle or high income categories, with about 30% of the solar purchasers and 27% of the comparative purchasers in the high income category. The only variation in the table is the larger percentage of solar purchasers -- about 31% -- who fall into the under $20,000 income range.

Table 5-2

INCOME AND HOUSEHOLD SIZE OF SOLAR AND NON-SOLAR PURCHASERS



The last socio-economic characteristic explored in this report is the household size of both purchase groups. The data in Table 5-2 show that a much larger percentage of solar purchasers have small households as compared to the group of non-solar purchasers. Sixty-seven percent of the solar purchasers consist of one or two member households, while only 38% of the comparative purchasers are one or two member households. Conversely, only 17% of the solar purchasers consist of 4 or 5 member households, while 51% of the comparative purchasers are of this size. This distribution seems to suggest that solar attracts smaller households than do comparable conventional units.

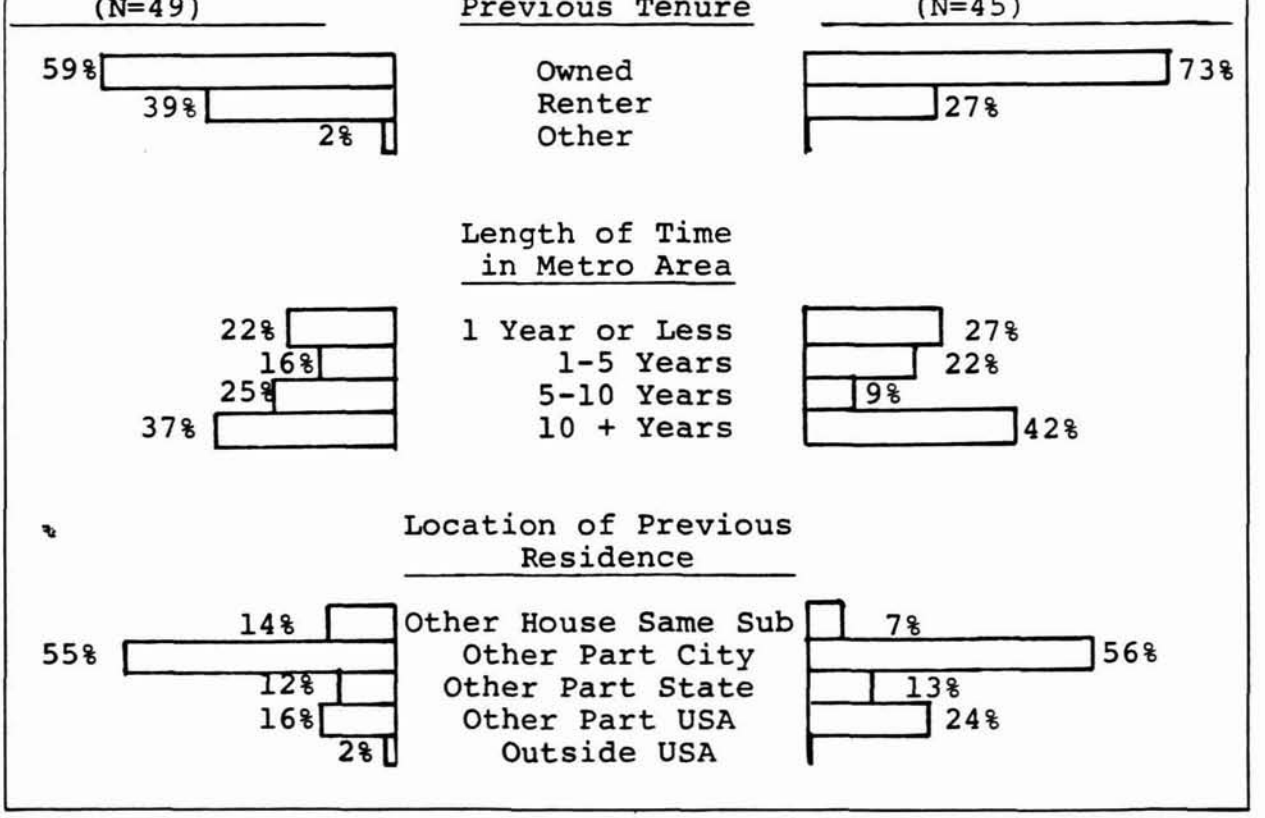
In summary, the data indicate that the socio-economic profile of solar purchasers does not differ markedly -- either in terms of age, education, occupation, or level of income -- from the comparable group of purchasers of conventional housing. The only major difference occurs in household sizes. The data show that solar purchasers have smaller households than non-solar purchasers. The tables tend to provide some support, however, to the notion that solar purchasers tend to be well educated professionals with relatively high levels of income.

Previous Housing Experience

A second area of inquiry attempts to present a better understanding of the previous housing experience of solar home purchasers. The interest is to determine if solar purchasers differ in some way from the comparable home purchasers. The specific questions related to previous housing experience are previous tenure (owner or renter), length of time in the metropolitan area, and reasons for moving. Data on these issues are presented in Table 5-3.

Table 5-3

PREVIOUS HOUSING EXPERIENCE



The findings on previous tenure indicate that substantially more comparative purchasers are previous home owners than are solar home purchasers. Fifty-nine percent of the solar purchasers owned a home prior to the solar unit while 73% of the comparative purchasers had been previous homeowners. In the 1st cycle of the program 75% of the purchasers were previous home owners. The proportion drops to 57% among buyers of 2nd cycle units. No 3rd cycle purchasers have been interviewed.

Knowledge of whether the solar purchasers are local or long distance movers may be of use to the builder interested in developing a solar marketing strategy. Recent movers to an area and high mobility transients may exhibit different buying characteristics than residents who have been in the area for a long time and are making a local move. The figures in Table 5-3 show that solar purchasers, like their comparative counterparts, tend to be long term residents of the area, with over 60% of the solar purchasers residing in their area for at least 5 years and over 50% of the comparative purchasers with similar longevity. It should be noted that a significant minority of solar purchasers are relatively recent movers (22%), but this proportion corresponds closely with the recent movers of the comparative sample (27%).

The data on location of previous residence suggest that solar purchasers are predominantly short distance movers. Coupled with the findings on length of time in the same area, this may mean that solar dwellings appeal more to locally established households than to households which are geographically transient. This latter group may focus on homes which have proven resale value -- something which solar homes have not had time to demonstrate.

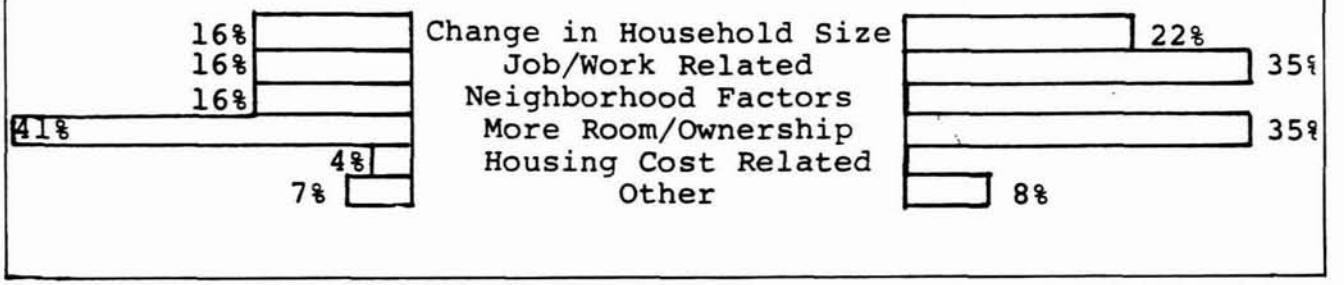
Mobility Patterns

A third area of interest is why solar purchasers moved. Is it because of a traditional reason such as change of job, desire for a better house, changing family composition or was the move directly related to the interest in the solar unit? Differences emerge between responses to this question. More specifically, solar purchasers are more likely to move from their previous residence because of a desire for more space or to own their own home. This finding conforms to the fact that many solar purchasers were previously renters.

The next most frequently mentioned responses are distributed evenly among a change in the household composition of the individual family, job change requirements, a desire for better housing, and a desire to change neighborhoods. Significantly, only one solar purchaser mentioned utility costs as a reason for moving from a previous residence. Comparative purchasers, on the other hand, are more likely to move because of a change in the

Table 5-4

REASON FOR MOVING



composition of the household, or a desire for better housing. A second frequently cited response for moving is job related, and the third is a desire to have more room or to own a house. No comparative purchaser specified utility costs as a reason for moving from a previous residence.

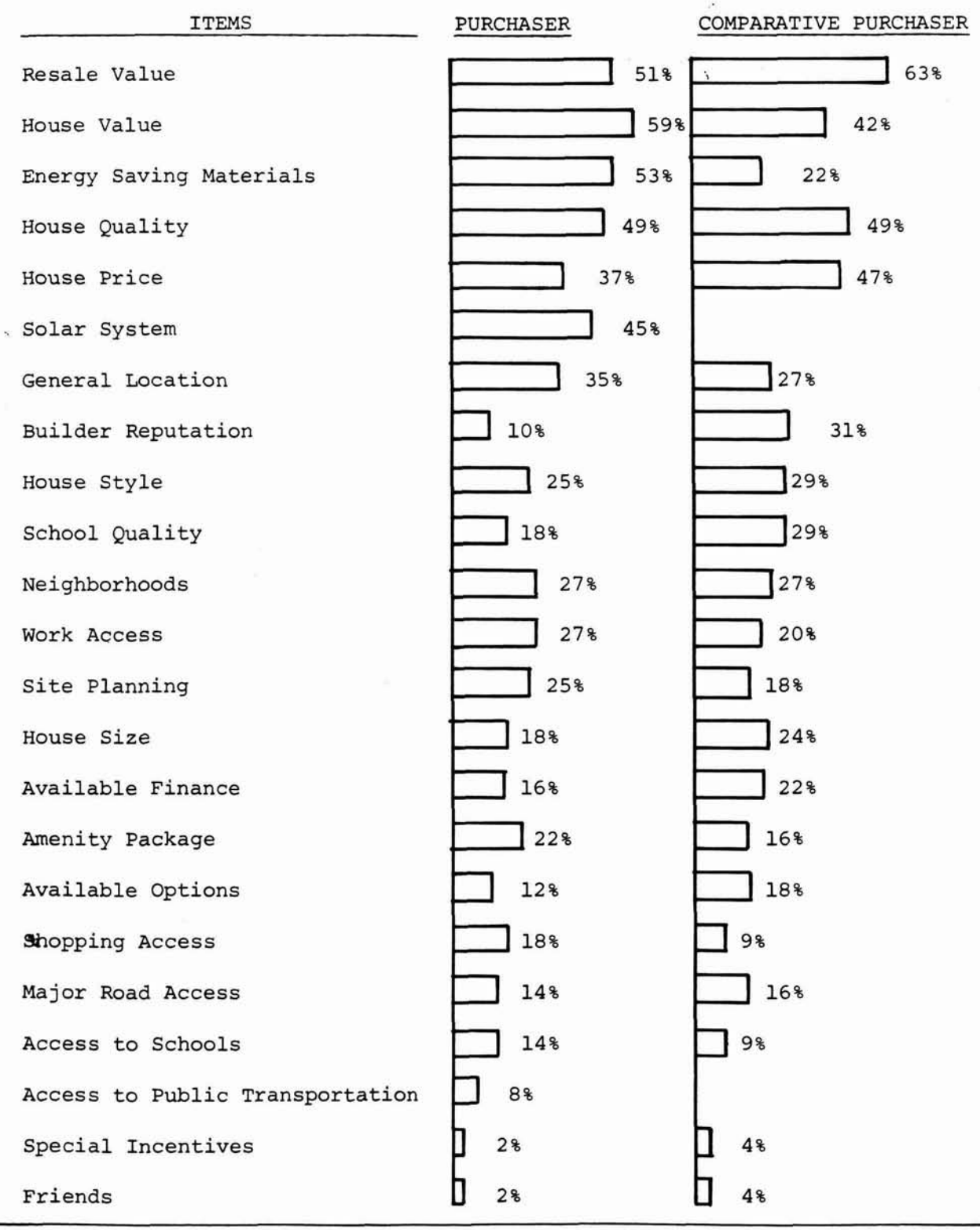
The Purchase Decision

Each purchaser interviewed is asked to evaluate their purchase decision by ranking a variety of house, development and area factors. These items are listed in Table 5-5. Each respondent rates these factors very important, important, neutral, not important, or not at all important to the purchase decision. The table that appears in this section of the report displays only the "very important" ratings.

The most striking finding to emerge when the responses of the two purchaser groups are compared is the degree of emphasis placed by solar purchasers on energy related items as compared to the purchasers of conventional housing. Fifty-three percent of the solar purchasers stress energy saving materials as an important inducement to the purchase of a solar house. Forty-five percent of the solar group also rated the solar energy system as very important in making this particular home purchase. Only 22% of the comparative group of purchasers stress energy as an important factor in making a home purchase decision. Apart from this variation, solar purchasers and the comparative group generally agree on the most important items in the purchase of a house. Both groups frequently mention resale value, house value, house quality and price as "very important" factors for deciding on a home purchase. General location of the home or the development is also a factor stressed by both groups.

Table 5-5

CHARACTERISTICS OF HOUSE, DEVELOPMENT, AND AREA CONSIDERED "VERY IMPORTANT" BY PURCHASERS AND COMPARATIVE PURCHASERS



These data indicate that the solar system is not the only or even the most important motivating factor in the purchase decision. Less than half of the solar home buyers ranked it as "very important." This may be the single most important finding displayed in this section for it implies that a solar system, by itself, will not "sell" a house.

Reasons for Visiting the Development

As discussed in the previous chapter (Chapter 4), purchasers of grant units learn about the solar home or subdivision from a variety of sources, as displayed in Table 5-6.

Table 5-6

SOURCES OF INFORMATION ABOUT THE DEVELOPMENT

	Solar Purchasers	Comparative Purchasers
Printed Media (Newspaper,Magazine)	31%	16%
T.V./Radio	2	-
Friends/Personal Contact	25	29
Builder/Agent	20	33
Passing Through	22	20
Other	-	2
	100% (N=49)	100% (N=45)

There are some variations between solar and comparative purchasers which suggest that solar purchasers may be attracted to a development in a slightly different way than their counterpart non-solar purchasers. Solar purchasers, for example, are much more likely to have received their information about the development from the printed media (31%) than non-solar purchasers (16%); conversely, 33% of the non-solar purchasers received their information about the development from professional real estate sources (builder, agents, etc.) while only 20% of the solar home purchasers relied on this group as a source of information about the development. Two other sources of information about the development for both solar purchasers and non-solar purchasers are referrals about the development from friends or relatives -- 25% for the solar group and 29% for the nonsolar group -- and "just passing through" which was cited by 22% of the solar purchasers and 20% of the non-solar purchasers.

A more specific area of inquiry involves an attempt to determine if purchasers visited the development specifically because of the solar housing units. The responses, presented in Table 5-7, indicate that a minority of solar purchasers (29%) specifically visited the development because of solar, while only 18% of the non-solar purchasers visited the development for the same reason.

Table 5-7

VISIT SUBDIVISION SPECIFICALLY BECAUSE OF SOLAR?

	Solar Purchasers		Comparative Purchasers	
Yes	(14)	29%	(7)	18%
No	(35)	71	(33)	82
		100%		100%
		(N=49)		(N=40)

Non-solar Purchaser Views of the Solar Units

In addition to solar home and comparative home purchasers, the demonstration program is conducting interviews with prospective purchasers. That is, individuals who visit the solar house, but for a variety of reasons decide not to buy it. The sample size of prospective purchasers is very small at this time. Nonetheless, these respondents are included in this chapter because they provide an interesting contrast to the solar purchasers and the purchasers of conventional homes in the same area.

Comparative and prospective purchasers are asked if they liked the solar assisted units that they inspected. Prospectives respond much more favorably to this question than comparative purchasers. Within the two groups, 67% (10 of 15) of the prospective purchasers indicate that they liked the solar unit, while only 42% of the comparatives give a favorable response. Further, a sizable number of the comparatives -- 34% -- have negative opinions about the solar unit in the neighborhood.

Comparative and prospective purchasers are also asked if they seriously considered buying a solar assisted unit when they visited the house or subdivision. Over 30% of the combined non-solar purchaser group (comparatives and prospectives) state that they had given serious consideration to purchasing a solar unit. A detailed breakdown of these attitudes is provided in Table 5-8.

Table 5-8

SERIOUS INTENT TO PURCHASE A SOLAR UNIT

	Comparatives		Prospectives	
Yes	(10)	24%	(7)	47%
No	(31)	76	(8)	53
		100%		100%
		(N=41)		(N=15)

Concerns About Solar Systems

Although most solar homeowners are satisfied with their purchase, and many comparative and prospective purchasers express serious interest in solar assisted housing, a substantial number in all groups express some concern about buying a solar house. This is not surprising considering the relative uniqueness of this technology combined with the high level of capital investment required in the purchase of any home. Table 5-9 shows that 35% of the solar purchasers, 40% of the prospective purchasers, and 46% of the comparative purchasers indicate some concern about buying a solar house that they would not have in the purchase of a conventional unit. All groups generally give the same reasons for this concern. Most frequently mentioned are the possible breakdown of the system, the impact of solar on the resale value of a house, maintenance costs, and lack of data on the actual savings received from the operation of a solar unit.

Table 5-9

ANY SPECIFIC CONCERNS ABOUT BUYING A SOLAR HOUSE

	Purchaser		Comparatives		Prospectives	
Yes	(17)	35%	(17)	46%	(6)	40%
No	(32)	65	(20)	54	(9)	60
		100%		100%		100%
		(N=49)		(N=37)		(N=15)

Future Purchase Decision

Perhaps the most encouraging data to emerge from this preliminary analysis of solar purchasers and non-solar purchasers are reflected in Table 5-10. Respondents are asked if knowing what they know now they would consider solar in their next home purchase. The overwhelmingly positive response to this question is striking. Among purchasers of solar units, 80% indicate that they would again purchase a solar unit if they were to buy another

house. Sixty-four percent of the non-solar purchasers also indicate that they will give serious consideration to the purchase of a solar unit when they are next in the market for another house. These response patterns show that the demonstration solar units have had a positive impact on solar home purchasers and on the neighboring purchasers of comparable conventional dwelling units.

Table 5-10

FUTURE SOLAR PURCHASE

	Purchasers	Comparative Purchasers
Yes	80%	64%
No	2	20
Don't Know	18	16
	100%	100%
	(N=49)	(N=45)

6 Institutional Impact on Consumer

Another group of institutional actors specified in the market acceptance model are long term (mortgage) financing institutions, utilities, insurance companies, and tax assessors. The institutional processes discussed in previous chapters which operate during the pre-construction stage of solar, and which essentially involve the builder, have only indirect impact on the purchaser of solar assisted housing. A more direct impact on consumer acceptance of solar housing results from decisions made by institutions that determine interest rates, property tax rates, household utility rates, and insurance rates.

There is concern that these institutions may act as barriers to the widespread acceptance of solar energy among consumers. So far, however, the data do not confirm the existence of such barriers. Solar home purchasers have not been treated differently than conventional home buyers by these institutions. Furthermore, current institutional policies do not appear to act either to encourage or to discourage the development of solar energy. This is still an early stage in the development of solar energy, however, and as this type of housing stock grows, the attitudes and policies of these institutions may change. Some may begin to resist solar through the adoption of restrictive policies or rates, while others may begin to provide incentives that may act to accelerate market acceptance.

This chapter discusses the specific treatment accorded solar units and the attitudes, policies, and outlook of financial institutions, utilities, insurance companies and tax assessors. The data are based on interviews with 33 participating permanent lenders; 32 auxiliary, or backup, utilities and 20 alternative utilities; 28 participating insurance agents and 32 tax assessors. It should be noted that response rates vary from question to question, and that conclusions are held to a minimum because of the clearly limited sample size. Many analytic questions -- such as regional trends -- must await further data collection.

Lending Institutions

Unlike construction lenders, permanent lending institutions directly impact the home purchasing decision making process. The availability of long term financing (or short term home improvement loans) at a reasonable rate of interest tends to stimulate home purchasing, and as a result has a beneficial effect on the

sale of solar assisted units. Conversely, any interest rate schedule that runs counter to prevailing rates, any unusually sharp rise in interest rates, or any additional interest imposed on solar home mortgage because these units are perceived by lending officials to be more risky than comparable conventional housing units, will adversely affect the sale of solar housing. It is, therefore, important for the demonstration program to gain a better understanding of the attitudes of lending institutions such as savings and loans and commercial banks toward solar housing.

The focus of the interviews with mortgage lenders has been to determine current lending policies and how they apply to solar housing; to determine appraisal techniques that are used to value solar equipped units; how or if energy costs are computed in determining monthly housing costs and, therefore, monthly mortgage payments; and to learn how lenders view the future of solar energy for residential purposes. Data in this section reflect interviews with 33 participating permanent lenders and 36 non-participating permanent lenders.

Information gathered thus far in this study from purchaser questionnaires indicates that few of those who have purchased HUD solar grant houses have had problems obtaining mortgage financing -- less than 10%. The few that cited problems said that they were caused either by a less favorable rate or by a delay in the loan. Terms have been reasonable. The average length of a mortgage is 30 years, interest rates range between 8.25 and 9.50, and most loans are conventionally financed. The primary concern of the demonstration program is to determine if this lending attitude will continue, particularly as the overall size of the solar assisted housing stock expands nationally.

Profile of Permanent Lenders

A profile of participating and non-participating lenders appears in Table 6-1 below. As the table shows, the primary source of permanent financing for solar purchasers is Savings and Loan Associations. In terms of size, defined by total assets, the data show that most participating lending institutions are medium to large institutions. Thirty-four percent have assets of $100-$499 million, 22% have assets of $500-$999 million, and 19% of the institutions have over a billion dollars in assets. The majority of participating institutions have sizeable residential mortgage portfolios, with 40% of the sample institutions having an annual volume of residential mortgage lending of over $50 million.

Table 6-1

PROFILE OF PERMANENT LENDING INSTITUTIONS

		Permanent Lenders	Comparative Lenders
Type of Lending Institution:	Savings & Loan	60%	67%
	Mutual Savings Bank	6	-
	Commercial Bank	12	31
	Independent Mortgage Bank	22	-
	Insurance Company	-	-
	Other	-	2
		100% (N=33)	100% (N=36)
Total Assets/ Deposits:	Less than $10 million	9%	-%
	$ 10- 24 million	3	-
	$ 25- 49 million	-	8
	$ 50- 99 million	9	17
	$100-499 million	34	33
	$500-999 million	23	31
	$1 billion +	19	11
	Not applicable	3	-
		100% (N=32)	100% (N=36)
Annual Volume of Residential Mortgage Lending:	Less than $1 million	-%	-%
	$ 1- 4 million	10	14
	$ 5- 9 million	3	10
	$10-24 million	20	17
	$25-49 million	20	10
	$50+ million	40	45
	Not applicable	7	4
		100% (N=30)	100% (N=29)*

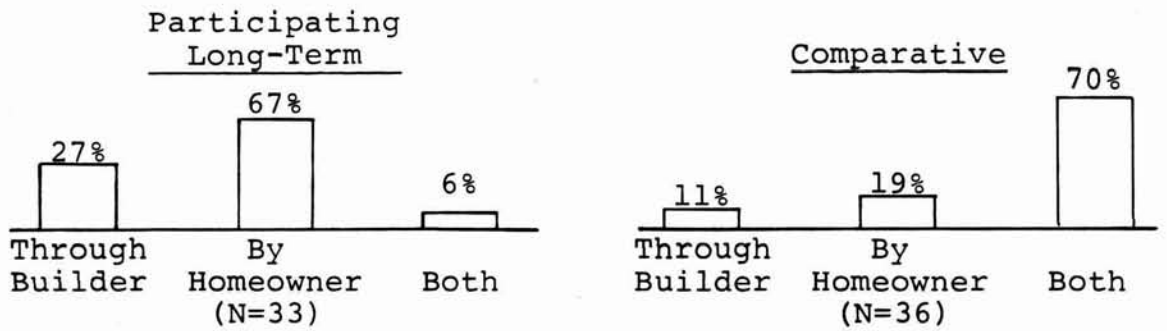
*Only a portion of those interviewed are involved in residential mortgage lending.

Lending Arrangements

Permanent financing is most frequently arranged directly by the purchaser, rather than through the builder. In the case of the participating lending institutions, 67% indicated that the purchaser arranged for financing, while 27% stated that builders arranged for financing and 6% stated that both the builder and the purchaser arranged the financing. Among comparative institutions, most (70%) officials stated that their lending is arranged by both the builder and home purchaser.

Table 6-2

ARRANGEMENT OF FINANCING



Some builders offer mortgage financing packages to purchasers. The financial institution makes the final individual mortgage decision, but agrees, in general, to finance units in a given project. Before extending permanent financing to developers, 52% of the participating institutions and 33% of the comparatives require that the builder meet special requirements. This may include the viability of the development, presale requirements, and a thorough review of the project plans. Only half of the participating group use FHA criteria as the minimum construction standards for their conventionally financed homes. The remainder use either city construction, Federal Home Loan Mortgage Corporation, or their own standards.

Some aspects of a development are considered more important than others in granting financing. The following table shows how closely various factors are examined. There is less emphasis on energy-related features than on other aspects of development.

Table 6-3

FACTORS IN EXTENDING PERMANENT FINANCING TO BUILDER/DEVELOPER

	Close Examination	Some Examination	Little/No Examination
Unit/Site Features (N=29)	76%	17%	7%
Project Amenities (N=28)	61%	29%	10%
Materials/Construction (N=28)	50%	36%	14%
Energy Features (N=29)	34%	32%	34%

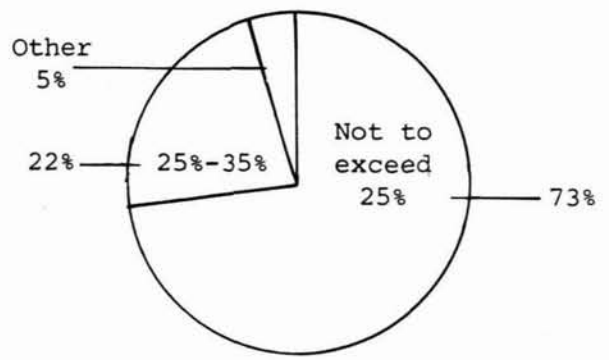
Only 42% of the respondents ever suggest to a builder that changes be made in the Heating, Ventilating, and Air Conditioning (HVAC) System. This usually occurs when the lender believes the HVAC system is obsolete or does not meet building code requirements. Similarly, only 12% ever ask that the builder's plans be changed to use a lower cost fuel, or that the builder use energy conserving materials as a condition for providing permanent financing.

Energy Costs and Monthly Mortgage Payments

In defining the homeowner's ability to afford mortgage costs, institutions use the ratio of monthly payments to income as a standard. Shown below are the ratios employed by participating institutions.

Table 6-4

MONTHLY PAYMENTS: INCOME RATIO



Even in the evaluation of a homeowner's long-term financing, energy issues are not considered significant factors in determining eligibility. Only 24% of the participating mortgage lenders (and 31% of the nonparticipating lenders) take energy costs into consideration when defining the monthly payments. Moreover, only about 30% are considering policies which would include energy costs as part of the determination of a borrower's eligibility for a mortgage. In short, the data suggest that energy costs are yet to be considered significant factors in total housing costs.

Table 6-5

ENERGY COSTS IN MORTGAGE ELIGIBILITY BY REGION

Considering Inclusion of Energy Costs?	Region			
	Northeast	North Central	South	West
Yes	-	62%	43%	19%
No	100%	38	57	81
	100%	100%	100%	100%
	(N=2)	(N=13)	(N=21)	(N=26)

When examined by region the data show that the North Central (62%) and Southern (43%) states are considering policies which would include energy cost as part of the determination of a borrower's eligibility for a mortgage.

The Solar Loan/HUD Grant Impact

Of the 33 solar loans, only 8 were arranged by builders and the remainder (76%) were arranged directly by the buyer. In only two cases were there special applications for permanent financing, and only two delays in processing the application because it involved solar were reported. More than 80% of the lenders report that they had no specific concerns regarding the application and only a few were concerned about the solar system itself.

In considering the request for permanent financing each official was asked about the examination of various facets of the solar house/project. Although 44% of the respondents considered the solar system closely, only 26% actually requested to examine it. None of these long-term lenders made any recommendations regarding the type of solar system to be used. Approximately 45% of this group require that some auxiliary, or back-up, system be used and 18% recommend such a system. Reasons given include solar energy systems are still somewhat experimental and the lender was not familiar with the equipment, or because there was a concern over the reliability of the solar equipment and its storage capability.

Table 6-6

LEVEL OF EXAMINATION OF SOLAR HOUSE/PROJECT

	Close Examination	Some Examination	Little Examination
Unit/Site Features (N=27)	63%	22%	15%
Project Amenities (N=25)	52%	16%	32%
Materials/Construction (N=26)	42%	43%	15%
Energy Features (N=27)	37%	30%	33%
Solar System (N=27)	44%	33%	23%

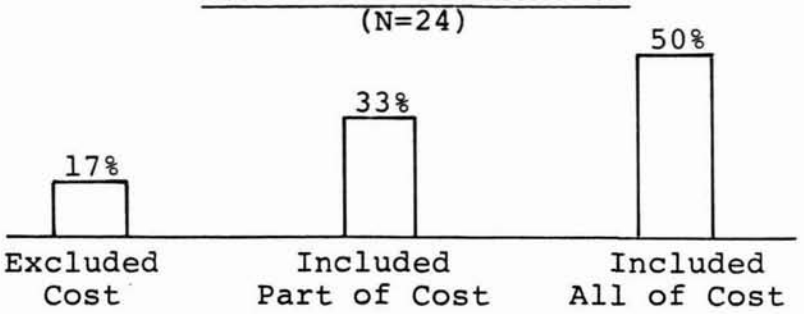
Nearly 60% of the respondents were aware that the solar system was being financed with a grant from the federal government. However, only about half of these officials said the grant was a factor in the decision to provide permanent financing. These officials stated that the grant helped bring the price of the solar unit into a conventional-home range and thus reduced the risk. About 10% stated that their institution would have reviewed the application differently if the system had not been financed by the grant; that it would have been more difficult for the builder or home buyer to receive the long-term commitment.

Appraisal Techniques

Valuation techniques used by lending institutions to appraise solar systems will have a strong impact on the financing costs to the home buyer. How the additional cost of the system figured into the appraised value of the HUD-grant units is shown in Table 6-7. These data suggest that a uniform approach to valuing solar systems has not developed.

Table 6-7

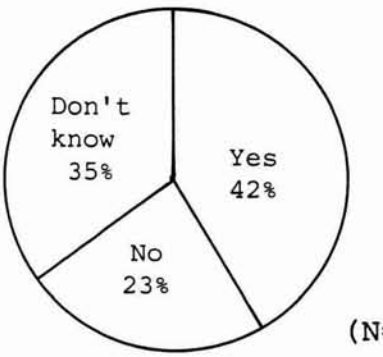
SOLAR SYSTEM VALUATION
(N=24)



In estimating the value of the solar system for lending purposes, about 40% of the respondents consider the system as an individual component, about 50% consider it on the basis of per-square-foot costs, and the remainder use both approaches. When asked whether the solar system has features whose costs are greater than value, lenders responded as follows:

Table 6-8

SOLAR COSTS GREATER THAN VALUE?



(N=31)

Officials who believe that solar systems have features whose costs are greater than their value explained that installation costs are very high and a back-up system is still required. As Table 6-9 indicates, lenders are approximately evenly split on the question of the valuation of such costs.

Table 6-9

METHOD OF HANDLING FEATURES WHEN COSTS ARE GREATER THAN VALUE

Exclude the cost in excess of value	38%
Include the entire cost	31
Include in overall appraisal in some way	31
Offset by lower loan to value ratio	-
	100%
	(N=33)

In determining the level of permanent financing available to a homeowner, only 12% of the institutions included the energy cost factor. Some believe that the energy savings due to the solar system cannot be measured and the borrower's ability to repay is of greater importance. The cost of the solar system itself normally is not factored into the determination of a homeowner's eligibility.

Approximately half of the participating long-term lending institutions have a home improvement program and all of that group said they would be willing to finance the retrofitting of a conventional home with solar equipment. Some are considering a special low interest rate to encourage energy conservation measures. Three have received and approved home loan requests to retrofit.

Solar Attitudes

Several questions in the interview deal with the attitudes of lending institutions toward the future success and marketability of solar homes. One such question is: "Could a builder who installed a solar energy unit in a house without a grant recover the cost of the unit in the sales price?" The responses are detailed in Table 6-10. The table shows that less than half the lenders believe that solar costs can be recovered.

Table 6-10

RECOVER SOLAR COST IN SALE PRICE

	Participating Long-Term Lenders	Comparative Lenders
Yes	45%	36%
No	30	45
Don't Know	25	19
	100%	100%
	(N=33)	(N=36)

Officials who responded negatively believe the cost cannot be recovered because costs of solar systems are greater than those of conventional heating/cooling systems. Others remarked that the investment recovery period is too long.

Another question seeks to determine the lender's assessment of the current marketability of solar homes.

Table 6-11

DIFFICULTY IN RESELLING A SOLAR HOME

Q. Would it be difficult to resell a solar equipped home at the present time?

	Participating Long-Term Lenders	Comparative Lenders
Yes	18%	25%
No	70	50
Don't Know	12	25
	100%	100%
	(N=33)	(N=36)

Most participating lenders do not foresee any difficulty in reselling a solar home. However, only half the comparative lending institutions share this confidence.

Table 6-12

IMPACT OF SOLAR SYSTEM ON HOME VALUE

Q. What is the likely effect on home values of the inclusion of a solar energy heating or cooling system?

	Participating Long-Term Lenders	Comparative Lenders
Adds to Value	61%	54%
No Effect	18	29
Reduces Value	3	0
Don't Know	18	17
	(N=33)	(N=35)

A further question was asked as to impact of the solar system on its resale value. In this array of responses, the lenders are quite positive about the impact of solar systems. The positive responses are based on the view that over the long run energy cost savings will add to value, and there will be greater consumer acceptance in the future.

The final question is relatively general, soliciting the institution's outlook on solar home mortgages. The responses are cross tabulated by the type of institution and size of institution.

Table 6-13

INSTITUTION'S ATTITUDE TOWARD PROVIDING FINANCING FOR SOLAR UNITS BY PARTICIPATING AND COMPARATIVE LENDERS

Q. How would you assess your institution's attitude toward providing financing for solar energy houses?

	Participating Long-Term Lenders	Comparative Lenders
Very Favorable	33%	28%
Favorable	55	53
Not at All Favorable	0	5
No Opinion	12	14
	100%	100%
	(N=33)	(N=36)

Table 6-14

SOLAR ATTITUDES BY TYPE OF INSTITUTION

	Participating Long-Term and Comparative Lenders			
Type	Very Favorable	Favorable	Not at All Favorable	No Opinion
Savings & Loan (N=42)	26%	52%	5%	17%
Mutual Savings Bank (N=2)	50	50	-	-
Commercial Bank (N=14)	29	64	-	7
Independent Mortgage Bank (N=7)	43	43	-	14
Insurance Company (N=1)	100%	-	-	-

Table 6-15

SOLAR ATTITUDES BY SIZE OF INSTITUTION

Assets	Participating Long-Term and Comparative Lenders: Very Favorable	Favorable	Not at All Favorable	No Opinion
Small (N=3) (Less than $10 million)	100%	-	-	-
Medium (N=14) ($10-$99 million)	29	64%	-	7%
Large (N=51) ($100 million +)	27	55	4%	14

Tables 6-13, 6-14 and 6-15 indicate that there is a similarity in attitudes among the lenders who provided mortgage financing for the HUD grant houses and among the comparative, non-participating lenders. There are no discernible differences among the various types or sizes of lending institutions. The responses indicate that nearly 85% of all lenders are either very favorable or favorable toward providing financing for solar equipped houses.

Knowledge and Policy Outlook

Although solar systems have operated in some parts of the country for many years, this technology is still relatively new. Many lenders have made decisions based on a low level of knowledge. Their own assessment is shown in Table 6-16.

Table 6-16

LEVEL OF KNOWLEDGE ABOUT SOLAR

	Participating Long-Term Lenders	Comparative Lenders
Very knowledgeable	6%	6%
Knowledgeable	23	22
Slightly knowledgeable	52	64
Not at all knowledgeable	19	8
	100%	100%
	(N=31)	(N=36)

Responses shown in Table 6-17 indicate that participating lenders in the Northeast, North Central, and West see a need for solar use in the respective areas. Southern respondents appear less positive.

Table 6-17

GREATER NEED FOR SOLAR ENERGY SYSTEMS

Q. Compared to other regions in the country, do you think there is any greater need for solar energy systems in the area where you do most of your lending?

	Northeast	North Central	South	West
Yes	2	5	2	7
No	0	1	6	4
Don't Know	0	1	4	2

Lenders who feel there is a greater need for solar in their region based this on two factors: the colder weather and/or shortage of natural gas.

Finally, each financial institution is asked to assess the outlook for solar energy systems for residential purposes. Nearly 40% of the lenders classified their institution's outlook as interested and committed. Another 51% are interested, but not committed. Forty-five percent of the participating mortgage lenders stated that they had learned something from their involvement in the HUD solar grant program -- specifically about the cost effectiveness of the systems. Despite this relatively large number, only about 5% of the institutions have made a special effort to assess the impacts of solar housing on their lending policies. However, based on current levels of knowledge and policy toward solar lending, half of the officials expected the policies of their institution to be modified within the next three years as they adapt to changing markets.

Summary

Although lenders are somewhat concerned about the ability of a developer to recover the cost of the solar system in the sales price of a unit, they are positive about the long-term impact of a solar system on housing. Financing terms are generally comparable to those for conventional homes. The various types of lenders -- both participating and non-participating -- have a predominantly favorable attitude toward mortgage lending on solar units. These attitudes will be traced further as the effect of solar units on utility bills can be determined and the marketability of units can be assessed.

Utility Companies

Utility policies and rates have the potential to act as barriers to the market acceptance of solar housing. Because solar is an alternative energy source, its extensive use could impact the total fuel demand on existing utilities. In addition, some auxiliary or backup service is necessary in order to counteract extended periods of cloud cover. Thus, utilities, and in particular, electric utilities must have the capacity to generate enough energy to serve both conventional and solar units at peak demand periods. Additional capital investment and operating costs may be necessary to maintain this capacity without a commensurate increase in revenues.

Two other issues are involved. Utility savings must be realized if the homeowner is to amortize the added cost of the solar system. Cost savings will be directly affected by the pricing policy of the utility. A strong conservation program, on the other hand, could have a positive impact on solar. These efforts are likely to raise the energy consciousness of the general public and possibly facilitate the adoption of solar. Thus, it will be important as more data are collected to monitor changes in the direction of conservation policies and rates among utility companies.

Utility Service to Solar Homes

Two types of utility companies are interviewed during the course of this study. Utilities that provide auxiliary or backup service to the solar grant units and alternative utilities that are located in the same service area as the solar unit but do not provide the backup service to the solar house. The following table provides a breakdown of these utilities.

Table 6-18

DISTRIBUTION OF UTILITIES

Energy Type	Auxiliary	Alternative
Gas	17%	65%
Electric	50	35
Combined	33	-
	100%	100%
	(N=32)	(N=20)

Among the alternative utilities, 70% indicated that they are aware of solar homes in their specific service area, and over 50% stated that they are providing either heating, ventilating, or air conditioning (HVAC) service to a solar assisted unit. When queried about providing service to a solar unit, both groups stated that they had few problems providing auxiliary service.

Among the problems mentioned by a small number of utilities are the waiting period for gas service, and some instances of installation difficulties because of frozen components of the solar system (see Table 6-19).

Table 6-19

SERVICING PROBLEMS

	Grant House Problems	Other Solar Problems	
		Auxiliary	Alternative
Yes	10%	-	-
No	80	100%	100%
Don't Know	10	-	-
	100%	100%	100%
	(N=30)	(N=24)	(N=14)

The type of rate requested by the developer and approved by the utility company is also of interest to the demonstration program. The sample shows that most developers request a standard rate, and correspondingly the majority of utility companies provide standard rates to most developers.

Table 6-20

UTILITY RATE REQUESTS FOR SOLAR HOUSE

Rate Requested By Developer		Rate Granted By Utility	
Standard Rate	73%	Standard Rate	91%
Special Rate	7	Solar Heat Rate	3
Block Rate	3	Block Rate	3
None	17	Space Heating Rate	3
	100%		100%
	(N=30)		(N=30)

As noted earlier, the cost of utility services can impact the market acceptance of solar energy. Respondents are asked, therefore, if they believe the current rate structure encourages or discourages the use of solar for residential purposes. Generally, most officials stated that existing rate structures neither encouraged nor discouraged the use of solar energy.

Table 6-21

RATE IMPACT ON SOLAR ASSISTED HOUSING

	Electric Utility	Gas Utility	Gas/Electric Utility
Encourages	22%	17%	36%
Discourages	4	22	9
No Impact	70	61	55
Don't Know	4	-	-
	100% (N=23)	100% (N=18)	100% (N=11)

Among the responses 36% of the combined utilities (gas and electric) indicate that their rate structure encourages solar, while 22% of the electric companies and only 17% of the gas utilities respond in a similar fashion. A larger percentage of gas utilities express the view that current rate structures act to discourage the development of solar -- 22% of the gas utilities as opposed to 9% of the combined utilities and only 4% of the electric utilities surveyed thus far in the demonstration program.

Table 6-22

CONSIDERING SPECIAL RATES FOR SOLAR UNITS

	Utility Type		
	Electric	Gas	Combined
Yes	43%	11%	45%
No	52	78	45
Don't Know	5	11	10
	100% (N=23)	100% (N=18)	100% (N=11)

Although most utilities provide standard rates to service area customers, there are indications, as evidenced by the data in Table 6-22, that many utilities are considering or already have special rates for solar assisted housing. Among the respondents, 45% of the combined utilities, 43% of the electric utilities, and 11% of the gas utilities stated that they offered some type of special rate to solar home purchasers. However, when these same officials are asked what type of impact the special rate would have on monthly utility bills, the responses of the officials were fairly evenly divided between those who indicated that the bills would be higher (33%), lower (33%) or about the same (34%).

Table 6-23

EFFECT OF SPECIAL RATE ON MONTHLY BILL
(Electric Utilities Only)

	Auxiliary	Alternative
Higher	33%	50%
Lower	33	33
About the Same	34	17
	100%	100%
	(N=9)	(N=6)

Controversy over CED and other innovative rates and the impact of such rates on solar remain unresolved. In this sample, about 70% of the auxiliary respondents report that they have either adopted or are considering the use of CED or time of day rates while less than 50% of the alternative utilities have or are considering such rates. CED rates are generally being applied to residential customers using 1) time of day rates; 2) graduated increasing rates; 3) demand-peak load rates. In a few cases this approach is experimental, being used in a few sample homes. When asked the effect of CED rates on monthly utility bills, where a comparable amount of fuel is used, less than 20% felt that the bills would increase. Subsequently, the same officials were asked if CED rates penalize homeowners who practice energy conservation. The results are presented in Table 6-24.

Table 6-24

DO CED RATES PENALIZE PRACTICE OF ENERGY CONSERVATION?

	Auxiliary	Alternative
Yes	19%	36%
No	81	64
	100%	100%
	(N=28)	(N=14)

Officials who responded that CED rates did not penalize homeowners explain that the rates give the homeowner an opportunity to adjust utility consumption to economize on utilities and to take advantage of off-peak cost savings.

The Need for Solar

Some measure of the need for and practicality of solar energy as expressed by utility companies provides insight into the posture the companies may assume regarding the commercialization of solar energy in their service areas. For this reason the survey instruments include questions that address themselves to solar needs and practicality. The responses are difficult to interpret at this time because of the limited sample size. But the wide regional spread of utilities indicates utility attitudes toward these issues. With respect to the need for solar, 55% of the alternative utilities and 39% of the auxiliary utilities stress that there is a need for solar energy alternatives in their area. When broken down by region (Table 6-25), the most important finding is the small number of Southern utilities (11%) indicating that solar energy is needed in their service area, while 75% of the Western utilities and an equal percentage of Northwest utilities indicated a need for solar.

Table 6-25

GREATER NEED FOR SOLAR IN YOUR REGION

	All Respondents		Region			
	Auxiliary	Alternative	Northeast	North Central	South	West
Yes	39%	55%	75%	46%	11%	75%
No	48	40	25	54	61	25
Don't Know	13	5	-	-	28	-
	100%	100%	100%	100%	100%	100%
	(N=31)	(N=20)	(N=4)	(N=13)	(N=18)	(N=16)

When asked if solar is a practical alternative, however, a much smaller percentage of respondents answer positively. Among the sample, only Western utilities indicate that solar is a practical alternative, followed by 31% of the utilities in the North Central region, 28% of the Southern utilities, and 25% of the Northeastern utilities. Officials who respond negatively explain that they believe that solar systems today are not cost effective, although some believe that with a tax rebate solar could become practical.

The perception of utility officials of the future importance of solar energy in individual service areas is another area of interest to the demonstration program. A substantial number of these officials believe that solar will be an important energy source in their service area in the future. Many officials cite the rising cost of fossil fuels as the major reason. Those that state that it would not be an important factor base this opinion on past trends (i.e., solar has yet to become competitive),

inefficiency of existing systems, and prohibitive costs of labor and installation.

Table 6-26

SOLAR ENERGY:
A PRACTICAL ALTERNATIVE

	All Respondents	Region			
		Northeast	North Central	South	West
Yes	40%	25%	31%	28%	65%
No	54	75	54	72	29
Don't Know	6	-	15	-	6
	100%	100%	100%	100%	100%
	(N=52)	(N=4)	(N=13)	(N=18)	(N=17)

The widespread use of solar assisted housing could impact utility services in a given market area. It is important, therefore, to learn what impact utilities believe solar will have on their operations and what type of future involvement these officials feel their companies will have in the solar energy field. Responses to this question are varied. Common responses include the expectation that solar energy will keep peak load factors constant while producing lower revenues. Some gas utilities suggest that solar might be a way of extending their supplies. There is some uncertainty expressed about the impact of solar energy on operating revenues. Some utilities indicate that it may result in reduced sales and therefore operating losses, while others do not believe that reduced sales will occur when solar energy use becomes widespread.

One other major concern is the issue of the utility load factor of solar assisted housing on electric utilities. Electric utility officials are asked if they have any concern about the impact of solar energy on electric utility loads. A substantial number of these officials (64%) express some concern that solar would have an impact on utility loads. The reasons for this concern are arrayed in Table 6-27.

Table 6-27

CONCERN OVER ELECTRIC LOAD FACTOR

Explanation	Responses
Demand for auxiliary utility use depends on the weather	12%
Difficulty in predicting the peak load demand	10%
Would cause load factor costs to increase	12%
Expected to add to peak demand without a revenue increase	12%

In order to obtain some measure of the future involvement of utilities in the commercialization of solar, officials were asked whether utility companies would get involved in the leasing of solar equipment as its use becomes more widespread, or if they would become involved in servicing solar systems. The majority believed they will not or did not know whether they will get involved in servicing or leasing solar equipment. Some officials feel that these activities may not be permitted by the state's utility commission; that servicing is something the utility cannot handle efficiently; and that existing warranties will cover servicing needs.

Table 6-28

DEGREE OF PARTICIPATION IN THE COMMERCIALIZATION OF SOLAR ENERGY

	Involvement in Leasing Solar	Involvement in Servicing Solar	Other Solar Residential Involvement
Yes	24%	27%	59%
No	39	41	27
Don't Know	37	32	14
	100%	100%	100%
	(N=51)	(N=51)	(N=51)

The last column of Table 6-28 indicates whether the utility company can foresee other types of solar involvement. Respondents who answer positively are not inclined toward involvement with the physical system, but rather in related areas: marketing, providing technical assistance and public relations advice, and monitoring the solar homes.

Energy Conservation

Nearly all of the utility companies report that they have an established energy conservation program. Areas which are emphasized in their respective programs include the following:

- perfection of heating equipment
- insulation and construction design
- encouraging energy efficient appliances
- public relations information

Despite these programs, only about 20% of the companies have any energy conservation requirements or options linked to utility hook-ups.

Finally, about 40% of the utility officials indicate they plan to monitor the experimental solar homes to determine energy usage and cost savings. A few intend to construct a demonstration solar home, provide technical advice to builders in the area, or test and design systems themselves.

Summary

At this point there is no clear indication that either utility pricing policy or company attitudes will have a negative impact on the market acceptance of solar assisted housing. Only a small number of companies, however, foresee any servicing or leasing involvement with the systems. There is a noticeable difference in the perceptions of the need for and practicality of solar among the geographic regions. Opinions in the West are considerably more positive about solar than those in the South. Both auxiliary and alternative groups are optimistic about the future role of solar. The exception is with electric utilities that express apprehension about the impact of solar on their load factors. The longer-term impact will be monitored as additional interviews are completed and as utility bills of solar home purchasers are monitored.

Insurance Companies

Insurance payments are an additional financial burden in the overall cost of homeownership. If insurance companies were to charge significantly higher premium rates for homes with solar systems, this could discourage the long-term acceptance of residential solar energy. In insuring a home equipped with a solar system, an insurance company may be liable for actual damage to the system or for damage to the remainder of the house caused by the system. To offset some of these risks the insurance company could insure the solar system separately from the rest of the house and/or refuse to insure against damage caused by the equipment. In either case, the costs of these risks are passed on to the homeowner. Premium rates are established by past claims experience. The data from the insurance company interviews indicate that there has been little experience in covering solar and to date none of the firms has modified their policies to adapt to solar homes.

Insuring Solar Homes

Twenty-eight agents of companies that insured the solar HUD grant houses have been interviewed. To date, few insurers have had any problems in processing the solar home insurance application. Table 6-29 indicates that insurers have had very little difficulty in processing coverage for HUD grant units or for other solar units.

Table 6-29

INSURANCE PROCESSING PROBLEMS

	Grant House			Other Solar Units		
	Problems	Special Processing Problems	Delays in Approval	Problems	Special Processing Problems	Delays in Approval
Yes	1	2	0	1	0	0
No	25	24	26	8	8	8

Most decisions are made by the company's regional offices or an independent insurance agent. Rarely was the home office involved in the decision to insure and only once did the head office ask about the installation of the system.

Table 6-30

SPECIAL INSURANCE DATA NEEDS

	Grant House		Other Solar Units	
	Special Instructions From Home Office	Special Information Requested	Special Instructions From Home Office	Special Information Requested
Yes	0	1	0	1
No	26	25	9	7

A comparison between the rates for solar homes and other conventional units is necessary to determine if insurance premium costs could impede the market acceptance of solar. This question was asked of these participating insurance companies, and all respondents said that the rates for both the solar grant house and other solar homes were "about the same" as those for conventional units. (This trend could change during future HUD grant cycles, and will be traced as further information is gathered.) Further, only one agent said the fact that the HUD house was financed by a federal grant had any impact on processing the application -- in this case it facilitated the process.

Of all the solar homes insured by participating insurance agents, in only one instance was the solar system insured separately from the house itself. (There was no indication that this had any impact on the cost of premiums.) However, some concern is expressed about potential wind damage, breakage, or special repair problems during the insurance period. But none of those who expressed this concern listed any specific potential damage clause in the policy to offset the risk.

Table 6-31

DAMAGE CONCERNS

	Grant House Concern About Potential Damage	Other Solar Concern About Potential Damage
Yes	3	1
No	23	6

Policy Outlook

The majority of respondents (85%) believe that there is no difference between conventional housing and a solar energy house for insurance purposes. Only three insurance companies have placed any restrictions on insuring a house with a solar energy system.

Table 6-32

INSURANCE COMPANIES' ATTITUDES TOWARD SOLAR

	Solar House Different From Conventional	Limits Placed on Insuring Solar Energy Homes
Yes	4	3
No	23	24

Only one respondent believes that authorization from the underwriting department of the insurance company would be needed before insurance on additional solar units could be sold. Several others were not sure if future policy writing would have to be cleared at higher levels. Reasons given were the unknowns surrounding solar systems and the fact that no underwriting history has been established.

With respect to future insurance rates for solar equipped homes, there is less consensus. Several respondents (18%) expect rates to increase as exposure and experience affect the rates. None of the insurers foresees a lower rate for solar residences.

Table 6-33

FUTURE INSURANCE RATES FOR SOLAR HOUSING

Q. How will future solar insurance rates compare with conventional rates?

Same	46%
Higher	18
Lower	-
Don't Know	36
	100%
	(N=28)

While most firms have not developed any special policies or guidelines relating to solar energy systems, this may be partially due to the fact that few expect their agency's policies toward solar home insurance to be modified within the next three years.

Table 6-34

UNDERWRITING POLICY

	Have special policies been developed	Will the current policy be modified
Yes	2	5
No	25	12
Don't Know	1	11

Summary

Results from these interviews indicate that insurance companies have done little to adapt their policies to solar equipped homes. This could be because those who set underwriting policy actually do not see any difference between insuring solar and conventional homes. It is possible, however, that solar policies are currently such a small portion of the total premiums outstanding that no thorough evaluation of potential impacts has been made. Later HUD grant cycle responses will be monitored to see if present trends continue.

Tax Assessors

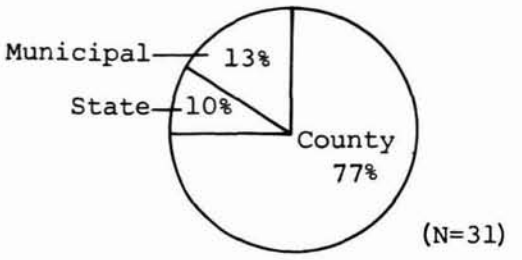
The practices and policies of the local tax assessor can affect the market acceptance of as well as the cost of owning a solar home. If the solar system is appraised separately from the home and is considered an "overimprovement" it will increase the tax burden carried by the homeowner. However, if it is treated as a conventional heating system the tax impact will be negligible. Only one-half of the solar grant homes assigned to the study have been assessed (16 of 32). But many of the assessors have other solar homes within their jurisdiction and have had some experience in their valuation.

Assessment Policies

The 32 participating assessors are most frequently at the county government level, but municipal governments or state agencies are occasionally involved. Table 6-35 shows this jurisdictional breakdown.

Table 6-35

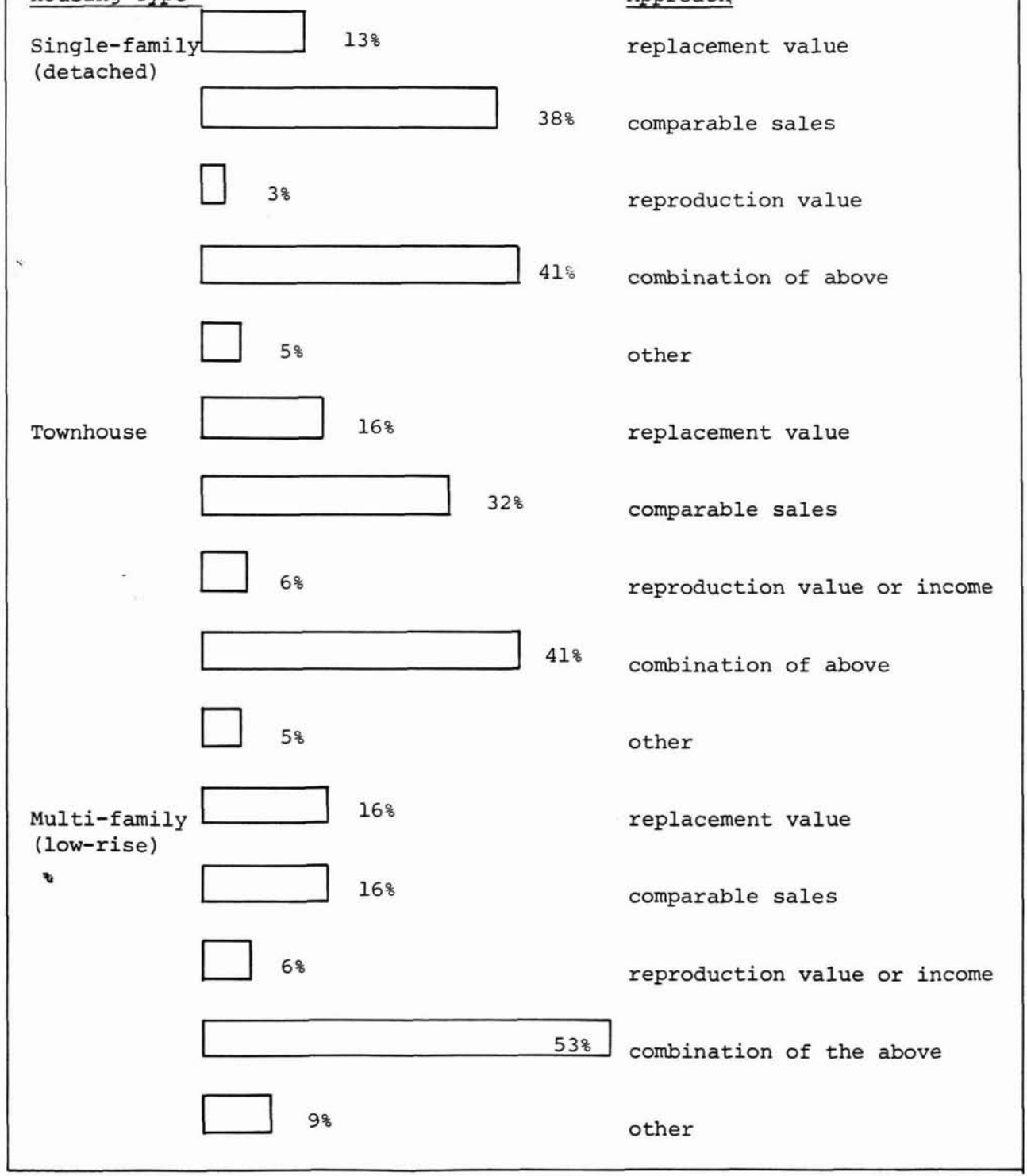
ASSESSOR'S LEVEL OF GOVERNMENT



Techniques for assessing different types of residential properties vary among respondents. Table 6-36 displays these methods.

Table 6-36

METHOD OF APPRAISAL



Solar Appraisals

In determining the value of solar equipped homes, in only one case did the assessor consider the initial front-end costs of the solar system as compared to the potential long-term energy savings. In appraising the solar system, all respondents appraised it as part of the house. About 60% of the non-grant solar homes were assessed in this manner and of the remainder, 11% considered the solar system separately.

Conventional single-family assessment techniques are used to assess the solar homes: replacement cost, reproduction cost, or market data/comparable sales. Two-thirds of the respondents report that the appraised value of the solar homes is roughly equivalent to comparative non-solar homes in the area. The remainder derived a higher appraised value (or could not remember the comparison). All used normal procedures to arrive at the value, and none of the jurisdictions required special training in order for the tax assessor to appraise solar units. Additionally, the majority believe it took no longer to assess solar units than conventional units.

Of the 16 who at the time of the interview had already determined the value of the HUD grant home, none reported that the fact that the unit was funded by a federal grant had any effect on the appraisal procedure. Neither the appraisal process nor the value established would differ between HUD grant and non-grant solar homes.

Each assessor is asked if appraisal procedures have been modified to accommodate or facilitate the use of solar energy systems in residential developments. About one-fifth have altered procedures, as indicated in Table 6-37.

Table 6-37

MODIFICATION IN PROCEDURES

Yes	19%
No	74%
Don't Know	7%
	(N=31)

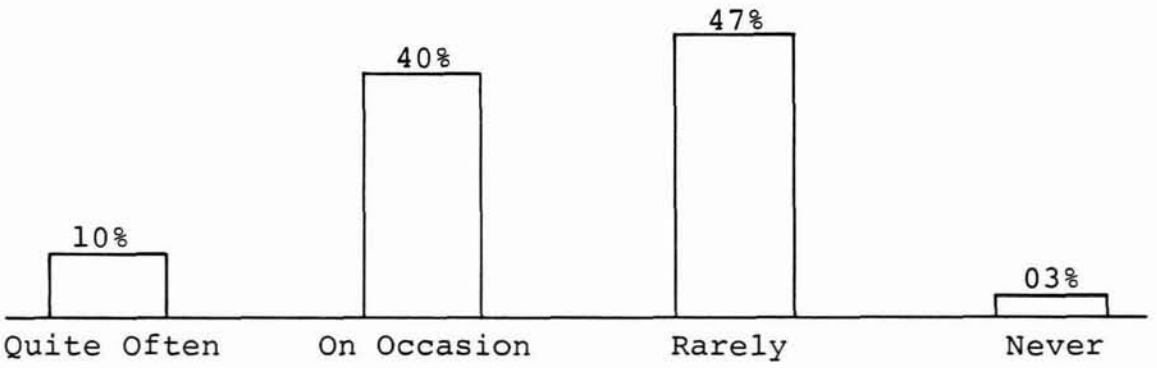
Those jurisdictions with modifications offer either a tax exemption or a lower assessment rate. Half the respondents believe that there are either existing or proposed property tax statutes or regulations which would stimulate the use of solar energy for residential purposes. Again, these statutes are most commonly tax exemptions. More than 80% of the assessors do not think there are, in their jurisdiction, tax assessment procedures that could serve as barriers to widespread utilization of solar energy systems.

Energy Conservation Features

Of the 30 respondents, only 3 often use energy efficiency as a factor in arriving at the value of a residential building. Several note that extra insulation increases value. The frequency at which assessors encounter energy efficient homes is shown in Table 6-38.

Table 6-38

EXPOSURE TO ENERGY EFFICIENT HOMES



(N=30)

When the assessor's office encounters energy saving features in homes they are handled in one of two ways: the energy saving features are excluded in the appraisal or they go into overall cost determination.

Each assessor is also asked to identify specific areas where assistance would be helpful to their appraisal functions. The table below shows these results.

Table 6-39

ASSISTANCE NEEDS

Type	Absolute Frequency
Training	24
Manuals	23
Guidelines	19
System Certification and Valuation	14
Technical Support/Additional Staff	3

(N=29)

Summary

Solar homes, particularly the HUD grant homes, have been assessed very similarly to conventionally heated homes. The system itself is normally treated as an integral part of the house, rather than as a separate entity. For this reason, the appraised value derived (in about two-thirds of the cases) is approximately equivalent to that of conventional homes. The tax assessor, as an institution, has apparently not been a deterrent to market acceptance. In fact, some jurisdictions have now, or are considering "tax breaks" for solar equipped units. This should serve to encourage rather than discourage solar development. Discussion of these incentives is beyond the scope of this report; however, they are the subject of other HUD investigations.

7 Consumer Satisfaction with Solar

A key component of the HUD program is the long term monitoring of purchaser satisfaction with their house and the development in which they live. The ultimate measure of market acceptance of solar housing will be the long term satisfaction expressed by individual purchasers of solar.

The findings in this area are quite limited at this point in the project because most solar purchasers have only recently moved into their units. It is anticipated that subsequent interviews with solar home purchasers (conducted at six month intervals after the initial interview) will provide accurate information on the general satisfaction expressed by solar purchasers with their home purchase, as well as specific information about their likes and dislikes about their solar unit. This type of information will be of great utility to builders interested in constructing solar housing outside the demonstration program.

As reported in Chapter 5, many solar purchasers and non-solar purchasers express the view that they would seriously consider a solar unit if they were to purchase another house. It was also found that among the small number of prospective purchasers available to the study at this time, most of this group would also give serious consideration to the purchase of a solar unit. A more precise indicator of long term interest in solar will develop as data on the actual experiences of solar purchasers are collected. The first interview with purchasers initiates this process with a series of questions which focus on the level of satisfaction with the development and the housing units. These questions are asked of both the solar purchasers and the non-solar purchasers. Responses to these questions are discussed in this chapter.

Satisfaction with the Development

As indicated in Table 7-1, most purchasers like the development that they moved into: 87% of the solar purchasers and 91% of the non-solar purchasers responded that they are more than just satisfied with the development. Responses to this particular question, although interesting at this time, should gain importance in subsequent interviews with the purchasers of the solar units. Levels of satisfaction may continue to remain high, or they could decline as new purchasers establish some length of residency that makes them evaluate their purchase a little more critically.

Table 7-1

SATISFACTION WITH DEVELOPMENT

	Solar Purchasers	Comparative Purchasers
Like it very much	53%	73%
Like it	34	18
Satisfied	9	5
No opinion	4	4
	100%	100%
	(N=49)	(N=45)

Rating of Home Features

Purchasers of the solar units are asked how well they like their home. This question is posed after they have lived in the solar dwelling for one or two months. Solar purchasers are enthusiastic about their purchase. Ninety-two percent of the respondents express either strong satisfaction with the solar unit (63%) or indicate that they are generally satisfied with their purchase (29%). Only eight percent of the sample are unsure or actively dislike the solar unit they bought. Among comparative purchasers, 63% indicate that they either liked the unit or felt that there was little difference between the solar unit and a conventional house, while 37% state that they do not care for the solar unit.

Table 7-2

LIKE OR DISLIKE THE SOLAR UNIT

	Solar Purchasers	Comparative Purchasers
Like unit or like it very much	92%	40%
Neutral	6	23
Dislike unit	2	37
	100%	100%
	(N=49)	(N=35)

Table 7-3 lists a variety of home features in a central column. The left side of the table displays the frequency with which solar purchasers mention them as either positive or negative. The responses of comparative purchasers are displayed on the right side of the table. It should be noted that only comparative purchasers who have knowledge of the solar units are included in this table. As a result, the number of responses is quite small and caution must be employed to not overinterpret these findings.

Table 7-3

RATINGS OF HOME FEATURES

Solar Purchasers	Features Liked Most	Comparative Purchasers
14%	House Style	20%
12	Home Size	10
26	Floor Plan	20
7	Room Size	--
16	Construction Quality	10
5	Solar Energy System	35
20	House Location	5
100%		100%
(N=43)		(N=20)
	Features Liked Least	
7%	Home Style	29%
5	Home Size	4
5	Floor Plan	25
5	Kitchen	4
9	Room Size	13
2	Number of Rooms	4
14	Construction Quality	4
12	Solar Energy System	17
9	House Location	--
32	None- Like Everything About the House	--
100%		100%
(N=43)		(N=24)

The data indicate that both groups find a number of features of the solar units to be attractive. Of particular interest is the finding that so few solar purchasers find the solar system the aspect they like most about their house. This reinforces the earlier conjecture that marketing of solar homes may be most successful if features other than solar energy are stressed in marketing approaches. It also lends some support to the notion that a solar system by itself will not sell a house.

Future Research

As was noted earlier, data on satisfaction with the solar house and the solar system are limited at this time because of the general lack of experience most purchasers have had with their solar house. As the length of residency among solar purchasers increases, more information will be available to the demonstration program on long term satisfaction with living in a solar assisted house. In

addition, specific information on energy use, solar system efficiency, maintenance problems and costs of solar upkeep, will also be available. This will allow for a more detailed examination of levels of satisfaction with living in a solar house.

8

General Market Acceptance

Previous chapters have focused on the participants in solar market acceptance. However, a fundamental issue involved in assessing the potential for widespread application of solar energy in the residential sector is whether solar-equipped units will be readily received and accepted in the marketplace. As indicated in the conceptual model, the aggregate perspective on market acceptance implies an assessment of what the marketing record has been, and exploration of the prospects for future acceleration of solar construction.

The purpose of this chapter is to describe how solar builders perceive the market for solar equipped residences and to compare these perceptions to those of comparative builders. A second objective is to begin a process of documenting the sales history of solar units and identifying factors that may be associated with solar units which sell quickly and those which do not.

It may be noted at the outset that the material presented in this chapter is of a very preliminary nature. Because of the small sample size -- of solar purchasers and solar homes available for sale -- the full comparisons that would be desired are not currently possible. Although the limited data and analyses presented will be useful in further attempts to estimate market acceptance, only tentative conclusions and a framework for future analysis can be presented at this time.

The first section of this chapter presents a summary of findings on how builders perceive the market for solar-equipped units. The second section outlines a preliminary approach to the full analysis and exploration of the question of market acceptance. This section does not present statistical data, but it specifies how empirical measures of aggregate market acceptance can be created and amplified in subsequent analysis efforts.

Perceptions of Market Acceptance

From the builders' perspective, the discretionary market is felt to have the most potential for solar applications and acceptance. The luxury market is ranked second, and the segment with the least potential is the price-sensitive market. These descriptions of market segments are commonly used marketing terms. Price sensitive refers to those purchasers who are more governed in their choice of housing by whether the price is affordable than by many other factors; these are generally first-time home buyers of moderately priced units. Discretionary buyers are more likely to be

second-time home buyers, with some choice in location, housing style, and amenities; prices are usually in the middle to upper ranges. Luxury buyers are relatively insensitive to prices, and very often prefer custom designed homes; obviously, wide choices exist in housing types and locations.

These builder assessments are presented in Table 8-1. The popularity of the discretionary or middle-level of the market is evident among the solar builders. Many builders state that they want to appeal to a broad market, with suitable housing at affordable prices. Coupled with the second most preferred luxury market, there is a middle to upper segment orientation in target market definition.

Table 8-1

PREFERRED MARKET SEGMENT

	Solar Builders	Comparative Builders
Price Sensitive	16%	19%
Discretionary	52	38
Luxury	22	26
Mix	10	17
	100%	100%
	(N=58)	(N=125)

Among the comparative builders, there is a different distribution. The discretionary market again is most popular, but less dominant. There is more emphasis on the price-sensitive and the luxury segments.

Another way of identifying the builders' preferred market is presented in Table 8-2, which illustrates which units builders believe sell best in their area. The distributions are essentially the same for solar and comparative builders, and parallel the price market targets displayed in Table 8-1.

Table 8-2

UNITS WHICH SELL BEST

	Solar Builders	Comparative Builders
Lower-Priced Basic Units	6%	10%
Moderate Priced-Some Options	58	50
Higher Priced-Full Options	23	27
Mix	13	13
	100%	100%
	(N=48)	(N=117)

Tables 8-3 and 8-4 crosstabulate the builders' preferred target market by region, cycle and builder characteristics. As seen in these data, there is little evidence to support a shift among market segments either by grant cycle or by region. However, the sample is too small to draw firm conclusions.

Similar, mixed findings emerge from the crosstabulations by builder experience, builder size, or (in the case of the participating builders) solar experience. It is anticipated that more informative patterns will emerge with subsequent analysis and a larger data base.

Table 8-3

BUILDING FOR CONSUMER IN WHAT PRICE MARKET
(PARTICIPATING BUILDER)

		Price Sensitive	Discretionary	Luxury	Mixed
Cycle					
Cycle 1	(N=20)	20%	50%	25%	5%
Cycle 2	(N=27)	7	59	19	15
Cycle 3	(N= 9)	22	34	33	11
Region					
Northeast	(N=11)	-	37	36	27
South	(N=15)	33	33	27	7
North Central	(N=15)	20	80	-	-
West	(N=17)	6	53	29	12
Builder Experience					
1 year or less	(N= 5)	-	80	20	-
1- 1.9 years	(N= 4)	75	-	-	25
2- 4.9 years	(N=12)	8	50	17	25
5- 9.9 years	(N= 8)	12	50	38	-
10-19.9 years	(N=17)	18	59	23	-
20+ years	(N=12)	8	50	25	17
Builder Size					
9 or less	(N=16)	25	31	44	-
10- 49	(N=17)	-	-	-	-
50- 99	(N= 5)	-	40	40	20
100-249	(N= 8)	12	88	-	-
250-749	(N= 7)	43	29	-	28
750+	(N= 4)	-	50	50	-
Previous Solar Experience					
Yes	(N=43)	14	53	19	14
No	(N=15)	20	47	33	-

Table 8-4

BUILDING FOR CONSUMER IN WHAT PRICE MARKET
(COMPARATIVE BUILDER)

		Price Sensitive	Discretionary	Luxury	Mixed
Cycle					
Cycle 1	(N=55)	27%	24%	29%	20%
Cycle 2	(N-56)	16	50	21	13
Cycle 3	(N-14)	-	50	29	21
Region					
Northeast	(N=22)	4	55	23	18
South	(N-34)	44	18	17	21
North Central	(N=34)	12	50	20	18
West	(N=35)	11	37	40	12
Builder Size					
9 or less	(N=17)	6	53	23	18
10- 49	(N=52)	19	35	36	10
50- 99	(N=11)	9	64	-	27
100-249	(N=25)	28	28	20	24
250-749	(N=11)	18	37	27	18
750+	(N= 6)	17	33	17	33
Builder Experience					
1- 1.9 years	(N= 8)	50	25	25	-
2- 4.9 years	(N=23)	26	22	26	26
5- 9.9 years	(N=24)	8	59	25	8
10-19.9 years	(N=37)	16	43	22	19
20+ years	(N=30)	14	33	33	20

Builders attempt to match consumer preferences and demand by offering units judged to have market appeal. The number of bedrooms is a key dimension of market appeal. In terms of the size of the units that are felt to be selling best, builders' responses again are concentrated in the middle range. As shown in Table 8-5, there is roughly the same distribution of the most popularly perceived units among the solar builders as among non-solar builders. Clear favor is shown for three bedroom units. In terms of variation by region of the country the data are limited and inconclusive. However, a shift over the three solar grant cycles towards larger units (four bedrooms) may be occurring.

Table 8-5

SIZE OF UNITS
(Square Feet)

		Number of Bedrooms					
		2	3	4	3-4	Mixed	Total
Solar Builder	(N=41)	7%	54%	22%	7%	10%	100%
Comparative Builder	(N=107)	2	51	27	11	9	100
Solar Builder							
Cycle 1	(N=15)	7	73	13	7	-	100
Cycle 2	(N=19)	11	42	26	11	10	100
Cycle 3	(N= 6)	-	33	34	-	33	100
Comparative Builder							
Cycle 1	(N=50)	2	48	32	8	10	100
Cycle 2	(N=47)	2	60	19	11	8	100
Cycle 3	(N=10)	-	20	40	30	10	100
Solar Builder							
Northeast	(N= 6)	-	67	17	16	-	100
South	(N=11)	-	73	18	9	-	100
North Central	(N=14)	-	43	36	-	21	100
West	(N=10)	30	40	10	10	10	100
Comparative Builder							
Northeast	(N=18)	-	39	44	17	-	100
South	(N=32)	-	53	31	3	13	100
North Central	(N-27)	4	44	26	15	11	100
West	(N=30)	4	60	13	13	10	100

Builders are also asked to characterize the market for solar units by classifying the buyers of the units according to their family and socio-economic status (age, life cycle stage, employment, and household income). These market assessments, by both the participating and comparative builders, are presented in Table 8-6. The profile of socio-economic characteristics is essentially the same among solar and comparative builders. There is little to distinguish among the types of households that the builders feel are the best candidates for the purchase of a solar home or any other home. The solar purchaser profile that was developed in Chapter 5 of a young family or couple, of professional or white collar employment, and of upper middle income holds for both market audiences. The single notable difference -- in the distributions in the employment area -- is slight. More professional and blue collar workers appear as a proportion of the solar market audience than of the comparative market audience.

Table 8-6

BUILDERS' PERCEPTION OF PURCHASERS

Purchasers' Characteristics	Solar Builders	Comparative Builders
Young	40%	40%
Middle Aged	30	31
Old	2	1
Mixed	28	28
	100%	100%
	(N=54)	(N=127)
Single/Young Couples	15%	10%
Couples/Families	52	67
Elderly/Older Couples	7	6
Mixed	26	17
	100%	100%
	(N=55)	(N=127)
Blue Collar	15%	7%
White Collar	18	31
Professional	40	23
Mixed	27	39
	100%	100%
	(N=55)	(N=124)
Low Income	2%	1%
Middle	30	32
Upper Middle	53	52
High	11	13
Mixed	4	2
	100%	100%
	(N=54)	(N=126)

Another means of gauging market acceptance is to determine the importance of various factors affecting the decision to purchase a solar home and the decision to visit the subdivision in which a solar home is located. These factors are reported by the builders. They reflect their views of what attracts purchasers. Table 8-7 compares the factors that builders suggest draw consumers to visit a subdivision and to purchase a home.

The rankings or factors contained in Table 8-7 were developed by taking the first, second, and third reasons in each case, and with equal weighting, summing the frequencies with which a specific reason was cited. Equal weighting was used because it was felt that little difference exists between the first and third reasons. The frequency of the factor was divided by the total number of builder respondents, and expressed as a percentage. Factors are ranked by those percentages in the table.

Table 8-7

FACTORS IN DECISION TO VISIT SUBDIVISION
VS. FACTORS IN DECISION TO BUY

Factors	Decision to Visit (N=58)				Decision to Buy (N=131)			
	Solar Builder		Comparative Builder		Solar Builder		Comparative Builder	
	Rank	Percent	Rank	Percent	Rank	Percent	Rank	Percent
General Location	1	50%	1	51%	1	57%	2	44%
House Quality	2	28	2	36	3	36	1	54
House Price	3	24	3	33	2	41	3	36
Solar Energy Systems	4	21	-	-	9	14	-	-
Builder Reputation	5	17	4	31	8	14	4	24
House Style	6	16	5	16	7	16	5	23
Energy Savings Package/Utilities	7	16	6	11	6	17	14	2
Amenity Package	8	14	7	10	5	19	7	13
House Size	9	7	8	9	11	5	11	3
Convenient to Access Roads	10	7	9	7	14	2	9	5
Convenient Schools	11	5	10	6	-	-	12	2
House Value	12	3	11	5	4	22	6	17
Available Options	13	3	12	4	-	-	13	2
Availability of Financing	14	3	13	4	10	7	8	5
Convenient Shopping	15	3	14	2	13	3	15	1
Quality of Schools	16	3	15	2	12	5	10	5

There is remarkable uniformity in the decision to visit the subdivision. With the exception of the attraction of the solar energy system (which does not occur with the comparative builders), the rankings of the reasons to visit the subdivision are essentially the same. The leading factor for both building groups is the location of the subdivision, with house quality, house price and builder reputation following in order. In the case of the solar builder, interest in solar energy systems is rated among the top five reasons. But it is noteworthy that among the audience most committed to solar systems -- the participating builders -- it is felt that potential buyers visit the subdivision for the traditional and customary reasons, with solar ranking only fourth among such motivations.

Table 8-7 shows the same uniformity of opinion over the first three reasons to buy a home -- general location, house quality, and house price. Among the solar builders, the rankings of factors in the decision to buy then departs from the rankings for the decision to visit the subdivision. The fourth factor is

house value. The order of the fifth through ninth reasons is reversed, the amenity package, energy savings package/utilities, house style, and builder reputation ranking ahead of solar energy systems as reasons to purchase. Again, it is noteworthy that the availability of solar energy ranks rather far down the list, indicating that builders assess solar energy along with a host of other factors, and among these factors, solar is not dominant.

The assessment of the decision to buy as reported by comparative builders is somewhat different. The top five reasons to buy are similar to those advanced for the decision to visit. Beyond that, such factors as house value, amenity package, and availability of financing become more important. The energy savings package/utilities factor is cited relatively infrequently by the builders not participating in the solar demonstration program.

In all of these findings, after the initial three or four factors, rather small differences emerge. What is dramatic is that three factors clearly dominate -- location, quality and price -- regardless of whether the ranking is made by a solar or a comparative builder, or whether a decision to visit or a decision to purchase is involved. Also, the attraction of solar energy systems is felt to be modest in either case.

Despite the fact that builders do not see solar as the predominant market draw, there is a strong commitment shown by solar builders and a strong endorsement of the prospects for the use of solar energy in the residential sector. Sixty-two percent of the HUD program participants state that they are committed to solar construction. Among the comparative builders, there is less commitment, but strong interest.

Table 8-8

BUILDER'S OWN OUTLOOK TOWARD SOLAR FOR RESIDENCES

	Solar Builders	Comparative Builders
Interested and Committed	62%	18%
Interested, Not Committed	36	72
Not Interested	2	8
Not Interested at All	-	2
	100%	100%
	(N=58)	(N=125)

BUILDER'S ASSESSMENT OF OUTLOOK OF OTHER BUILDERS IN COMMUNITY

	Solar Builders	Comparative Builders
Interest and Committed	10%	3%
Interested, Not Committed	60	82
Not Interested	30	12
Not Interested at All	-	3
	100%	100%
	(N=50)	(N=111)

Builders are also asked to assess the attitudes of other builders in their area toward solar energy. Interestingly, comparative builders report that they find their peers more interested in solar energy than participating builders feel their counterparts to be.

Measures of Market Acceptance

The previous section presented findings on how the builders view the market for solar equipped residences. There is a high degree of unanimity and optimism in these perceptions. In one sense, however, the primary criterion by which market acceptance can be measured is whether consumers choose to purchase solar residences. From the aggregate perspective, the track record, or sales history, of the solar demonstration units is of primary importance.

At this initial stage of the data analysis, direct empirical evidence on solar unit sales is incomplete. As discussed in Chapter 2, data on the sales and marketing history of the individual solar units are compiled from a variety of original sources. Unresolved inconsistencies among these sources preclude meaningful analysis in this report. However, the basic approach to developing reliable measures of aggregate market acceptance is itself of interest and is outlined here. This mode of analysis will be featured in subsequent data reports.

From the builders' perspective -- especially those in the construction industry who are observing the demonstration program in anticipation of evidence of the marketability of solar residences -- a builder's ability to achieve asking price in the sale of a solar home, and the length of time a dwelling remains on the market prior to sale are the basic dimensions of financial success. In an era when the construction of large numbers of speculative units is on the wane, the building community is highly sensitive to the financial exposure involved in building residences which will not sell immediately at their original asking price.

Price data on the solar units will, in future, be available for three discrete points in time for each demonstration unit. When builders apply for a HUD award a proposed asking price for the unit is established. When construction is completed, the grantee again reports an asking price for the unit. Finally, a sale price is provided at the time of purchase. These figures will allow each solar unit to be characterized in terms of a "difference index" between asking price and the sale price. Three basic difference patterns can be anticipated: (a) asking price is higher than sale price, indicating the builder had to reduce the unit price in order to sell; (b) asking price is equal to sale price; indicating the builder correctly gauged the market for the unit; and (c) asking price is lower than sale price, indicating the builder was able to take advantage of favorable market conditions.

A second, independent empirical measure of aggregate market acceptance can be constructed on the basis of the length of time solar units remain on the market prior to sale. A unit which does not move in a reasonable period of time is a financial burden to the builder. Costs are incurred during the period a home is in inventory that may or may not be recouped in the final sale price. It should be noted that "a reasonable period of time" is a relative concept. On a large and very expensive house, the builder may be able to hold the unit in inventory for a considerable number of weeks without significant financial loss, whereas a more modestly priced unit may reach break-even much more quickly.

Length of time on the market can be estimated from data collected in the course of the demonstration program. Under the terms of the awards, grant units may not be pre-sold. The date construction begins, the date construction is completed, and the time of sale can be firmly established for each solar grant unit. Thus, each unit can be characterized by length of time between construction and sale. Builders are also asked to define the point when marketing of their units begins. Marketing may begin before the unit is constructed (but after award of the HUD grant), during construction or following construction. The duration of the marketing period will provide a means of documenting the sales history of the solar units.

Both measures of market acceptance -- the price difference index and length of time on the market -- can be examined for variability between regions of the country, unit price, solar system type, and other factors which might be expected to influence market acceptance. In addition, these measures will permit the identification of units which have been especially "successful" and those which have been less successful. Detailed case studies of these extreme cases (referred to as deviant case analysis) can be undertaken to determine if characteristics of the residence itself, the market in which it is located or the marketing techniques of the builder best explain their performance.

In spite of the limitations on the data and the limited analysis that is possible at this time, summary statistics have been compiled to illustrate the type of data now available. It should be cautioned that these figures are preliminary and will be subject to change. The findings are reported in Table 8-9. They refer to the 94 units profiled in Chapter 2.

In the first portion of the table, the number of sold and unsold units is presented. The total number of units sold (as of January 1, 1978) is 51; the unsold inventory is 43. If the inventory is arrayed by cycle, the data show what is expected -- the number of unsold units is greater in later cycles. On the other hand, about 40% of the units from Cycle 1 are unsold. If the units are arrayed by market type, slight differences emerge.

The sold units are more evenly distributed with a larger proportion in the price-sensitive category. The differences are so slight, however, that interpretation is difficult.

A clear difference emerges if the housing market characteristics are examined. The units that have been sold tend to be located in "very strong" markets, while the unsold units have been more concentrated in "moderately strong" and to a lesser extent, "weak" housing markets. These characteristics of local markets are the product of field visits and consultation with real estate professionals.

In terms of the price of the units, there appears to be a clear difference among the sold and unsold units. The sold units are generally lower in price, as may be seen by comparing the average asking price of the homes. The average price of the sold units is about $63,000. As seen in Chapter 2, statistics must be adjusted because the sample contains 16 identical units (at an asking price of $47,000 each) which bias the data. If an adjustment is made to remove fifteen of the units, and then to recalculate the distributions of the units, the average asking price of the sold units is approximately $69,000. In either case, the average price is very different from the average asking price of the unsold units, which is almost $79,000. The distribution of the sold and unsold units by both asking price and by asking price per square foot confirms this difference. If the asking price is examined alone, there appear to be two clusters of units in both the sold and unsold groups -- one at about $50,000 per unit and another at $80,000 per unit.

This finding changes if the per square foot data are examined. If the asking prices are compared with the selling prices -- among those 51 surveyed units that have sold -- it appears on first examination that there is substantial difference in the price distribution, with asking prices considerably lower than selling prices. Comparing adjusted asking price with the average selling price reveals that the numbers are reasonably close, $69,225 versus $70,489. Therefore, it cannot be determined at this time if any price differences exist between the asking and selling prices among the sold units.

The final portion of the table presents the limited evidence on market acceptance in terms of the marketing period required to sell the solar units. Again, interpretation is difficult because a large number of cases are not included in this measure. But among the data that are available, there is a pattern of units selling reasonably well in the short-run, and a smaller number of units not selling for a considerable period of time.

Table 8-9

MEASURES OF MARKET ACCEPTANCE

Inventory of Surveyed Units
(As of January 1, 1978)

	Units Sold		Units Unsold		Total
	No.	Percent	No.	Percent	No.
Number of Units	51	100%	43	100%	94
Number of Units, By Cycle					
Cycle 1	17	33	10	23	27
Cycle 2	32	63	20	47	52
Cycle 3	2	4	13	30	15
Number of Units, By Market Type					
Price Sensitive	8	16	3	7	11
Discretionary	35	68	32	74	67
Luxury	8	16	8	19	16
Number of Units, By Housing Market Characteristics					
Very Strong	40	78	15	35	55
Moderately Strong	9	18	22	51	31
Weak	2	4	6	14	8

Price of Surveyed Units

	Units Sold		Units Unsold		Total
	No.	Percent	No.	Percent	No.
Asking Price					
Under $40,000	4	8	0	0	4
$40,000-$ 50,000*	19	36	2	5	21
$50,000-$ 60,000	9	18	8	19	17
$60,000-$ 70,000	2	4	4	9	6
$70,000-$ 80,000	7	14	14	32	21
$80,000-$ 90,000	2	4	8	19	10
$90,000-$100,000	4	8	2	5	6
Over $100,000	4	8	5	11	9
Mean *	$62,688		$78,979		
Adjusted Mean*	$69,225		-		

Table 8-9

MEASURES OF MARKET ACCEPTANCE
(continued)

Price of Surveyed Units
(continued)

	Units Sold		Units Unsold		Total
	No.	Percent	No.	Percent	No.
Asking Price, Per Square Foot					
Under $30.00	2	4%	1	2%	3
$30.00-$39.99*	33	65	14	33	47
$40.00-$49.99	9	17	17	40	26
$50.00-$59.99	5	10	11	25	16
$60.00 and Over	2	4	-	0	2

Asking Price Versus Selling Price

	Distribution of Units at:				
	Asking Price			Selling Price	
	No.	Percent	Adjusted Percent*	No.**	Percent
Under $40,000	4	8%	11%	3	9%
$40,000-$ 50,000	19	36	11	2	6
$50,000-$ 60,000	9	18	25	7	21
$60,000-$ 70,000	2	4	6	4	13
$70,000-$ 80,000	7	14	19	8	24
$80,000-$ 90,000	2	4	6	2	6
$90,000-$100,000	4	8	11	3	9
Over $100,000	4	8	11	4	12
Total	51	100%	100%	33	100%
Mean	$62,688			$70,489	
Adjusted Mean	$69,225			-	

Marketing Period in Weeks

Weeks on Market	Distribution of Units	
	Number***	Percent
0 - 4	14	50%
5 - 12	7	25
12 - 30	5	12
Over 30	2	8
Total	28	100%

See notes on following page.

Table 8-9

MEASURES OF MARKET ACCEPTANCE
(continued)

Notes

* It should be noted that there are 16 units (in the same subdivision, built by a single builder) at the same price ($47,000) in the sample. Because of this large number, there may be clear bias injected to any analysis. The categories where these units are located are indicated in all portions of this table. In order to adjust for that bias, 15 of the 16 units have been subtracted out and results re-calculated in many items in the table; those adjustments are also noted.

** There were 18 missing cases where data were not available for the selling price. This discrepancy arises due to the merging of different data files.

*** There were 23 missing cases where data were not available.

9 Images of Solar in the Market Place

The purpose of this final chapter is to gain a better understanding of the nature and scope of the emerging solar housing market, as it is perceived by key participants of the residential housing construction industry. The importance of exploring attitudes on future prospects of solar energy is two-fold. First, there is a need to begin to develop measures of future demand for solar assisted housing among the various and varied housing markets that exist across the country. Data gathered from builders and purchasers are already beginning to provide some indication of the degree of market acceptance of solar energy among the building community and among purchasers of solar and non-solar housing. Second, clues to the future acceptance of solar housing provide a way of anticipating significant barriers, constraints, or opportunities associated with the development of a viable solar marketing program.

This chapter describes and analyzes the attitudes and opinions of relevant actors on the current and future acceptance of solar. Some of these issues have been touched on in previous sections of this report. Builders are asked if they would build solar units outside the grant program. They are asked if they could recover the cost of solar in the asking price of the unit. Lenders are asked if they would finance solar units other than the grant units. They are also asked if it would be difficult to resell a solar unit. Public institutions are asked if there are specific regulations, ordinances or administrative procedures that might interfere with the development of residential solar units in their community. And, consumers are asked if they would purchase a solar unit when they considered the purchase of another home. The specific responses of each of these groups is explored in more detail below.

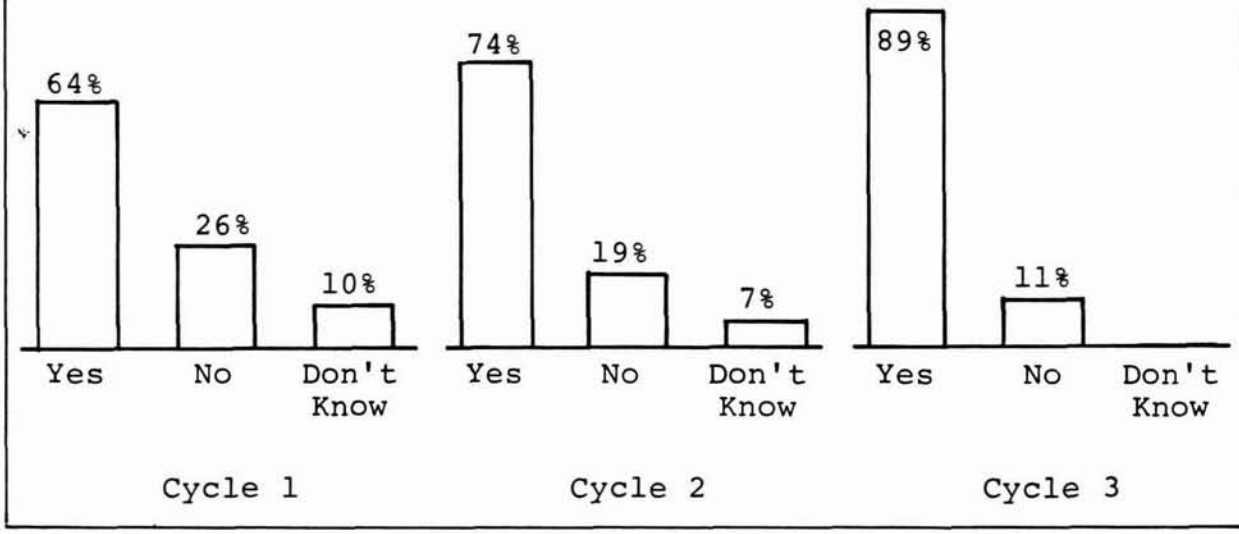
A second level of analysis employs simple crosstabulations of selected variables against two key questions in the participating and non-participating builder questionnaires. The first is whether builders would be willing to construct solar units without a government subsidy, and the second is whether builders believe that they can recover the cost of solar in the asking price. These two questions are examined in terms of grant cycle, region, scope of construction activity, builder size, and builder experience.

Builder Perception of Solar

There is a strong belief among participating builders that consumers are ready to accept solar energy. Among the participating builders, 72% indicate that there has been an interest in solar housing among serious home purchasers. Seventy-four percent of these builders report that visitor reaction to their solar units has either been favorable or very favorable. Builders cite cost savings, energy concerns, environmental concerns, and the impact of general advertising campaigns as the major reasons given by visitors for inspecting the solar units.

Table 9-1

PARTICIPATING BUILDERS' PERCEPTION OF CONSUMER INTEREST IN PURCHASING A SOLAR HOUSE BY HUD GRANT CYCLE



This perception of consumer interest in solar assisted housing is reflected in the commitment of many participating grant builders to continue constructing solar units beyond the demonstration program. Among the builders, 48% indicate that they are building other solar units in addition to the HUD solar grant houses. More importantly, 71% of the participating builders indicate that they will build solar units without demonstration program financial assistance. This latter figure is even more encouraging in view of the fact that for 74% of the participating builders the HUD program represents a first experience with solar energy. This suggests that the demonstration program itself has had a strong positive effect on individual builders, persuading them in some cases to continue the construction of solar housing as a result of their experience with the demonstration grant.

An additional important finding that is beginning to emerge from these data is that a majority of participating builders (57%) believe that they can recover the cost of a solar system in the asking price of the house. Builders who do not believe that the initial cost of solar can be recovered cite general economic

factors such as the lack of financial feasibility of solar and the long pay-back period. These builders state that the factors which would influence them to continue in the solar housing market are better information on market factors, system costs, and general public interest.

Non-participating builders, on the other hand, tend to approach solar with a greater degree of caution and are less likely to commit themselves to constructing solar housing. Most of these builders (70%) are aware of solar construction that is going on in their community, and 34% of these builders have kept up with the progress of this construction.

Specific responses to questions about construction of solar housing and the ability to recover equipment and installation costs in the sale price indicate continued resistance to constructing a solar unit. Among non-participating builders, 31% state that they would construct a solar unit without a government subsidy (this is in contrast to 74% of the participating builders), while only 21% believe that they could recover the cost of solar in the sales price of a solar unit. The more frequently cited reasons are that the costs are too great, and the overall risk associated with the construction of a solar unit is too high. About 40% of the non-participating builders do believe that solar housing improves the marketability of a development, while 42% feel that a solar unit would have neither a positive nor a negative impact on sales in a subdivision.

Tables 9-2 and 9-3 detail the attitudes held by builders about building other solar housing. Among participating builders, the more revealing trends occur when responses are crosstabulated by grant cycle and the region in which the homes are built. Interest in constructing additional solar units increases from Cycle 1 to Cycle 2 of the demonstration program, with a slight leveling off in Cycle 3. (The small number of respondents in the 3rd cycle, however, makes it difficult to draw any specific conclusions about long term trends.) In Cycle 1 55% of participating builders expressed an interest in constructing a solar unit outside the demonstration program. In Cycle 2 this figure increases to 85%.

Table 9-2

PARTICIPATING BUILDERS:
CONSTRUCT A SOLAR DWELLING APART
FROM THE DEMONSTRATION PROGRAM

	Cycle		
Construct Solar	Cycle 1	Cycle 2	Cycle 3
Yes	55%	85%	78%
No	30	11	22
Don't Know	15	4	-
	100%	100%	100%
	(N=20)	(N=27)	(N=9)

Another finding that emerges from these data is that the generally positive attitudes about future participation in solar housing projects are stable across regions of the country, scope of construction activity, builder size, and builder experience. There are, however, a number of exceptions to this trend. For example, while over 70% of builders in the Northeast, North Central, and West express an interest in continuing with solar, only 50% of the Southern builders share this commitment.

Table 9-3

PARTICIPATING BUILDERS:
CONSTRUCT A SOLAR DWELLING APART
FROM THE DEMONSTRATION PROGRAM

	Region			
Construct Solar	Northeast	South	North Central	West
Yes	73%	50%	87%	77%
No	18	43	7	12
Don't Know	9	7	6	11
	100%	100%	100%	100%
	(N=11)	(N=15)	(N=15)	(N=17)

When the data are examined by builder size, it appears that medium-sized and very large builders are most likely to either express a lack of interest or doubts about continuing with solar construction. Only 50% of the medium and very large builders report such an interest, while over 80% of the other builders say they are willing to build more solar residences.

Table 9-4

PARTICIPATING BUILDERS:
CONSTRUCT A SOLAR DWELLING APART
FROM THE DEMONSTRATION PROGRAM

	Builder Size - Number of Units				
Construct Solar	9 or Less	10-49	50-99	100-249	250 or More
Yes	81%	82%	50%	75%	50%
No	19	18	25	25	20
Don't Know	-	-	25	-	30
	100%	100%	100%	100%	100%
	(N=16)	(N=17)	(N=4)	(N=8)	(N=10)

Although no specific trend is established, it can be noted that while close to 80% of builders with 2 to 19 years of experience indicate they would construct other solar units, only 55% of the

builders with 20 or more years of experience and 67% of builders with less than 2 years of building experience indicate an interest in continuing with solar construction.

Table 9-5

PARTICIPATING BUILDERS:
CONSTRUCT A SOLAR DWELLING APART
FROM THE DEMONSTRATION PROGRAM

	Experience				
Construct Solar	1-1.9 Years	2-4.9 Years	5-9.9 Years	10-19.9 Years	20+ Years
Yes	67%	75%	70%	88%	55%
No	33	25	15	6	27
Don't Know	-	-	15	6	18
	100%	100%	100%	100%	100%
	(N=9)	(N=12)	(N=7)	(N=17)	(N=11)

All builders are asked if they would build solar homes without a government grant. Comparatives are less likely than participants to answer positively. In general, the data show very little variation over grant cycles. The greatest differences that emerge within the sample are with builder size, builder experience, and region of the country. The smallest builders voice the greatest interest in constructing unsubsidized solar housing, while the most inexperienced builders express the least interest in constructing non-grant solar units. By region, the data show that comparative builders in the Northeast (48%) and the West (42%) are most interested in constructing solar units, followed by the South with 37% and the North Central states with 28%. These findings are summarized in Table 9-6.

Another measure of the acceptance of solar energy is the degree to which builders believe that they can recover the price of solar in the selling price of the house. Tables 9-7 and 9-8 detail these findings. Again the tables show that there is a growing level of confidence in solar as the demonstration program moves through successive cycles of grants. While only 43% of Cycle 1 participating builders believe they can recover the cost of the grant in the asking price, 63% of Cycle 2 builders and 78% of Cycle 3 builders feel that they can recover such costs. Other findings are that smaller builders are more likely to feel that they can recover solar costs (70%), as opposed to larger builders (under 50% overall), and that regional and national builders believe that they can recover solar costs (69%) more often versus local builders (55%). And, when the data are examined in terms of level of builder experience, it appears that the least experienced builders (under 5 years) and long term builders are more

Table 9-6

COMPARATIVE BUILDERS' WILLINGNESS TO CONSTRUCT SOLAR UNITS WITHOUT A GOVERNMENT GRANT

Willingness to Construct	By Cycle	
	Cycle 1	Cycle 2
Yes	32%	39%
No	57	52
Not Sure	11	9
	100%	100%
	(N=44)	(N=52)

	By Region			
	Northeast	South	North Central	West
Yes	48%	37%	28%	42%
No	39	52	63	48
Don't Know	13	11	9	10
	100%	100%	100%	100%
	(N=23)	(N=27)	(N=32)	(N=31)

	By Builder Experience (Comparative Builder)				
	1-1.9 Years	2-4.9 Years	5-9.9 Years	10-19.9 Years	20+ Years
Yes	22%	29%	36%	58%	31%
No	78	52	59	33	58
Don't Know	-	19	5	9	11
	100%	100%	100%	100%	100%
	(N=9)	(N=21)	(N=22)	(N=33)	(N=26)

	By Builder Size					
	9 or Less	10-49	50-99	100-249	250-749	750+
Yes	68%	42%	20%	23%	22%	33%
No	21	50	70	68	55	67
Don't Know	11	8	10	9	23	-
	100%	100%	100%	100%	100%	100%
	(N=19)	(N=48)	(N=10)	(N=22)	(N=9)	(N=3)

Table 9-7

PARTICIPATING BUILDERS:
RECOVERY OF SOLAR COST IN SALE PRICE

Can Costs be Recovered	By Cycle		
	Cycle 1	Cycle 2	Cycle 3
Yes	43%	63%	78%
No	52	26	22
Not Sure	5	11	-
	100%	100%	100%
	(N=21)	(N=27)	(N=9)

	By Region			
	Northeast	South	North Central	West
Yes	64%	50%	53%	65%
No	36	43	27	29
Don't Know	-	7	20	6
	100%	100%	100%	100%
	(N=11)	(N=14)	(N=15)	(N=17)

	By Builder Size				
	9 or Less	10-49	50-99	100-249	250+
Yes	69%	71%	50%	50%	27%
No	19	21	50	50	55
Don't Know	12	8	-	-	18
	100%	100%	100%	100%	100%
	(N=16)	(N=17)	(N=4)	(N=8)	(N=11)

	By Builder Experience				
	1-1.9 Years	2-4.9 Years	5-9.9 Years	10-19.9 Years	20+ Years
Yes	60%	83%	43%	65%	33%
No	20	17	43	24	58
Don't Know	20	-	14	11	9
	100%	100%	100%	100%	100%
	(N=5)	(N=16)	(N=7)	(N=17)	(N=12)

Table 9-8

COMPARATIVE BUILDERS:
RECOVERY OF SOLAR COST IN SALE PRICE

Can Cost be Recovered	By Cycle	
	Cycle 1	Cycle 2
Yes	15%	31%
No	67	60
Don't Know	18	9
	100%	100%
	(N=46)	(N=52)

	By Region			
	Northeast	South	North Central	West
Yes	27%	23%	22%	29%
No	50	58	69	63
Don't Know	23	19	9	8
	100%	100%	100%	100%
	(N=22)	(N=26)	(N=32)	(N=35)

	By Builder Experience				
	1-1.9 Years	2-4.9 Years	5-9.9 Years	10-19.9 Years	20+ Years
Yes	25%	19%	25%	30%	26%
No	63	50	71	52	67
Don't Know	12	31	4	18	7
	100%	100%	100%	100%	100%
	(N=8)	(N=21)	(N=24)	(N=33)	(N=27)

	By Builder Size				
	9 or Less	10-49	50-99	100-249	250+
Yes	55%	26%	18%	13%	14%
No	28	65	55	74	79
Don't Know	17	9	27	13	7
	100%	100%	100%	100%	100%
	(N=18)	(N=46)	(N=11)	(N=23)	(N=14)

likely (approximately 70%) to believe that they could recover solar costs in the sale of a house. In general, the data show that a majority of participating builders believe they can recover the cost of solar in the asking price of a solar unit.

As with the question on the construction of a solar unit without a grant, most non-participating builders are not convinced that solar costs can be recovered in the asking price. However, when the data are examined by cycle, a doubling of the percentage of the builders who believe that solar costs can be recovered is observed between Cycle 1 and Cycle 2.

The smaller builders (those that build under 9 units of housing per year), are more optimistic about recovering solar costs (55%) than larger builders, whose positive responses range from 13 to 26%. The largest builders are least convinced that they can recover the cost of solar in the asking price of the house.

Builders are also asked whether they believe there is consumer interest in solar energy in their market area. Some interesting variations appear when this question is examined by such factors as grant cycle, region of the country and builder size. These data are presented in Table 9-9. In general, the findings show that the majority of participating builders believe there is strong consumer interest in solar energy. Eighty-seven percent of the North Central builders, 65% of the Western and 67% of the Southern states builders believe that there is consumer interest. A difference among builders is evident when consumer interest is crosstabulated with builder size. The table shows that while most builders feel there is consumer interest in solar, a smaller proportion (36%) of the largest builders (those that construct over 250 units of housing per year) share this view.

Lender Perception of Solar

In order to gain a better understanding of the attitudes of lenders toward the future prospects for solar energy in residential construction, representatives of lending institutions are asked to describe their attitudes towards providing loans to builders who were interested in constructing solar housing units. They are also asked whether in their view it would be difficult to resell a solar unit, and if a builder in their area can recover the cost of solar in the sales price of the unit. Again, it should be noted that these findings are based on very small sample sizes that will increase as the demonstration program moves through additional grant cycles.

The figures in Table 9-10 describe the responses of participating construction lenders, participating permanent lenders, and non-participating construction and/or permanent lenders. Overall, the data show that most participating lenders are favorably disposed to lending for the construction or permanent financing of solar assisted housing units. The major exception occurs in the

Table 9-9

BUILDERS' PERCEPTIONS OF CONSUMER INTEREST IN SOLAR HOMES

Is There Consumer Interest	By Region			
	Northeast	South	North Central	West
Yes	73%	67%	87%	65%
No	27	27	13	18
Don't Know	-	6	-	17
	100%	100%	100%	100%
	(N=11)	(N=15)	(N=15)	(N=17)

	By Scope of Construction Activity of Builder	
	Local	Regional
Yes	68%	86%
No	23	14
Don't Know	9	-
	100%	100%
	(N=44)	(N=14)

	By Builder Size				
	9 or Less	10-49	50-99	100-249	250+
Yes	75%	75%	80	88%	36%
No	19	17	20	12	45
Don't Know	6	8	-	-	19
	100%	100%	100%	100%	100%
	(N=16)	(N=17)	(N=5)	(N=8)	(N=11)

	By Builder Experience				
	1-1.9 Years	2-4.9 Years	5-9.9 Years	10-19.9 Years	20+ Years
Yes	56%	75%	100%	88%	42%
No	22	25	-	12	42
Don't Know	22	-	-	-	16
	100%	100%	100%	100%	100%
	(N=9)	(N=12)	(N=8)	(N=17)	(N=12)

Table 9-10

LENDER ATTITUDES TOWARD
FINANCING SOLAR UNITS

Participating Construction Lenders

Attitude Toward Financing Solar Units	By Region			
	Northeast	South	North Central	West
Very Favorable	20%	50%	13%	27%
Favorable	80	50	63	55
Not At All Favorable	-	-	-	-
No Opinion	-	-	24	18
	100%	100%	100%	100%
	(N=5)	(N=8)	(N=8)	(N=11)

	Size of Institution		
	99 Million or Less	100-999 Million	1 Billion or More
Very Favorable	-%	33%	50%
Favorable	100	57	25
Not At All Favorable	-	-	-
No Opinion	-	10	25
	100%	100%	100%
	(N=5)	(N=21)	(N=4)

Participating Permanent Lenders

	By Region			
	Northeast	South	North Central	West
Very Favorable	-	42%	-%	46%
Favorable	*	50	100	31
Not At All Favorable	-	-	-	-
No Opinion	-	8	-	23
	-	100%	100%	100%
	(N=1)	(N=12)	(N=7)	(N=13)

* 1 lender

	Size of Institution		
	99 Million or Less	100-999 Million	1 Billion or More
Very Favorable	57%	22%	50%
Favorable	43	67	33
Not At All Favorable	-	11	17
No Opinion	-	-	-
	100%	100%	100%
	(N=7)	(N=18)	(N=6)

Table 9-10

LENDER ATTITUDES TOWARD
FINANCING SOLAR UNITS
(continued)

Non-Participating Lenders

Attitude Toward Financing Solar Units	By Region			
	Northeast	South	North Central	West
Very Favorable	-	46%	13%	27%
Favorable	*	18	87	53
Not At All Favorable	-	9	-	6
No Opinion	-	27	-	14
	-	100%	100%	100%
	(N=2)	(N=11)	(N=8)	(N=15)

* 2 lenders

	Size of Financial Institution		
	99 Million or Less	100-999 Million	1 Billion or More
Very Favorable	33%	17%	50%
Favorable	56	52	50
Not At All Favorable	-	9	-
No Opinion	11	22	-
	100%	100%	100%
	(N=9)	(N=23)	(N=4)

North Central and Western areas where a number of construction lenders indicate that they are not favorably disposed to provide construction money for solar housing. When the data are displaced by size of financial institution, they show that a small percentage of the larger participating permanent financial institutions express some doubt about financing solar units -- 11% of the institutions with assets of $100-$999 million, and 17% of the institutions with assets of more than $1 billion.

Non-participating lending institutions also tend to favor financing solar housing units. A number of these institutions, however, express no opinion, indicating that they do not have a clear policy regarding solar housing, or that they have never had a request to finance such units and therefore do not know how they would review the application. Non-participating lenders from the South, and lending institutions with assets from $100 to $999 million most frequently express no opinion regarding the financing of solar assisted housing within their service area.

Lenders are least likely to agree on the question of solar resale. This question is difficult to answer because there is so little "real world" experience with the solar market. A substantial number of lenders report that they are unsure if it would be difficult to resell a solar unit at this time. By region, participating construction lenders in the South and non-participating lenders in the North Central area indicate that they are unsure if a solar unit would be difficult to resell (see Table 9-11). Construction lenders in the Northeast (40%) and non-participating lenders in the West (33%) state that they believe that it would be difficult to resell a solar unit at this time. Construction lenders in the West (82%) and permanent lenders in the South (75%) and West (77%) believe that there would be no problem with the resale of a solar house.

While participating builders tend to believe that they can recover the cost of solar in the sale price of a home, lending institutions are less sure that these costs can be recovered at the present time. Table 9-12 shows that construction lenders in the South and participating permanent lenders in the North Central states are least likely to believe that solar costs can be recovered. Lenders in the West are most likely to indicate that the cost of solar can be recovered in the sale price -- 69% of the construction lenders, 46% of the participating permanent lenders, and 40% of the non-participating lenders. In addition, 40% of the participating construction lenders in the Northeast state that they feel solar costs can be recovered. When this question is examined in terms of the size of the financial institution, no clear pattern emerges. For example, large participating permanent lenders believe that the cost of solar can be recovered, while large non-participating financial institutions do not.

Table 9-11

DIFFICULT TO RESELL A SOLAR HOME

Participating Construction Lenders

Would it be Difficult to Sell a Solar House	By Region			
	Northeast	South	North Central	West
Yes	40%	13%	25%	9%
No	40	50	63	82
Don't Know	20	37	12	9
	100%	100%	100%	100%
	(N=5)	(N=8)	(N=8)	(N=11)

	Size of Financial Institution		
	99 Million or Less	100-999 Million	1 Billion or More
Yes	30%	13%	25%
No	50	69	50
Don't Know	20	18	25
	100%	100%	100%
	(N=10)	(N=16)	(N=4)

Participating Permanent Lenders

	By Region			
	Northeast	South	North Central	West
Yes	-	25%	14%	15%
No	*	75	43	77
Don't Know	-	-	43	8
	-	100%	100%	100%
	(N=1)	(N=12)	(N=7)	(N=13)

*1 lender.

	By Size of Financial Institution		
	99 Million or Less	100-999 Million	1 Billion or More
Yes	29%	22%	-
No	71	67	67%
Don't Know	-	11	33
	100%	100%	100%
	(N=7)	(N=18)	(N=6)

Table 9-11

DIFFICULT TO RESELL A SOLAR HOME
(continued)

Non-Participating Lenders

Would it be Difficult to Sell a Solar House	By Region			
	Northeast	South	North Central	West
Yes	-	18%	25%	33%
No	*	55	38	47
Don't Know	-	27	37	20
	-	100%	100%	100%
	(N=2)	(N=11)	(N=8)	(N=15)

*2 lenders.

	By Size of Financial Institution		
	99 Million or Less	100-999 Million	1 Billion or More
Yes	11%	30%	25%
No	56	48	50
Don't Know	33	22	25
	100%	100%	100%
	(N=9)	(N=23)	(N=4)

Table 9-12

RECOVERY OF SOLAR COST IN SALE PRICE

Participating Construction Lenders

Can Builder Recover Solar Costs in Sale Price	By Region			
	Northeast	South	North Central	West
Yes	40%	13%	25%	46%
No	40	50	50	27
Don't Know	20	37	25	27
	100%	100%	100%	100%
	(N=5)	(N=8)	(N=8)	(N=11)

	By Size of Financial Institution		
	99 Million or Less	100-999 Million	1 Billion or More
Yes	40%	38%	50%
No	30	38	50
Don't Know	30	24	-
	100%	100%	100%
	(N=10)	(N=16)	(N=4)

Participating Permanent Lenders

	By Region			
	Northeast	South	North Central	West
Yes	*	33%	15%	69%
No	-	33	57	15
Don't Know	-	34	28	16
	-	100%	100%	100%
	(N=1)	(N=12)	(N=7)	(N=13)

*1 lender.

	By Size of Financial Institution		
	99 Million or Less	100-999 Million	1 Billion or More
Yes	29%	53%	67%
No	43	35	17
Don't Know	28	12	16
	100%	100%	100%
	(N=7)	(N=18)	(N=6)

Table 9-12

RECOVERY OF SOLAR COST IN SALE PRICE
(continued)

Non-Participating Lenders

Can Builder Recover Solar Costs in Sale Price	By Region			
	Northeast	South	North Central	West
Yes	-	36%	37%	40%
No	*	55	37	40
Don't Know	*	9	26	20
	-	100%	100%	100%
	(N=2)	(N=11)	(N=8)	(N=15)

* 1 lender

	By Size of Financial Institution		
	99 Million or Less	100-999 Million	1 Billion or More
Yes	56%	35%	-
No	22	49	75%
Don't Know	22	16	25
	100%	100%	100%
	(N=9)	(N=23)	(N=4)

Attitudes Among Utilities

A growing interest in solar energy and energy conservation among utility customers is reflected in the responses to questions addressed to key officials of gas and electric utilities. Among the utility officials, 91% indicate that they see a growing interest in energy conservation among their customers. Sixty-nine percent note a growing interest in solar assisted housing specifically, and 94% of the overall sample state that they have received some form of request for information about solar energy from their customers. The most frequent requests are for information on costs and equipment availability.

Table 9-13

UTILITY ATTITUDES TOWARDS SOLAR

Is there a growing interest in energy conservation in your service area?

Yes	91%
No	9
	100%
	(N=53)

Is there an interest in solar among your customers?

Yes	69%
No	31
	100%
	(N=53)

Do you receive customer requests for solar information?

Yes	94%
No	6
	100%
	(N=53)

When queried about specific future involvement in the solar energy field, however, many utilities assume a more cautious posture. Although many utility officials interviewed believe that solar energy will play a major role in their area (50% of the participating backup utilities and 85% of the non-participating utilities). Participating officials who expect solar to grow in importance cited rising conventional fuel costs and increased market success. Those that do not see the need for solar mention cost and labor factors. Non-participating officials cite the heat pump and government efforts at solar commercialization. A substantial number of utilities express concern over specific issues such as the impact of solar on electric peak loads (63% of the participating electric utilities and 88% of the

non-participating electric utilities). And, when asked if they see a greater need for solar in their part of the country only 34% of the participating utilities and 55% of the non-participating utilities see a need for solar.

Table 9-14

WILL SOLAR PLAY AN IMPORTANT ROLE IN THIS AREA

	Auxiliary Utilities	Alternative Utilities
Yes	50%	85%
No	38	10
Don't Know	12	5
	100%	100%
	(N=32)	(N=20)

Most utilities have not adopted special rates for solar units -- 31% of the participating utilities and 35% of the non-participating utilities indicated that they had adopted such rates. Many utilities do plan to adopt some type of rate that would impact on solar energy. Fifty-nine percent of the participating utilities and 35% of the non-participating utilities report that they have plans to adopt such rates. The most frequently mentioned rates are "time of day rate" or "demand rate."

Table 9-15

EXPANDED SOLAR INVOLVEMENT

Leasing of Solar

	Auxiliary Utilities	Alternative Utilities
Yes	19%	30%
No	42	35
Don't Know	39	35
	100%	100%
	(N=31)	(N=20)

Servicing of Solar

	Auxiliary Utilities	Alternative Utilities
Yes	28%	30%
No	41	40
Don't Know	31	30
	100%	100%
	(N=31)	(N=20)

Other indications of the current uncertainties of the role utilities expect to play in the area of solar energy are reflected in the questions related to leasing and servicing of solar equipment. When asked if they intend to lease or service solar equipment, slightly less than 30% of both utility groups indicate that they would get involved in servicing solar equipment, and approximately 25% of both groups state that they might develop some type of leasing program for solar equipment in the future. Approximately 30% of the total sample, however, report that they do not know at this time if they would get involved either in the leasing or servicing of solar equipment. A number of utilities who responded negatively to this question indicate that local regulations and opposition from consumer groups make it difficult for them to extend operation into new areas.

Local and Public Officials

An analysis of the attitudes of local public officials, gathered from both formal and informal field interviews, suggests that most local governments have yet to address themselves directly to the issue of residential solar energy and the impact local policies and regulations may have on its accelerated development.

Only a small percentage of local planning and zoning officials in Western States (16%) report that local zoning ordinances have been modified to accommodate solar energy. When asked if they anticipate further changes in local zoning regulations, however, a substantial number of officials in all areas of the country state that they anticipate some modification of local regulation to deal with solar energy in residential construction. This group includes 40% of the planning officials in the Northeast, 43% of planning officials in the North Central region, and 31% of planning officials in the South. General knowledge about solar energy among these officials was also quite low with only 7% of the sample stating that they have any depth of knowledge about solar energy.

Similarly, many building code officials interviewed in the early phases of the demonstration program report that their locality has not yet addressed itself to the question of solar energy and its implications for residential construction. Table 9-16 shows that only 42% of the Southern code officials and 23% of the Western code officials are aware of local code provisions for solar installation. In addition, virtually all code officials believe that, as far as they know, no steps have been taken to modify existing code regulations to specifically facilitate the use of solar energy in residential assisted housing. And, more importantly, a substantial number of code officials believe that existing code regulations could impede the widespread acceptance of solar energy in their community.

Table 9-16

ANTICIPATE CHANGES IN REGULATIONS THAT COULD FACILITATE THE USE OF SOLAR ENERGY

Anticipate Further Changes	Region			
	Northeast	South	North Central	West
Yes	40%	31%	43%	25%
No	60	69	29	50
Don't Know	-	-	28	25
	100%	100%	100%	100%
	(N=5)	(N=13)	(N=14)	(N=12)

Table 9-17

DOES CODE CONTAIN PROVISION FOR SOLAR INSTALLATION?
(Building Code Officials)

Solar Cost Provision	Region			
	Northeast	South	North Central	West
Yes	-	42%	-	23%
No	100%	50	92%	77
Don't Know	-	8	8	-
	100%	100%	100%	100%
	(N=4)	(N=12)	(N=14)	(N=13)

ARE THERE CODE REGULATIONS THAT COULD IMPEDE WIDESPREAD ACCEPTANCE OF SOLAR ENERGY?
(Building Code Officials)

Code Impediments	Region			
	Northeast	South	North Central	West
Yes	75%	42%	92%	54%
No	25	58	8	46
	100%	100%	100%	100%
	(N=4)	(N=12)	(N=11)	(N=11)

HAVE CODE REGULATIONS BEEN MODIFIED TO FACILITATE SOLAR ENERGY IN RESIDENTIAL DEVELOPMENTS?
(Building Code Officials)

Code Modifications	Region			
	Northeast	South	North Central	West
Yes	-	-	-	-
No	100%	100%	79%	100%
Don't Know	-	-	21	-
	100%	100%	100%	100%
	(N=4)	(N=11)	(N=14)	(N=13)

Table 9-18

SERIOUS INTENTION TO PURCHASE SOLAR IN THE FUTURE

	Solar Purchasers	Comparative Purchasers
Yes	80%	64%
No	2	20
Don't Know	18	16
	100%	100%
	(N=49)	(N=45)

Consumer Acceptance

It is difficult to draw specific conclusions about long term consumer acceptance at this time. A review of institutional responses to the demonstration program suggest that while most of these institutions are cautious about their involvement in the solar energy field, and that there is some evidence that barriers to solar acceptance still exist, the general feeling is one of optimism.

Most participating builders remain very enthusiastic about residential solar energy and emphasize that they intend to continue to construct solar units beyond the demonstration program. Many comparative builders, although still conservative about solar, believe that solar energy will play a major role in the future of housing.

Lending institutions maintain a wait and see attitude about their specific involvement in solar financing, but anticipate a growing interest in the field as the technology improves and becomes more widespread.

Utility companies continue to remain uncertain about their specific role in the development and application of solar energy technology. Utilities, particularly electric companies, however, do anticipate some problems with solar energy, although they expressed the view that the field is too new to draw any firm conclusions.

Local public officials on the other hand, are rather vague about the impact of solar energy on local building codes, tax assessment practices and zoning and planning regulations.

Summary

Finally, perhaps the most encouraging statistic that emerges from this first detailed evaluation of the market acceptance of solar energy is the optimism expressed by the purchasers of solar assisted housing units financed by the demonstration program. When purchasers of solar grant houses and comparative purchasers of non-solar grant units are asked, "knowing what you know now -- would you buy a solar equipped unit," 80% of the solar purchasers and 64% of the comparative purchasers state that they would seriously consider solar when they contemplate the purchase of another house.