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FINAL TECHNICAL REPORT

Grant Title:	An Investigation of the Acceptance of Solar Heating and Cooling in the Housing Industry in New Mexico
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CHAPTER I

INTRODUCTION

Background of the Study

Energy conditions affect all aspects of American life--our economic, social, and cultural lives, as well as our political lives. No aspect of our society is immune from the influence of energy. The existence and growth of society is dependent upon the acquisition of energy from the environment.

The major source of energy utilized by American society is in the form of fossil fuels--oil, coal, and natural gas. Fossil fuels have allowed America to develop its industrial and technological capabilities.

The once plentiful fossil fuels upon which mankind has relied so heavily have been diminished. Thus, the world's shortage of these fuels has precipitated the energy crisis. The need and demand for energy significantly exceeds the amount of available energy. The recent creation of the Federal Energy Administration which is charged with planning in the energy area is one of society's latest attempts to deal with the energy shortage.

Today, it is evident that energy from fossil fuels will be available for only a limited period of time. Alternative sources of energy must be found to supplement the deficit in the supply of fossil fuels. Even an effective conservation program coupled with increased domestic production and foreign imports of fossil fuels cannot reverse the energy shortage in the United States. As an alternative energy source, solar energy is now gaining eminence.

Only a few years ago, the public regarded the development of solar energy on a significant scale as remote. Very few people ranked solar energy with nuclear power as a future alternative to oil. However, the situation has changed drastically during the last decade.

Solar-energy technology is available today for heating and cooling applications. Its rapid adoption by the housing industry could serve as the necessary impetus for the widespread use of solar-energy technology and help to reduce the strain of the energy crunch.

Statement of the Problem

Vigorous efforts to develop alternative energy technologies are necessary in view of the rapidly expanding energy needs of the United States. Solar energy is one untapped source for heating and cooling buildings. The rate of its diffusion into the housing industry is a major problem in the use of solar energy. This study is concerned with the factors influencing the adoption of solar heating and cooling technology in the New Mexican housing industry. In addition, the study probes the factors which may impede the acceptance and diffusion of solar heating and cooling technology.

Objectives of the Study

The general objective of this project is to gather a data base of information relating to the acceptability of solar-energy technology in the New Mexican housing industry. More specifically, the study seeks (1) to describe the factors which influence the adoption of solar-energy systems in the New Mexican housing industry; (2) to determine the degree of acceptability of various solar factors

among New Mexican consumers, architects, contractors, financiers, energy suppliers, and governmental officials; and (3) to acquaint New Mexican consumers, architects, contractors, financiers, energy suppliers, and governmental officials with the current attitudes toward the acceptability of solar-energy factors in the New Mexican housing industry.

Definitions and Assumptions

Solar-energy systems involve the use of solar energy for heating and/or cooling buildings. Solar-energy systems may be broken into two basic types: active and passive. An active solar-energy system is one which depends upon mechanical equipment for the gathering, storing, and transporting of energy. A typical active solar system involves a flat-plate collector to gather the heat, a rock or liquid tank storage area, and a ductwork or pipe system for distributing the heat. A passive solar-energy system is one in which the building's structure is designed to absorb the sun's rays by using dense materials such as adobe, brick, tile, and rock. When temperatures drop, the storage material radiates the heat and warms the structure without mechanical contrivances.

An acceptance factor indicates conditions which are perceived to be favorable to the use of solar-energy systems. A neutral factor indicates conditions which are perceived to be neither favorable nor unfavorable to the use of solar-energy systems. A rejection factor indicates conditions which are perceived to be unfavorable to the use of solar-energy systems by at least one of the key groups. In the context of this report, the term acceptability may have a positive, negative, or neutral connotation.

The term diffusion refers to the degree of acceptance and incorporation of solar-energy systems into the housing industry.

The building industry refers to the construction of all types of structures. The housing industry, a facet of the building industry, is involved with constructing only residences. Typical types of residences are single-family and multifamily dwellings.

Limitations of the Study

This study is limited to an examination of the acceptability of solar heating and cooling systems in the New Mexican housing industry. Hence, the results of the study will be applicable only to the housing industry of New Mexico. The findings should not be used to make generalizations about groups other than those investigated. Other limitations of this study include limitations of the sampling procedures, limitations of the interview procedures, and limitations of the questionnaire procedures.

Consumers for this study were selected from telephone directory listings. Telephone listings may have a slight middle or upper class bias which might influence the findings. In addition, telephone listings are not available for those with unlisted numbers and for those who have recently received telephone service.

Representatives of each of the groups under investigation were interviewed. Because the interview approach was nontraditional and the respondents were asked to place items on a matrix, some respondents might have given uncharacteristic responses. In addition, the interview situation required that the interviewer record the comments of the respondent. Unwarranted impressions and interpretations may have resulted during this process.

The questionnaire procedures may have resulted in the collection of unsatisfactory data. Although the questions were carefully analyzed and critiqued after the interviews, they still may not have been adequately constructed. All respondents may not have interpreted each item in the same framework.

New and unusual techniques used in the research design may have inherent weaknesses which have not yet been revealed.

CHAPTER II

REVIEW OF RELATED LITERATURE

Old Southwest Practice: Capturing Heat from the Sun

Solar energy usage has a long history in New Mexico. Centuries ago, early and yet surprisingly sophisticated cultures in certain respects made practical use of the sun's rays. The settlers of the Anasazi culture at Pueblo Bonito in Chaco Canyon developed apartment-like structures which were warmed largely by heat radiating from the massive sun-warmed walls of stone and adobe. Since Muench and Pike (9:139) have suggested that only "a few coals were needed to keep off the chill," it seems reasonable to assume that the primitive, passive solar heating systems of Chaco Canyon worked rather well.

In fact, the basic principle of using a dense mass to absorb and to radiate the sun's energy has remained in use for more than a thousand years. Contemporary New Mexicans, following the tradition of the Anasazi culture, have continued to use stone and adobe to combat the scorching heat of the New Mexican day and the freezing cold of the New Mexican night.

New Mexico Pioneers the Way

By 1950, creative New Mexicans such as Peter Van Dresser began to incorporate solar heating into New Mexican houses. Other New Mexicans have followed Van Dresser's lead until about 50 operating solar structures--many in private homes--exist in New Mexico (see Appendix A: Inventory of State of New Mexico Solar Heated and/or Cooled Houses).

New Mexico offers a wealth of solar facilities and expertise, probably unrivaled by that of any other state. In 1976, New Mexico will boast two of the largest solar heated and cooled buildings: Los Alamos Scientific Laboratory's National Security and Resources Study Center in Los Alamos and New Mexico State University's Agriculture Building in Las Cruces. Casa del Sol, a three-bedroom experimental house featuring solar heating and cooling as well as a solar hot-water system, will provide Las Cruces researchers with a closely monitored source of data about the operation of a solar house.

Although research continues into the refinement of solar heating and/or cooling technology, are New Mexicans ready to accept solar heating and/or cooling systems in their homes? What factors will influence the acceptance or rejection of solar heating and/or cooling systems in New Mexican housing industry?

The Multidimensional Construct of Solar System Acceptability

The answers to the above questions are not to be found easily. They are intertwined in a multidimensional construct that involves many diverse factors which cannot be clearly delineated. Among the interacting factors are technology-related considerations, economic-related considerations, and culture-related considerations.

Restraints of Building and Safety Codes

The housing industry is constrained by numerous building and safety codes. McCue and Ewald (7:178) reported that more than 4,000 code-making agencies were uncovered by the Douglas Commission during its survey of local governmental units serving population centers in excess of 5,000 persons. While the TRW Systems Group

(15:7-55) indicated that there are four basic model building codes which have been accepted in various sections of the country, numerous modifications to the basic codes often have been made when they were adopted. To compound the problem:

> Codes related to building construction include building, mechanical, plumbing, electrical, life, safety, health, housing, land use (zoning, subdivision), occupational, health and safety, insurance, and minimum property standards. Many of the above have been combined into what is termed a "building code." Often, administratively, the jurisdiction of separate codes covering these various subjects is overlapping.

Furthermore, statewide codes and separate federal standards may be imposed upon the construction industry.

While much of Western Europe is under a federation of national systems of testing and evaluating laboratories which reduce the effects of local code variations, the United States struggles with problems created by thousands of code-setting bodies. According to Hirshberg and Schoen (3:7)," . . . often technological innovations in the U.S. must be separately approved by each code-setting body." The writers indicated that specification- rather than performance-oriented codes tend to constrain the use of new techniques by requiring the use of existing materials and methods rather than new ones. Hirshberg and Schoen (3:8) concluded:

> The successful builder is therefore usually reluctant to try a new technological innovation that requires code modification. Given this serious constraint, to be successful the technical design of a solar energy device should reflect existing codes to the greatest extent possible. . . . On the other hand, if code approvals on modifications are required, the associated costs may be quite large compared to the benefits which accrue due to the use of new technological innovation.

The Final Task Report of the Federal Energy Administration Project Independence Blueprint (5:II-60) has suggested that building code barriers will be encountered because the codes were drafted

before solar technology rose to prominence and that the code modifications necessary to incorporate solar technology "should not be difficult to accomplish."

Hirshberg (4:10) has endorsed the policy option of developing uniform building-code legislation and of establishing a group which could examine the code and other related issues which deter the use of solar energy.

Modification of Construction Techniques

Concern has been expressed by certain groups involved in the housing industry about possible changes in construction techniques in order to accommodate solar heating and cooling technologies. The Westinghouse researchers (16) and Hirshberg (4) have indicated that groups such as architects, builders, laborers, financiers, and energy suppliers are concerned about the size, weight, and space requirements of solar systems which could necessitate more structural support and possibly the adoption of new building procedures. But, as University of Colorado researchers (14:129) aptly state, "Building design innovations in single-family residences traditionally have been characterized by slow adoption rates."

Aesthetic Considerations versus Solar Systems

As most would suspect, architects appear to be very much aware of the need to merge solar technology and aesthetic considerations. The architect housing committee polled by Westinghouse researchers (16), assuming that costs of solar systems were comparable to those of conventional systems, cited the aesthetics of solar systems as the most important acceptance or rejection factor. The architecture design committee questioned by the same researchers identified

equipment space and aesthetics as the most important acceptance or rejection factors. In general, the architects surveyed said that the most aesthetically acceptable collector sites for both single and multifamily dwellings were off-site central locations and those integrated as part of the roof. Collectors located on garages and carports received high ratings in the case of single-family dwellings. As an additional bonus, these locations were thought by the architects to rate high in terms of technical feasibility. The researchers (16:4-36) arrived at these conclusions:

> Other modifications to the building design, such as unconventional floor plans, unconventional roof designs, smaller windows, and increased structural support of roof, were also found to be acceptable by architects and were not found to be highly objectionable by builders.

Builders, too, were found by Westinghouse researchers (16) to rank aesthetics as an important acceptance or rejection factor and to favor solar systems integrated as part of the roof. Several of the respondents objected to the amount and to the physical appearance of the collector surface required for residential buildings. The pollsters (16:4-30) surmised that "emphasis be placed on designing smaller, less conspicuous collectors." In addition, builders were found to be concerned with integrating the house into its physical surroundings in subdivisions and yet maintaining large southern exposures.

The same researchers found both financiers and energy suppliers to be concerned about the bulk and size of solar-system equipment. Surprisingly, the pollsters (16:4-31) found appearance, after cost, to be the greatest concern among energy suppliers; "many felt that collectors were too big, too heavy, and too ugly." The location of large heat-storage tanks was also viewed by some as a problem area.

Consumer acceptance of the solar-energy systems was found by the TRW Research Group (15:8-8) to depend to a large degree on how successfully solar components could be integrated into the overall architectural solution.

> Though this presents significant design challenges, there appear to be no insurmountable constraints, and (this) represents rather unique opportunities for creative solutions.

Long-term Dependability of Solar Systems

Perhaps the NSF/NASA Solar Energy Panel (10:14) best summarized the debate concerning the long-term dependability of solar systems: " . . . long-term experience with solar heating systems is limited."

Westinghouse researchers (16) found that energy suppliers listed the lack of dependability of solar systems during extended periods of bad weather as the most frequent reason for rejecting them. When interviewing builders, the researchers found the reliability of solar systems as a recurring acceptance/rejection factor. While the investigators speculated that builders would prefer a separate collector-unit location, this expection was not confirmed. The builders projected that the proven longevity of solar systems would influence mortgage lenders' decisions, and financiers indicated that the most influential favorable factors after the fuel cost savings are high reliability and warranty/manufacturer's reputation. University of Colorado researchers (14) also found a particular concern among financiers about the reliability of solar systems. The TRW Systems Group (15:7-57) summarized the probable acceptance by the financial community this way:

> Our discussions with lenders have not identified any long-range major obstacles to overcome, pending the requirement for an established solar industry which is producing reliable products.

The Interagency Task Force on Solar Energy (5) has suggested that additional research and development be directed in such areas as improved component efficiencies and lifetimes and durability of materials.

Warranty Specifications for Solar Systems

The rise in consumerism may create near-term obstacles for the acceptance of solar-energy systems in the building industry according to the TRW Systems Group (15:7-49).

> Legislation may be forthcoming which will require builders to warrant their homes for up to three years after occupancy. Until a strong SES industry develops and demonstrates that its products are reliable, most builders will not be willing to risk the potential financial exposure resulting from the failure of an unproven product and industry. Futhermore, most builders are highly resistant to innovative technology.

Westinghouse researchers (16:4-13) found that 44 percent of the builders polled indicated five years as the minimum acceptable warranty period; another 30 percent cited ten years as the minimum acceptable warranty period. The pollsters (16:4-9) found that 57 percent of the energy suppliers indicated that a five-year warranty period would be the minimum acceptable one, while another 35 percent favored a ten-year period. Interestingly enough, the researchers (16:4-29) found that a five-year warranty period was acceptable to most potential customers. Westinghouse researchers (16:4-26) summarized the feelings of financiers about the importance of solar system warranties this way: " . . . the respondents considered high reliability and warranty/manufacturer's reputations as the most important after fuel cost savings."

Repair and Maintenance Specifications for Solar Systems

Repair is generally differentiated from maintenance in that

the former is done on an emergency basis when the system is inoperable while the latter is done on a periodic basis to keep the system operable. While writers such as the Interagency Task Force on Solar Energy (5), University of Colorado researchers (14), and the TRW Systems Group (15) have addressed themselves to repair and maintenance concerns, the Westinghouse study (16) provides the most detailed information about repair and maintenance.

From energy suppliers, the Westinghouse researchers (16:4-8--4-9) found that the possibility of frequent maintenance and repair was the third most frequently cited rejection factor. The respondents indicated the following maximum acceptable rates of repair: 12 percent, once every six months; 36 percent, once a year; 31 percent, once every two years; 23 percent, less than every two years. They also indicated the following maximum acceptable rates of maintenance: 4 percent, monthly; 36 percent, every six months; 50 percent, yearly; 10 percent, every 18 months.

> Survey results indicate that a solar heating and cooling system can require more frequent maintenance than conventional systems and still be acceptable, although maintenance which is more frequent than once yearly would be considered unacceptable by more than half of the respondents.

Builders, according to Westinghouse researchers (16:4-12--4-13), indicated that maintenance and service were important factors influencing the acceptance or rejection of solar systems. Builders indicated the following maximum acceptable rates of repair: 16 percent, monthly; 32 percent, every six months; 32 percent, yearly; 21 percent, every 18 months. They also indicated the following maximum acceptable rates of maintenance: 3 percent, monthly; 9 percent, every six months; 63 percent, yearly; 25 percent, every 18 months. A number of builders expressed concern over the price

of maintaining a system which employs so many diverse technologies.

The architect housing committee surveyed by Westinghouse researchers (16:4-18--4-20) indicated that ease of maintenance as well as the availability of maintenance, servicing, and parts were their second and third most important factors influencing the acceptance or rejection of solar systems. The architect housing committee indicated the following maximum acceptable rates of maintenance: 5 percent, weekly; 50 percent, monthly; 40 percent, every six months; 5 percent, yearly. The researchers (16:4-22) found these opposing ideas about the maximum acceptable rates of maintenance from the architect design committee: 21 percent, weekly; 16 percent, monthly; 53 percent, every six months; 6 percent, yearly; 6 percent, every 18 months.

A distinct majority of financiers--82 percent--were found by Westinghouse researchers (16:4-25) to regard the possibility of high maintenance costs as a distinctly unfavorable influence on financing decisions.

Westinghouse researchers (16:4-28) found that the following were the maximum acceptable rates of repair according to potential customers: 1 percent, every three months; 6 percent, every six months; 25 percent, yearly; 42 percent, every two years; 24 percent, less than every two years.

> An acceptable minimum length of time between installation and first breakdown of a system was given as one year by 6 percent of the respondents, two years by 12 percent, five years by 44 percent, ten years by 21 percent, and more than ten years by 16 percent.

Potential customers indicated the following maximum acceptable rates of maintenance: 3 percent, weekly; 8 percent, monthly; 25 percent, every six months; 47 percent, yearly; 19 percent, every 18

months. To a typical consumer, an acceptable solar heating and cooling system would be one which required no more than bi-annual repair and annual maintenance.

Availability of Trained Solar Technicians

Although writers such as Hirshberg (4) and the TRW Systems Group (15) mention the need for adequately trained solar technicians to install and service solar equipment, the Westinghouse researchers (16) have examined this topic in more detail. Representatives of labor indicated acceptance of relatively long training programs--those up to one year in length were deemed to be acceptable. On the other hand, energy suppliers indicated less acceptance by rating the increased need for more skilled labor as slightly unacceptable. For repair and maintenance work, training periods greater than six months were viewed as distinctly unacceptable, while training periods of one month or less were viewed as acceptable. Builders held similar views of the training periods for those involved in the installation of solar heating and/or cooling systems. The availability of maintenance, service, and parts--and, hence, trained workers as well--was listed as the third most important acceptance or rejection factor by the architect housing committee. Financiers were found to view the scarcity of qualified installation and maintenance personnel as an unfavorable influence which could affect the financing decision of solar houses.

Temperature Variations in Solar Dwellings

The TRW Systems Group (15:8-8) reported:

> Since energy requirements for different types of buildings will vary with different ambient climatic conditions and the manner in which the shelter is used, solar energy designs will require individual analysis.

They (15:8-13) found that minor problems involving solar utilization may include possible inefficiency in night heating or heating during inclement weather and in requirements for slightly lower ambient room temperatures. While Niles (11) documented that a California house in a mild climatic zone with a specially designed collector which also served as an energy dissipator kept conditions inside the house within acceptable ranges throughout an evaluation period of one year, others have not reported such success. Santa Fe environmental architect David Wright (17) reported that the temperature variations in his adobe house with its passive solar system were beyond the toleration limits of most people during the cold winter months unless a backup system was used.

The Interagency Task Force on Solar Energy (5:II-5) has recommended the stabilization of interior room termperatures through careful building design.

> The interior temperature of buildings can be stabilized to a large degree without active heat transfer systems by controlling the absorption and emission of radiation to or from the exterior building surfaces as a function of time and conditions. The stability of interior temperatures can also be enhanced by appropriate design of the thermal capacity of various components in the building structure and by control of conduction and convection losses from the building.

Backup Systems Required for Solar Installations

Perhaps the TRW Systems Group (15:8-9) best summarized the need for conventional backup systems for solar installations.

> It is important to realize that total reliance on solar energy is practical for only a very limited number of applications. In general, the role of solar energy, particularly in the retrofit market, will be to reduce the requirements for conventional fossil fuels and to contribute toward a more economical use of limited natural resources.

Westinghouse researchers (16:4-11) found the following statement of a Midwest power company representative to be a typical concern of energy suppliers:

> For large systems, the utilities could not be expected to stand by if the full load of the solar unit should fail without compensation for this service. Such units should have an on-site standby of some type.

Since the solar systems envisioned for the immediate future involve some sort of conventional backup system, energy suppliers of conventional sources will still have to maintain adequate supplies to meet the sporadic needs of those with solar systems. The researchers (16:4-32) also found that the general opinion among energy suppliers was that they would have to adopt some kind of minimum or demand rate for their customers if solar installations became widespread.

The Critical Factor of Energy Consumption

Lundahl and Scott (6:1) succintly summarized the energy crunch: "The need and demand for energy signficantly exceeds the amount of energy available."

Much has been written about the magnitude of the energy problem, and the statistics cited vary with the interpretations of the authors. Hirshberg (4:ii) discussed the mismatch between the demand for energy resources and the growth rate of domestic supplies by quoting these statistics: "In the decade preceeding the oil embargo of 1973, domestic demand for energy resources grew at about 4.3% annually while domestic supplies grew at 2.6%." Later in his paper, he (4:13) estimated that about 25 percent of the energy budget of the United States goes into the heating and cooling of buildings.

Hirshberg and Schoen (3:1-2) cited the following statistics:

> Small-scale residential solar energy devices can provide a potentially significant method for reducing a portion of the mismatch between supply and demand. Residential energy uses currently account for about 22 percent of the total U. S. energy consumption; about 83 percent of this is used for space heating, water heating, and space cooling. While the technology to provide for these three uses with solar sources is either feasible or nearly so, because there are 75,000,000 dwelling units, the energy savings from residential applications will be realized if, and only if, they are accepted and diffused by the housing industry on a wide scale and at a rapid rate.

The NSF/NASA Solar Energy Panel (10:18) provided a glowing endorsement of the use of solar applications for residential heating and cooling:

> There is no doubt that among all the possible uses for solar energy, residential heating and cooling has the highest probability of success. There are the least uncertainties both in the technology and the economics of these domestic applications. There is, moreover, a very high benefit/cost ratio in that the total funds needed for the development of a viable enterprise will be only a small fraction of the annual value of fuel savings, or of equipment sales, or of some other measure of benefits to the economy.

A table constructed by members of the panel (10:10) indicated that by the year 2020, solar thermal applications in buildings can have a major impact on the building industry and a minor impact on the total energy consumption.

San Martin (12:4), a well-known New Mexican solar researcher, presented an even brighter picture of the role solar energy may play by the year 2020.

> One projection by a panel of experts indicates that by the year 2020, with a concentrated research effort, solar energy could provide up to 35% of the nation's heating and cooling demands; up to 20% of the total electric power generated in the United States; and a significant percentage of the fuel required in this nation. It is highly probable that solar energy will never satisfy the total energy demands of this nation or world. But it is one of our alternatives which can provide a significant percentage of our energy needs.

San Martin's view is eclipsed by that of Schoen, Hirshberg, and Winegart (13:3), who have written:

> In many parts of the country, solar technologies, if made commercially available, could supply over seventy percent of the electrical and thermal requirements for residential buildings as well as for many types of commercial, institutional, and industrial structures.

Writers such as Duffie and Beckman (2) and Hirshberg (4) have lauded solar thermal applications for heating and cooling buildings. The latter (4:ii) has written:

> . . . solar energy is a renewable energy source. The technology is either available now or requires relatively short-term development, and solar energy possessess few, if any, environmental hazards.

The NSF/NASA Solar Energy Panel (10:20) mentioned other advantages of making the shift from scarce fossil fuels to plentiful solar sources.

> Some of the intangible benefits of this development will be the alleviation of problems related to inadequate gas supplies in some areas of the country, the reduction of excessive and expensive electricity peak loads and associated power system failures during very hot weather, and the extension of oil and natural gas supplies further into the future.

A more cautious view toward solar energy has been presented by the Interagency Task Force on Solar Energy (5:II-7-II-8):

> The principal strategic thrust of the present program is to increase the number of available solar energy applications in order to reduce the consumption of large quantities of fossil-fuel resources and to conduct a thorough assessment of their economic feasibility and potential marketability.

Duffie and Beckman (2:149) perhaps best summarized the argument that increased usage of solar energy can alleviate part of the energy crunch associated with the heating and cooling of buildings: "Solar energy for buildings can, in the next decade, make a

significant contribution to the national energy economy and to the pocketbooks of many individual users."

Cost Considerations for Solar Systems

In America's housing industry, cost considerations are very important. "New products require a high degree of cost-effectiveness when substituted for existing products and systems," surmised the Interagency Task Force on Solar Energy (5:II-60-II-61). In addition to all of the engineering issues, feasibility must be convincingly demonstrated. Hirshberg and Schoen (3:3-4) have written:

> . . . Such demonstrations must be of sufficient scale and operated under "normal" industry conditions so that they are perceived by industry members as demonstrations under "real" conditions. . . . To demonstrate economic feasibility, analyses must be performed that are both relevant to the normal economic concerns of the industry and include considerations of all cost factors. . . . The economic questions are complex and the relevant economic tradeoffs are perceived differently by industry members.

The many conflicting statements about the economic acceptability of solar-energy systems substantiate Hirshberg and Schoen's statement that "The economic questions are complex and the relevant economic tradeoffs are perceived differently by industry members." Duffie and Beckman (2:143) have written:

> The basic problem with solar heating and cooling has been that the energy could not, except in special cases, be delivered at cost competitive with cost of energy from other sources. This situation is rapidly changing, and interest in solar energy is increasing almost daily as fuel costs rise. In areas where new natural gas connections are no longer available, where oil is not distributed, and where electrical resistance heating is the only alternative among conventional sources, solar heating is economically attractive.

Other writers have indicated that solar applications are economically feasible on a limited basis. The Interagency Task Force on Solar Energy (5:II-7) has written:

> A limited number of solar-heating applications are now economically feasible and competing successfully on the open market. Solar heaters for domestic hot water have been sold in varying quantities for some years and are now receiving commercial attention. In addition, swimming pool heaters and solar operated potable water distillation units for household use are being sold.

San Martin (12:3) has listed several of the same devices as being economically feasible and adds: "In some parts of our country it is projected that solar home heating is currently competitive with electric home heating."

The NSF/NASA Solar Energy Panel (10:18) has suggested that cost differentials between conventional and solar systems may be disappearing.

> The difference in the cost of heating supplied by solar collectors relative to conventional sources is disappearing and no longer appears to be a major problem. Marketing may, however, require innovative concepts for general acceptance by builders and home owners.

Several writers have indicated that solar systems are generally competitive with conventional systems. Hirshberg (4:1) has written:

> Recent analysis sponsored by the National Science Foundation . . . and others, indicate that solar heating and cooling systems for residential buildings are nearly economically competitive with fossil fuel and electric systems.

The NSF/NASA Solar Energy Panel (10:16) has reiterated this point:

> Subsequent economic studies have shown that in a wide variety of U.S. climates, solar heating is less expensive than electric heating, and in a few locations, it is nearly competitive with gas or oil heating.

Schoen, Hirshberg, and Weingart (13:2) have taken a slightly more cautious viewpoint:

> Although such systems will almost invariably raise the first cost of a heating/cooling system, the use of solar energy to provide space heating, water heating and cooling is competitive on a life-cycle cost basis with all electric systems; at 1973 electricity price levels of $.05 per kilowatt hour (kwh) no such competitive advantage will be

> possible with natural gas until gas prices rise dramatically (which is expected to occur before 1985).

Writers such as the Interagency Task Force on Solar Energy (5), the TRW Systems Group (15), University of Pennsylvania researchers (1), and Hirshberg (4:4) believe that "builders attempt to keep the first cost of their project low even if this means using a lower life-cycle cost building component." The TRW Systems Group (15:7-50) adds more details:

> . . . the availability of some form of SES may be valuable to builders as a promotional gimmick which will attract potential customers. However, if the cost of a solar system exceeds that of a conventional system past performance indicates that the more expensive alternate will be offered only as an option unless there are strong incentives provided to consider operating costs . . . The speculative builder who constructs buildings for sale rather than personal ownership will have little stimulation to utilize solar components unless he can substantiate a higher loan and sales value for his building which will more than offset his initial cost, and if he can demonstrate a high return on the investment for the solar equipment.

Stronger opportunities for the application of solar-energy systems may be found with the builder who constructs for personal ownership or for condominium ownership. The TRW Systems Group (15:7-51) has indicated that they

> . . . will be less first-cost sensitive, will be more concerned with system quality and performance, and will give more consideration to life-cycle costing requirements. Thus, this market will provide stronger opportunities for application of SES.

Initial costs for solar systems are higher than those for conventional systems. Writers such as the University of Pennsylvania researchers (1), Hirshberg and Schoen (3), and Duffie and Beckman (2:149) have confirmed this.

> Solar energy processes are generally capital-intensive; large investments are made in equipment to save operating costs (that is, fuel purchases). The essential economic

> problem is balancing annual cost of the extra investment (interest and principle, based on reasonable estimate of life-time) against annual fuel savings.

University of Colorado researchers (14:128) observed from their study of lending institution attitudes that lenders " . . . need to become cognizant of life-cycle costing concepts and be willing to recognize trade-offs between first costs and operating costs." They (14:147) did find, however, that 37 percent of the respondents consider life-cycle costs when evaluating mortgage loan requests.

After probing the feelings of various segments related to the housing industry, Westinghouse researchers (16:4-36) summarized their reactions to cost this way:

> A major constraint placed upon the system is, of course, cost. For retrofitting existing residences, the maximum acceptable, assuming a 50 percent reduction in fuel costs, is $2,500. If fuel cost can be cut by 80 percent, the maximum cost acceptable rises to $5,000. In incorporating solar heating systems in newly constructed residences, costs of up to $5,000 were rated as acceptable, regardless of fuel savings. In no cases, however, are costs of greater than $5,000 acceptable. In general, higher costs were acceptable in new buildings as opposed to retrofitting of existing buildings, and higher costs were also acceptable with increased fuel savings.

Financiers responding to a University of Colorado study (14) indicated that a payback period of approximately eight years could economically justify a solar energy installation in a single-family residence. But the Phase 0 studies of Westinghouse (16) and TRW (15) suggest that such a payback period is not currently feasible.

The government-sponsored research and technology program is designed to reduce the first cost of solar-energy systems and to make them more competitive with conventional systems according to the Interagency Task Force on Solar Energy (5:II-40).

> However, first cost higher than for conventional systems will continue to constrain widespread adoption, since the building community is extremely sensitive to first cost. Tax relief, loan and interest incentives, and special depreciation policies will probably be required to overcome this constraint.

Availability of Solar Units

The demand for prefabricated solar units affects the availability of the units. The Interagency Task Force on Solar Energy (5:II-16--II-17) explained the demand factor this way:

> . . . when a solar system results in "small" savings, there will be few solar devices installed. This will be particularly so in the early years until performance characteristics and reliability of solar devices have been proven. On the other hand, the more money there is to be saved, the more willing people are likely to be to "take a chance" on solar systems.

According to the NSF/NASA Solar Energy Panel (10:18), the principal factor limiting the adoption of solar systems is the lack of well-engineered and economically manufactured and distributed solar heat collectors; the writers continued: "The key problem is the development, optimization, production design, and manufacture of such units." Hirshberg (4) mentioned the assistance of mass production in reducing collector costs. Duffie and Beckman (2) added that flat-plate collectors are being manufactured on a small but growing scale in the United States. They (2:149) anticipate an increasing supply of solar collectors in the future: "Very large aggregate enterprise in manufacture, sale, and installation of solar energy equipment can result, which can involve a spectrum of large and small businesses.

Tax Subsidies as Incentives for Solar Installations

Hirshberg (4:i) has built a strong case for having subsidies or incentives to make solar systems more acceptable:

> It is difficult to believe that solar energy can easily compete with an existing multi-billion dollar, highly subsidized fossil fuel industry without subsidies or other incentives of its own. The penetration rate and therefore early impact of solar energy systems for buildings is highly dependent upon policy actions which create incentives for the early use of solar systems.

Other writers such as the Interagency Task Force on Solar Energy (5), Duffie and Beckman (2), and the TRW Systems Group (15) have discussed the matter of tax subsidies.

Duffie and Beckman (2:143) have written:

> Government encouragement to invest in solar energy systems in the form of tax write-offs or other inducements (as are provided for investments by other energy producers) could very rapidly change the competitive position of solar energy in relation to conventional energy sources.

The TRW Systems Group (15:7-58) believes that with a combination of quantitative and qualitative incentives, government can reduce the effects of the higher capital cost constraint, increase the operating cost advantage, and minimize the negative influence of institutional opposition to solar-energy systems.

Tax subsidies have many variants. Typical types of tax subsidies mentioned by the above authors and to which frequent mention is made in the literature are those reducing income, property, or sales taxes up to a certain amount or percentage and those allowing accelerated depreciation schedules for businesses. By passing such tax subsidies, governmental bodies are saying that the use of solar-energy systems is in the public interest and that those who choose to use solar systems may be economically rewarded.

During the special legislative session of 1975, the New Mexico legislature passed a bill giving New Mexicans a tax subsidy for the installation of solar systems (see Appendix B: Senate Bill 1, 32nd Legislature, Special Session, 1975 Laws, Chapter 12, Introduced by Senator Fred A. Gross, Jr.).

Guaranteed Mortgages as Incentives for Solar Installations

Low-interest loans, in addition to tax subsidies, have been mentioned by writers such as the Interagency Task Force on Solar Energy (5), the TRW Systems Group (15), and Hirshberg (4). The latter (4:8) has written:

> The lack of availability of loan money for solar energy systems either for home improvement loans or for new buildings is a potentially large barrier which low interest loans will help to eliminate.

He (4:20) later concludes that low-interest loans may provide nearly as effective an incentive as direct tax credits and may be more politically acceptable.

The TRW Systems Group (15:7-62) has indicated that the qualitative incentives of increasing the availability of mortgage money and of guaranteeing and insuring loans for solar energy systems will stimulate market demands. They (15:7-60) point out both the advantages and disadvantages of low-interest loans:

> . . . another politically feasible incentive method would be low-interest Federal financing for the SES portion of the total mortgage. Since the Government can borrow at lower interest rates than banks can (generally 2-3% below the prime rate), this method may be favored by the Government. Results reflected in capture potential would be relatively the same as with the tax credit . . . National benefits would also be the same as the tax credit case, but total cost to the Government would be less, since Government essentially would be offering loans at their borrowing rate. However, from an organizational standpoint, the low-interest loan program would be more difficult to administer and to terminate since the Government would be committed to 25-year mortgages. Administrative problems also may occur when the original homeowner sells his home.

Hookup Charges for Backup Systems

Discussions of hookup charges for solar energy backup systems are not frequently found in the literature. The Westinghouse

researchers (16:4-32) have found that utility companies and fuel suppliers believe that they would have to go to some kind of minimum or demand rate fee schedule if solar heating and cooling units come into widespread use.

The TRW Systems Group (15:8-16) has reported that many utilities have special provisions for customers having generating equipment of their own and wanting backup service.

> These provisions compensate the utility for its capital investment on a fixed-cost basis . . . plus fuel operating costs for any energy used. This fairly allocates the cost of providing backup power to those customers who desire this capability. This same policy applied to solar systems would likely make solar equipment operation very expensive. However, due to the energy storage units required by solar systems, a new policy could be established. If a storage system is capable of supplying the required energy for roughly one day, then perhaps the auxiliary power could be provided only at off-peak times. This could even out the daily variation of demand, much like electric space heating does, and could provide an incentive for a utility to supply auxiliary power at a much reduced rate compared with present standby power.
>
> The rate structure for auxiliary power to solar systems cannot be predicted accurately until operating experience is obtained. During this initial period, there will be few solar systems, and the effect on the utility system will be small. The eventual rate will depend on the operating characteristics of a particular utility. If solar heating systems reduce the revenues of summer-peaking utilities without reducing the power that must be available to meet the peak air conditioning demands, the solar systems have the effect of increasing the real costs of electricity even though they are saving energy. However, if the utility is winter-peaking, then the solar equipment may actually reduce the cost of electricity.

Solar Energy: Panacea for the Energy Crisis

Experts agree that the energy crunch is upon us and that the crisis is real. "Renewed interest in solar energy has been sparked by energy and environmental problems," according to Schoen, Hirshberg, and Weingart (13:2). The use of solar energy is viewed by many as a way to reduce the impact of the energy shortage. This

view is typified by the statement of the TRW Systems Group (15:8-9): "In general, the role of solar energy . . . will be to reduce the requirements for conventional fossil fuels and to contribute toward a more economical use of limited natural resources." Through emphasis of the energy shortage, society will switch to alternative sources of energy such as solar power. In doing so, the TRW Systems Group (15:8-13) believes that solar energy usage may enable the public to maintain or expand its standard of living at a time when the energy available from traditional sources is declining.

> . . . there are insufficient amounts of fossil fuels to adequately provide the necessary energy to support a continuously increasing standard of living. Furthermore, it is politically inexpedient to import increasing quantities of oil, and it is environmentally debatable to place increasing dependence on nuclear energy. Thus, solar energy can provide a means of alleviating the problems associated with decreased energy resource availability and increased energy demands arising from desires at least to maintain, and preferably to advance, one's living standards.

Westinghouse researchers (16) found that while most energy suppliers indicated that five years was not enough time for the necessary technological advances to make solar-energy systems implementable on a widespread basis, approximately half of the builders and housing architects questioned saw solar energy as an alternative energy source within five years. Energy suppliers were found to be more pessimistic concerning a ten-year implementation period than were builders and architects. The researchers (16:4-17--4-18) summarized the housing architects' viewpoints about the time period necessary to develop solar systems as a reasonable energy source and found these reasons for using solar energy:

> When asked to support their answers, positive reason for using solar energy included ideas that solar energy is a reasonable, free source of energy, that solar energy is needed to meet the fossil fuel shortage and to end U.S. dependence on foreign energy sources, and that the needed technology is presently available.

Outmoded: Traditional Systems for Heating and Cooling

Although implicit in the literature, it is extremely difficult to find statements directly documenting that because of the energy crisis and because of the rise of solar systems, traditional heating and cooling systems are outmoded. University of Pennsylvania researchers (1:7-10) found that after the energy shortage became widespread, there were significant shifts in the attitudes toward solar heating: "The 'show-me' posture has been replaced by an active interest and a desire to use novel, unconventional energy sources." Whether or not this is a lasting trend remains to be seen.

Unknown Social Acceptability of Solar Systems

Very little is known about the social acceptability of solar heating and cooling systems from the viewpoint of the sociologist. But Miller and Duffie (8:2) have provided some insight into the social sphere.

> In the social sphere (not independent of the economic), the reactions of individual people to an innovation will depend on several factors: a) The solar energy innovation, if it little affects or is perceived to favorably affect personal habits of individuals, can be more readily accepted than if substantial changes are implied. The more radical the innovation, the more important will be the educational program necessary to interest people in considering its adoption. b) Innovations can affect interpersonal relationships and dependencies. The perception of these implications can be critical to adoption.
>
> In the political sphere (again not independent of the others), the possibilities of successful solar energy

> innovation in energy supply will be linked to the wishes of those with authority and influence, and what they want to accomplish. This may be local economic improvement, broad-scale changes in dependence on other energy sources, or conceivably, no change at all.
>
> These various kinds of factors can be viewed as "forces." Socio-economic change brought about by a technological innovation can be thought of as resulting from the balance of these forces on the social entity (e.g., family, community) involved. The analogy is with a force balance on a physical object which results in acceleration.

The NSF/NASA Solar Energy Panel (10:11) has offered this statement about sociological research in the solar energy area.

> Research on the social conditions which foster solar energy technology protects against the truncating of a technological policy by the social responses it engenders. Analysis of social problems accompanying solar energy technology development requires a shift from the physical world to the world of social activity. There is a need for more social scientific work to define the social (including economic, political, and cultural) problems presented by solar energy utilization. The establishment of national priorities for the use of solar among other energy forms should recognize the social impacts of the utilization of each energy form.

Environmental Acceptability of Solar Systems

Numerous writers have dealt with the environmental concerns involving traditional and solar energy systems. Authors such as the Westinghouse researchers (16), Miller and Duffie (8), Duffie and Beckman (2), Hirshberg (4), Lundahl and Scott (6), and others have indicated that solar heating and cooling systems are much more environmentally acceptable than traditional fossil-fuel systems. One of the more detailed discussions of the environmental effects on solar-energy systems is that of the NSF/NASA Solar Energy Panel (10:9,11).

> Solar energy utilization on a large scale could have a minimal impact on the environment if properly planned. It is important, therefore, that a policy of research and review for environmental effects be made an integral

> part of the R&D process. . . . The most environmentally benign solar energy systems might be those of small scale that would fit into space already occupied by buildings. When considering large land based systems, great care must be taken to find suitable areas that would not be of unique ecological or recreational importance or cause serious alterations in local climate or weather.

More Information Needed About Solar Systems

Many writers on solar energy topics have suggested that additional research and information is needed. The NSF/NASA Solar Energy Panel (10:16) has stated this need succintly: "Further R&D is needed to reduce costs and develop better systems." More specifically, they (10:18) have written:

> Support is needed for engineering development and design studies, testing and improving well conceived systems, optimization studies, and production engineering design, followed finally by full demonstrations and trial public use.

The Interagency Task Force on Solar Energy (5:II-8) has noted that

> The solar heating and cooling of buildings presents a relatively low-risk, high payoff R&D area because there is no requirement for major technological breakthroughs. It is high-payoff because the amount of energy used for this application is a very large part of the national use of energy and thus presents an attractive pay-back picture.

In addition to the use of solar-energy data banks and clearinghouses, Hirshberg (4) has recommended dissemination of data through an intermediary so that technical information is translated into forms that are understandable to builders and other potential users.

The NSF/NASA Solar Energy Panel (10:8-9) made this significant statement about the scope and magnitude of solar-energy research and development.

> On close examination, the possibilities for the economic use of solar power, given reasonable R&D support, appear much better than generally realized. In regard to the level of R&D, if the nation is to obtain the maximum

> benefits for its energy R&D expenditures, then R&D expenditures on various sources of energy and processes should be carried to the point of equal marginal productivity of the incremental research dollar for each source and process. On the basis of this, as well as other, criteria, it appears that an objective allocation of R&D funds would call for substantially increased R&D support for a number of solar energy opportunities.

Synopsis of the Literature Review

The factors influencing the acceptability of solar heating and cooling systems are intertwined in a multidimensional matrix of technology-related considerations, economic-related considerations, and culture-related considerations.

Among the factors creating obstacles for the rapid adoption of solar systems are building codes and modifications of construction techniques which may necessitate changes in building codes. Another prime concern of the groups involved in the housing industry is the integration of solar systems with aesthetic considerations. Concern has also been expressed over the dependability of solar systems and the necessity for adequate solar-system warranties. Repair and maintenance as well as the availability of adequately trained solar technicians are also important factors. Excessive temperature variations in solar dwellings may be a problem area that can be overcome by backup systems.

In the future, solar systems will be able to supply a large portion of the energy that is needed for the heating and cooling of dwellings. While the initial costs of solar systems may be higher than those for conventional systems, the long-term costs of solar systems will become significantly lower. As more solar units are demanded and become available, prices for solar units will decrease. Other incentives to increase solar-energy usage include tax subsidies and guaranteed mortgages. However, this increased usage of

solar systems places suppliers of traditional energy sources in a predicament--how to charge for the conventional energy which is needed to fire solar-energy backup systems.

Solar energy is a panacea for circumventing many of the effects of the energy shortage. The shift toward solar energy may make traditional heating and cooling systems outmoded. Although the shift toward solar-energy systems continues, almost nothing is known about the social acceptability of solar heating and cooling systems from the viewpoint of the sociologist. While solar-energy systems are viewed as being environmentally acceptable, more research and development are needed in the solar-energy area, and the findings need to be widely disseminated to all potential users.

CHAPTER III

PROCEDURES

Background Enrichment Activities

Although already well versed on solar-energy matters, the investigators undertook additional study to expand their broad-based backgrounds. In addition to reading the materials that appear in the select bibliography, many additional pertinent sources were consulted. Members of the research team attended several solar-energy conferences and held numerous conversations with individuals knowledgeable about solar-energy matters. Visits were made by all three investigators to 15 solar sites, and an additional 10 sites were visited by one or more individual members of the research team.

Development of Interview Procedures

Based upon the preliminary study, the investigators identified the most influential factors affecting the diffusion of solar-energy technology in the New Mexican housing industry. During the first progress review by the NASA technical officials, these items were discussed along with a number of questions which the research team had identified. Much of the technical review centered around the question of what would develop as a result of the project and how the data could be analyzed. After much discussion, the researchers decided to rely to a large degree on the responses from a highly select group of people who would be interviewed using a modified delphi technique. Those interviewed were asked to evaluate a series of action statements not only in terms of their own personal

perspectives but also from the statewide perspectives. The respondents were queried closely regarding the information supporting their reactions. The careful querying was thought to be necessary since individual respondents or groups of respondents could share the same viewpoint and yet have different conceptualizations. Thus, it was considered desirable to find as many perspectives as possible since these perspectives would help to fill in the details of the construct surrounding the acceptability of solar-energy technology.

Six groups were selected to be studied in depth because of their impact on the New Mexican housing industry. The groups included architects, consumers, contractors, energy suppliers, financiers, and governmental officials. Five representatives from each of these groups were interviewed in depth by two well-trained interviewers.

Training of the Interviewers

Since the interview data were of such great importance, many precautions were taken to insure that the data gathered were of the highest quality. Two interviewers were selected for the project after careful consideration. A one-day training session for the research team and the interviewers was led by Ms. Ora Citron of the Jet Propulsion Laboratory, Pasadena, California, who had conducted interviews of a similar nature during a geothermal project. The training session culminated with practice interviews and critiques. Following the training session, the interviewers pilot-tested the interview procedures on two Western New Mexico University faculty members who were knowledgeable in solar-energy matters and were not associated with the research project. The interviewers then met

with the researchers for constructive criticism of their interview techniques.

Administration of the Interviews

Thirty potential interviewees were carefully selected by mutual agreement of the researchers. Each of the interviewees was sent an introductory letter which explained the study and asked for an interview. A copy of the introductory letter is presented in Appendix C. A solar-energy scenario accompanied each letter to assist the potential interviewee in synthesizing his viewpoint toward solar-energy technology. Approximately one week later, a telephone call was placed to each potential interviewee to determine whether or not he would accept the interview.

Alternates were selected in the event that the interview was not accepted. Only two of the originally selected individuals were unable to accept the interview. The governor had to cancel his interview because of more pressing business, but he did provide an assistant to be interviewed.

Each interviewer was provided with an interview guide which standardized the procedures for the interviews. A copy of the interview guide is included in Appendix D. After a brief explanation of the research project and its goals, the interviewer marked the demographic items. Next, the interviewer presented and explained the matrix board which was used to classify the action statements according to the personal and statewide perspectives as interpreted by the interviewee. After each action statement was placed on the matrix board, the interviewer probed and recorded the respondent's reactions and reasonings. After all items had been placed on the matrix board and discussed by the respondent, he was asked for other possible

action statements which might influence the acceptability of solar-energy technology in the New Mexican housing industry and yet were not included in the deck of action statements. After discussion of these items, a summary discussion was conducted. Immediately after the interview, the interviewer wrote a detailed report of each interview.

On one occasion, it was necessary for an interviewer to substitute for the other interviewer. This was not desirable because the second interviewer was related to the interviewee; but a careful analysis of the interview responses indicated that no bias was evident.

A critique was held at the conclusion of the 30 interviews to evaluate the methods used in gathering the data, to ascertain whether or not any biases existed, to elicit comments while the interview experiences were still in the minds of the interviewers, and to determine whether or not changes were needed in the action statements before they were incorporated into the questionnaire instruments.

Analysis of the Interview Data

The interview data collected by the interviewers were scrutinized thoroughly because of their importance in the study. Through these data, the researchers hoped to develop insights into the multidimensional construct surrounding the acceptability of solar-energy technology. Therefore, each comment was carefully analyzed from the standpoint of the nature of the item, the perspective of the interviewee, and the deviation from the norms.

Responses were plotted on matrices with the individual perspectives forming horizontal rows and the statewide perspectives

forming the vertical columns. Each interviewee was assigned a code letter so that his responses could be easily traced throughout the study. These 23 matrices are presented in Appendix E.

From the data, a summary statement was given in which those factors having acceptance, neutral, and rejection influences over the diffusion of solar technology in the New Mexican housing industry were discussed.

Development of the Questionnaires

A questionnaire was developed for each of the selected key groups to determine whether or not the interview responses of each group were characteristic of the larger group from which they were selected. The use of questionnaires allowed a much larger sample size which aided the development of valid statistical analyses.

Thorough scrutiny indicated that many of the interview items could be incorporated directly into the questionnaire instruments. However, the interviewees did not differentiate between the concepts of maintenance and repair; the researchers decided to combine both into one item. The initial cost item and the long-term cost item were combined into one cost item, following the advice of the interviewers. The warranty item was clarified by indicating a five-year time period, while the temperature variation item was clarified by the inclusion of $\pm$ 10 degrees. To simplify the questionnaire instruments, the action statements were presented in the middle of the page; the scale to the left of the action statements represented the personal perspective while the scale to the right of the action statements represented the statewide perspective. A copy of each of the questionnaire instruments is included in Appendix F.

Selection of the Questionnaire Samples

Assuming a 30 percent questionnaire return rate, the researchers decided that contacting approximately 200 representatives of each of the selected groups except consumers would yield about 60 samples. This number would be more than sufficient for valid statistical analyses on all questionnaires. The researchers decided that approximately twice as many consumers as representatives of other groups should be surveyed. In order to make the desired number of contacts with each of the six groups, the following selection procedures were used:

1. All licensed New Mexican architects were contacted.
2. Approximately 350 consumers were chosen by randomly selecting a name of an individual from every fifth white page of the 26 principal telephone directories in New Mexico.
3. Every 27th name was selected from the list of licensed New Mexican contractors.
4. All energy suppliers listed in the yellow pages of the 26 principal telephone directories of New Mexico were selected.
5. A financial officer from every bank on the New Mexican banking list was selected along with a financial officer from every savings and loan institution appearing in the yellow pages of the 26 principal telephone directories of New Mexico.
6. All New Mexican state and national representatives and senators, members of the New Mexico Supreme Court, members of the General Construction Board, and councilmen from the five largest New Mexican cities were selected to represent governmental officials.

A stamped preference response card and a cover letter asking for cooperation were sent to each person on the sample lists. If the individual made no indication of his willingness to cooperate, he was sent follow-up letters at approximately two-week intervals until he indicated a preference or until a large enough questionnaire

return was obtained. A person was sent a cover letter, questionnaire and a preaddressed and stamped envelope if he agreed to cooperate in the study. The response card and cover letter, follow-up letters, and cover letter for the questionnaire are included in Appendix G.

Analyses of the Interview Data

The questionnaire responses were computer analyzed in a number of ways. A tabulation was made of the total responses and of the key-group responses. Descriptive statistics, such as means, standard deviations, variances, and percentage responses by categories were calculated for each action statement.

Crosstabulations on each action statement were made for each key group that responded to the item. The Chi-square values computed from the crosstabulations when compared to the degrees of freedom yielded a value of the significance between the key-group means.

Cramer's V values were also calculated in order to further substantiate the relationship between key groups and action statements. Since few, if any, respondents had rated items in the lower end of the scale, a second computer run was made utilizing a collapsed scale for the top three categories--neutral, important, very important, and neutral, desirable, and very desirable--on each perspective. These values of significance and the Cramer's V values from the collapsed scale were meaningful in the study.

An analysis of variance was made in which categorical responses were treated as metric values. This analysis revealed the existence of differences in the perception of importance and desirability by groups on the various action statements. Where significant differences

were found to exist, a post-hoc test extended the basis for inference by investigating all possible pairs of subsamples for each item. Duncan's multiple-range test was used in developing a construct of the various opinions regarding action statements which were displayed by each group.

Summary of the Procedures

After background enrichment activities, the investigators developed the interview procedures for the study. The interviewers were carefully trained prior to the administration of the interviews. After the interviews were administered, the interview data were analyzed. Matrices were constructed to illustrate key-group response patterns. From the data, a composite picture was constructed which indicated those factors having acceptance, neutral, and rejection influence over the diffusion of solar technology in the New Mexican housing industry. Next, mailed questionnaires were used to validate the ratings from the interviews. The mailed questionnaire data were computer tabulated and analyzed. Crosstabulations and Chi-square values were calculated in order to determine relationships between action statements and key-group perceptions of their importance or desirability. Cramer's V values were also calculated to further substantiate the significance between key groups and action statements. Analysis of variance was performed to determine the amount of difference in the perception of importance and desirability by key groups on the various action statements.

CHAPTER IV

ANALYSES OF THE INTERVIEW FINDINGS

Overview of Interview Analyses

Thirty interviews were held with members of the six key groups utilizing a modified delphi technique. The interviews were very productive and yielded 87 typed pages of comments.

In order to gain proper perspective in analyzing the comments, the investigators duplicated and reassembled the comments using three different methods. These methods involved grouping the comments (1) according to the responses on each of the action statements; (2) according to the value of statewide importance on each action statement; and (3) according to the value of personal desirability on each action statement. In addition to the above methods, items were examined from the bases of key groups and substantial variations between the statewide importance ratings and the personal desirability ratings.

The comments associated with these arrangements were analyzed to determine any relationships which might exist. The object of these analyses was to find the reasons why respondents held such views on a number of solar-related subjects. The statements were grouped according to those with the highest and lowest arithmetic means of statewide importance as well as those with the highest and lowest average values of personal desirability. A grouping according to the composite scores for each item was also made. A scattergram was devised to display this distribution. Hence, those items which tended to have higher personal-desirability

ratings rather than higher statewide-importance ratings and vice versa are readily discernable. A listing was also made of those statements which received a higher arithmetic-mean rating on the statewide-importance scale rather than on the personal-desirability scale and vice versa.

The interview comments tended to fall into two categories: (1) those that were not related specifically to solar heating and cooling but, nevertheless, had influenced the interviewee's attitude toward the action statements and (2) those that displayed an attitude toward a specific aspect of the subject. The latter comments may be further divided into two subgroups: those that influenced all or most of the statements about solar heating and cooling and those that influenced only one or a few of the statements about solar heating and cooling.

NONSOLAR-RELATED ATTITUDES AMONG INTERVIEW RESPONDENTS

Eight nonsolar-related attitudes were found among the interview respondents. Each of these attitudes is discussed below.

Attitudes Toward the Pollution Problem

Interviewees tended to respond to the statement about placing emphasis on the nonpolluting aspects of solar heating and cooling according to how they viewed the pollution problem in New Mexico. Those respondents who viewed this problem low in statewide importance or personal desirability often commented that there is no pollution problem in New Mexico. Some of those who ranked the item high on the scales commented on the importance of reducing pollution. This position is further exemplified by the fact that only one of the four respondents who rated this item low was from Albuquerque, while

of the six respondents who placed this item high, three were from Albuquerque and one was from Farmington. These two cities are the only ones in the state where a serious pollution problem is said to exist.

Attitudes Toward the Believability of the Energy Shortage

A surprisingly large number of those interviewed made comments which indicated that they were not sure if an energy shortage existed. Some respondents themselves believed that there was an energy shortage, but they felt that other people did not believe that there was an energy shortage or that the shortage was a serious one. These attitudes permeated the comments and influenced the placement of the action statement in several instances. Thus, the attitudes of an individual toward solar heating and cooling systems as a means of saving energy are affected by his perspective toward an energy shortage. Initial costs, payback period, and information on solar energy were other items which were also affected by the individual's attitude toward the energy shortage.

Energy suppliers, one group which is aware of the energy shortage, often rated statements higher than other groups because of the importance of relieving the energy shortage. However, an interesting comment was made by an energy supplier: "There is no shortage of electricity, only gas."

Attitudes Toward Governmental Regulation and/or Intervention

In several circumstances, the respondents indicated that the action in question was inappropriate because they deplored additional governmental agencies, taxes, and control of their affairs. An opposing group of interviewees felt that the government should

intervene in order to stimulate the development and acceptance of solar heating and cooling technology. Some of these respondents specified that the state government should become more involved in solar-energy matters.

The influence of the individual's attitude toward governmental action was most evident in the comments regarding a governmental subsidy for solar-energy units. Those who opposed governmental influence rated this action low, whereas those who rated it high tended to cite the need for additional governmental commitment toward solar-energy technology. Other items where attitudes toward governmental actions were displayed included: changing building codes, mortgage loan guarantees, the long-term payback period (interest rate guarantees and support), manpower training, and dissemination of information. The item regarding the social acceptance of solar-energy technology by New Mexicans elicited several comments to the effect that the state should show more interest in this matter.

Financiers and energy suppliers displayed more opposition toward governmental activity than other interview groups, while consumers and governmental officials tended to favor more governmental action.

Attitudes Toward Free Enterprise

Somewhat related to the previous attitude was the individual's view of free enterprise. This attitude came into play on those action statements which had financial implications. In general, those who opposed governmental action were in favor of a free-enterprise environment. Interview respondents felt that in such matters as initial costs, payback period, mortgage loan guarantees, and

availability of solar systems, commercial concerns should be allowed to operate freely on the open market without interference, regulation, or stimulation from the government or other outside sources of influence.

These respondents often remarked that an investor was entitled to a fair return on his investment. Thus, a utility was entitled to higher hookup charges from those individuals using the utility as a backup for solar heating and cooling systems rather than from those individuals depending entirely on the utility for their heating and cooling--since the same amount of equipment would be required in each instance but the revenue derived from those with solar-energy backup systems would be much smaller than that derived from those using conventional heating and cooling systems.

Another viewpoint was that governmental assistance would tend to weaken the development of solar-energy systems because it would allow poorly conceived ideas and equipment to survive.

On the other hand, no interview respondent expressed an unfavorable attitude toward our economy and the free-enterprise system. The nearest opinion opposing our free-enterprise system was that the government should assure that smaller companies will be in a position to compete with larger companies. Several interview respondents indicated that the government should also assure that charlatans and "fly-by-night" operators are controlled and that honest and truthful information about solar-energy systems is given to the public. Some individuals further expressed favor toward governmental support for developing the solar-energy industry because the government has been doing this for many years with other industries, especially the petroleum industry and utilities--often by awarding

monopolies. Some respondents felt that utilities should have to endure the extra costs associated with solar-energy technology because the utilities have a guaranteed profit, while there were those who felt that such actions as subsidies and equal hookup charges would tend to penalize nonsolar users unfairly.

Attitudes Toward Cost Factors

Associated with the individual's view toward a free-enterprise system and toward economic factors is his perception of future fuel costs and interest rates. Respondents seemed to consider that fuel costs would remain the same in the future as they presently are. One interviewee implied that fuel costs might even go down in the future. On the other hand, interview respondents generally assumed that interest rates would remain high.

The influence of the latter factor was most apparent with regard to the long-term payback period. Those individuals who did not perceive any change in fuel costs and who expected high interest rates to continue tended to be skeptical that the payback period of solar-energy systems could be shortened.

One comment regarding initial costs was that higher initial costs could be tolerated because fuel costs would be higher in the future. The evaluation of a solar-energy backup system also might be influenced by the individual's perception of future fuel costs.

Attitudes Toward Resistance to Change

Resistance to change, although present, had much less influence on the thinking of respondents than was expected by the investigators. No definite reason for this fact was advanced by the interview respondents, but the investigators speculate that the need for

alternative means of energy production has become so apparent that most people realize that changes have to be made. Another possible explanation is that people generally feel that they cannot be against change. Evidence of this latter attitude could be exhibited by those who decry the importance or desirability of an action for somewhat illogical reasons. Little or none of this was displayed by the interview respondents.

The investigators expected that an opposite attitude toward change--an eagerness to embrace change or to be on the forefront of development--would be shown by some respondents. This attitude was expected to be demonstrated on the statement regarding pride in ownership. However, no comments of this nature were made. The most closely related comment was "everybody is proud of something new"--not different or unusual. The investigators had become aware of the pride in owning a solar-energy system during site visits and discussions with owners of solar-energy systems, but perhaps this pride is a feeling that an individual acquires after he has the solar-energy system in operation.

Attitudes Toward Temperature Variations

Tolerance toward colder and/or warmer temperatures and/or wide temperature variations influenced the responses given to the action statement concerning temperature variations. Comments related to temperatures were also made by interview respondents for the action statements relating to backup systems and initial costs. Careful analysis revealed that more important characteristics than temperature tolerance were evident. These characteristics have to do with the lifestyle of an individual and his willingness to alter his lifestyle to achieve other desirable objectives. Some respondents indicated

that they could not be satisfied with any heating and/or cooling system which does less than what conventional heating and/or cooling systems do today. These persons indicated that they would rather make sacrifices elsewhere. This feeling may also influence the individual's assessment of the state of the art of solar-energy development.

Attitudes Toward Aesthetics

In addition to the physical comfort and well-being attitudes previously discussed, there is an attitude toward the aesthetic considerations of solar-energy systems. The investigators expected that this feeling would be displayed on the statement regarding the appearance of solar-energy systems. The interview data analysis indicated that Santa Fe respondents, not necessarily architects, were more concerned with the preservation of the distinctive architectural styles of New Mexican homes rather than with the creation of a structure with a pleasing appearance. This attitude is in accordance with the fact that Santa Fe has unusually rigorous design constraints which require that all new buildings within the historical zones be built with one of two New Mexican architectural styles. While some respondents felt that the present solar-energy systems were pleasing in appearance already, others did not think this factor was important so long as the heating and/or cooling system was functionally effective. The latter attitude was also displayed on the action statement related to major modifications in house construction and on the action statement related to building codes. One respondent did not think that it was possible to modify an existing structure without destroying its design; he contended that solar-energy systems should be designed only into new structures. Another felt that building codes should not allow modifications which did not make sense from an aesthetic viewpoint.

Architects, by nature of their occupation, tended to be more concerned with aesthetic appearance than the other groups.

SOLAR-RELATED ATTITUDES AMONG INTERVIEW RESPONDENTS

Solar-related attitudes among interview respondents tended to be more specific than the nonsolar attitudes previously discussed. Therefore, comments about solar-related attitudes will be discussed in relation to the action statements to which they apply.

Development of the Interview Matrices

As mentioned in the previous chapter, interviewees were asked to place each action statement on a matrix board. In order to get a composite view of the data, each subject was given a code letter and this letter was placed in its appropriate place on a matrix for that statement. Accordingly, 23 matrices were developed. These matrices are presented in Appendix E.

These matrices enabled the investigators to do several additional analyses. For example, the comments were duplicated, cut up, and rearranged so that all comments on an action statement were placed together. By utilizing the matrices, the comments could be placed according to order of importance or desirability from lowest to highest.

Development of the Interview Scattergram

No special attempt was made by the interviewers to discriminate between those comments which pertained to statewide importance and those comments which pertained to personal desirability. Therefore, the investigators had to make this distinction whenever possible. A comment which referred to how the respondent felt on the topic

was deemed to be from the personal perspective, while a comment which referred to people in general, the state, or to a general trend was deemed to be from a statewide perspective.

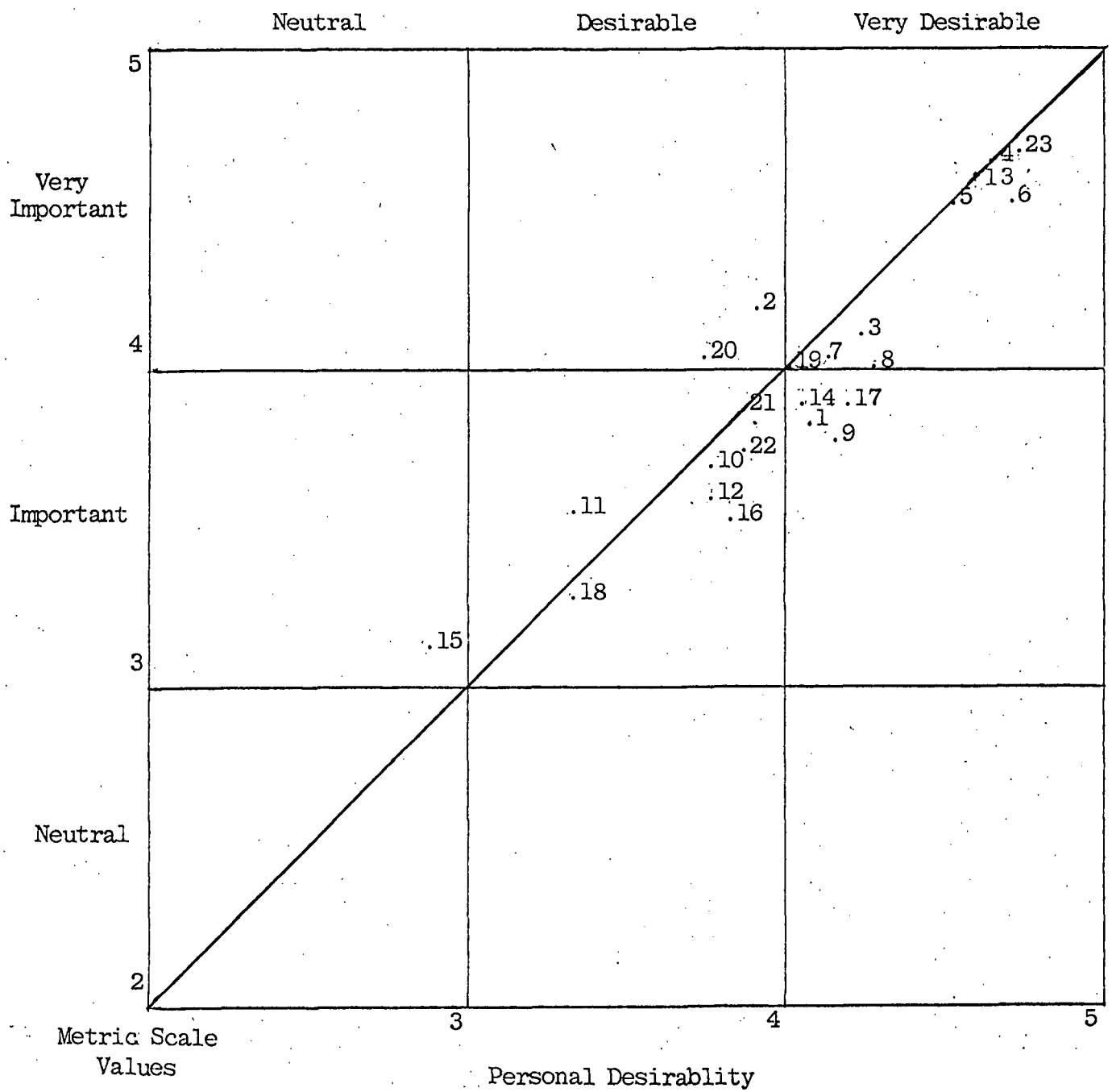
Analyses were made from three perspectives: statewide, personal, and composite. By means of the letter code, individual and group responses could be readily identified. Comments were examined according to significance levels, scattering or clustering of groups, and comparative placement of statewide versus personal ratings above or below the 45-degree line. Finally, arithmetic mean scores for each action statement were computed according to statewide, personal, and composite ratings. For this computation, a five-point scale was used: one point was given for the very unimportant and very undesirable ratings while five points was given for very important and very desirable ratings. No comment responses were eliminated from the calculation.

Interpretation of the Interview Scattergram

A scattergram, Figure 1, was constructed using the statewide and personal composite arithmetic mean scores. Note that only the three upper levels of values are presented because no item has an arithmetic mean below the neutral level. As a matter of fact, only five of the nine scattergram boxes contain arithmetic mean scores.

A line was drawn from Cartesian coordinates (2,2) through (3,3), (4,4), and (5,5). This line represents the position of equal statewide importance and personal desirability. There were four items with composite scores above this line and seventeen items with composite scores below the line. Composite scores of two items appeared on the line. An action statement whose score was above the line was assessed more statewide importance than personal

Figure 1. Scattergram of Arithmetic Mean Scores for each Interview Action Statement by Statewide Importance and Personal Desirability



Numbers Refer to Action Statements on the Action Statement Listings for Figure 1--Appendix M

desirability, whereas an action statement below the line was assessed more personal desirability than statewide importance. There were more than four times as many scores below the 45-degree line than above the line. Thus, respondents were more likely to give a higher rating to an item from a personal perspective rather than from a statewide perspective.

The four action statements given more statewide importance than personal desirability were:

Emphasize the possibility of an energy shortage to stimulate the use of solar energy

Change the building codes to accommodate solar heating and/or cooling systems in homes

Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems

Emphasize that traditional heating and cooling systems are outmoded

The first three items represent actions which are rather remote from an individual. The fourth item received the lowest rating of any of these four items. The respondents were probably trying to say "I don't like this action at all, but maybe it would have some importance to other people." It is also interesting that none of these ratings fell into the highest level box for very important--very desirable ratings.

Three of the five scattergram boxes contain items which had been evaluated one level different on either the statewide or the personal perspective. Two of these three boxes had higher statewide ratings than personal ratings. These boxes were: very important--desirable and important--neutral desirability. The former contained two items, and the latter contained one item. The other box, important--very desirable, contained four items with higher personal rather than statewide ratings.

Figure 1 shows that although only four items had higher significance on the statewide ratings rather than on personal ratings, three of these items differed by one level from their personal ratings. On the other hand, seventeen items had higher personal ratings than statewide ratings, but only four of them differed from the statewide ratings by one level.

The three action statements which had one-level higher statewide ratings than personal ratings were:

Emphasize the possibility of an energy shortage to stimulate the use of solar energy

Change the building codes to accommodate solar heating and/or cooling systems in houses

Emphasize that traditional heating and/or cooling systems are outmoded

The four action statements with one-level higher personal ratings than statewide ratings were:

Use solar-energy systems to reduce pollution in New Mexico

Develop solar systems with lower repair costs than for conventional systems

Design solar heating and/or cooling systems with reasonable temperatures and variations

Issue strong warranties for solar heating and/or cooling systems

Development and Interpretation of the Interview Comparative Rating Table

A table was constructed which ranks the ratings on the various action statements. Table 1 displays the items ranked from highest to lowest arithmetic means on the composite basis for each category in the following order: very important--very desirable; important--very desirable; very important--desirable; important--desirable; important--neutral desirability. Statewide and personal arithmetic mean scores are also given for each action statement.

Table 1. Rating of Interview Action Statements by Statewide Importance and Personal Desirability According to Matrix Placement Categories and Descending Order of Arithmetic Mean Composite Scores

Action Statement	Arithmetic Mean Composite Score	Arithmetic Mean Personal Desirability Score	Arithmetic Mean Statewide Importance Score
	VERY IMPORTANT - VERY DESIRABLE		
Make the Initial Cost of Solar Heating and/or Cooling Systems Comparable to Conventional Systems	4.695	4.850	4.540
Provide More Information on Solar Energy	4.645	4.680	4.610
Design Solar Systems with Long-Term Dependability	4.615	4.630	4.600
Make Energy Consumption a Critical Factor in House Design	4.600	4.600	4.600
Make Solar Heating and/or Cooling Units as Available as Conventional Units	4.535	4.600	4.470
Make Houses with Solar Heating and/or Cooling Systems as Attrative as Nonsolar Houses	4.215	4.290	4.140
Develop Solar Systems with Lower Maintenance Costs than for Conventional Systems	4.100	4.200	4.000
Make the Long-Term Cost (Payback Period) of Solar Heating and/or Cooling Systems Lower than for Conventional Systems	4.100	4.130	4.067

Table 1. Continued.

Action Statement	Arithmetic Mean Composite Score	Arithmetic Mean Personal Desirability Score	Arithmetic Mean Statewide Importance Score
	VERY IMPORTANT - VERY DESIRABLE Continued		
Develop Solar Heating and/or Cooling Systems which do not Require Major Modifications in House Construction	4.025	4.050	4.000
	IMPORTANT - VERY DESIRABLE		
Use Solar Energy Systems to Reduce Pollution in New Mexico	4.150	4.400	3.900
Design Solar Heating and/or Cooling Systems with (Reasonable Temperatures) and Variations	4.050	4.150	3.950
Issue Strong Warranties for Solar Heating and/or Cooling Systems	4.000	4.030	3.970
Develop Solar Systems with Lower Repair Costs than for Conventional Systems	3.970	4.070	3.870
	VERY IMPORTANT - DESIRABLE		
Emphasize the Possibility of an Energy Shortage to Stimulate the use of Solar Energy	4.105	3.960	4.250
Change the Building Codes to Accommodate Solar Heating and/or Cooling Systems in Homes	3.925	3.800	4.050

Table 1. Continued.

Action Statement	Arithmetic Mean Composite Score	Arithmetic Mean Personal Desirability Score	Arithmetic Mean Statewide Importance Score
	IMPORTANT - DESIRABLE		
Emphasize that Solar Heating and/or Cooling Systems are Socially Acceptable to New Mexicans	3.880	3.930	3.830
Emphasize the Pride in Owning a Solar Heating and/or Cooling System	3.820	3.930	3.710
Award a Tax Subsidy for the use of Solar Heating and/or Cooling Systems in Houses	3.765	3.800	3.730
Make Solar Heating Systems that Require no Backup Systems	3.735	3.850	3.620
Establish the same (Utility Hookup Charge) for Conventional and Solar Backup Systems	3.695	3.790	3.600
Establish a Fund to Guarantee Mortgage Loans for Houses with Solar Heating and/or Cooling Systems	3.500	3.330	3.670
Implement Manpower Training Programs for Solar-Related Jobs	3.425	3.500	3.350
	IMPORTANT - NEUTRAL DESIRABILITY		
Emphasize that Traditional Heating and Cooling Systems are Outmoded	3.025	2.880	3.170

According to Table 1, five items had the highest composite arithmetic mean ratings--all above 4.500. These items were:

Make the initial cost of solar heating and/or cooling systems comparable to conventional systems

Provide more information on solar energy

Design systems with long-term dependability

Make energy consumption a critical factor in house design

Make solar heating and/or cooling systems as available as conventional units

These five action statements comprise the upper range items. The order of significance of these items was exactly the same from the personal perspective. These five items were also the five highest in statewide importance, although the ranking order was not the same as that found in the composite ratings.

Of the four remaining action statements located in the upper right-hand category, the highest ranked action statement had an arithmetic mean composite score of 4.215. This action statement and the highest ranked action statement in the important--very desirable category appear to be transitional items because of the influence of the previously discussed nonsolar-related attitudes.

It must be emphasized that there is a significant difference between the fifth action statement--the last item in the upper range category--with its arithemtic mean composite score of 4.535 and the sixth action statement--the first transitional action statement--with its arithmetic mean composite score of 4.215. This difference signifies that two out of three respondents ranked the sixth action statement one category lower on either the statewide or personal perspective than they did on the fifth action statement.

The remaining three action statements of the very important--very desirable category, the three remaining action statements in the important--very desirable category, and the two action statements in the very important--desirable category have arithmetic mean composite scores from 4.105 to 3.970, and, thus, they have a narrow range of .125. These eight action statements comprise the middle range category.

The seven action statements in the important--desirable category and the one action statement in the important--neutral desirability category comprise the lower range action statements. These eight items have a broad range of .860. The significance of this range is that nine out of ten respondents rated the lowest action statement one level lower on both perspectives than they did on the highest ranked item in the lower range category.

The three lowest action statements, with arithmetic mean composite scores equal or less than 3.500, ranked from the lowest score upward were:

Emphasize that traditional heating and cooling systems are outmoded

Implement manpower training programs for solar-related jobs

Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems

UPPER RANGE ACTION STATEMENTS

A summary discussion of the comments relating to the upper range action statements is presented in the following section in descending order of their composite arithmetic mean ratings.

Make the Initial Cost of Solar Heating and/or Cooling Systems Comparable to Conventional Systems

Interview respondents had a considerable number of comments about this action statement. In general, comments could be easily

categorized. Thus, of the four no comment interviewees, there were three respondents who expressed doubt that initial costs of solar-energy systems could be made comparable to initial costs of conventional heating and/or cooling systems. The other individual felt that the statement was so poorly written that he could not comment about it. The four comments in the desirable level also contained three comments doubting that the initial solar-energy system costs could be made comparable with those of conventional systems. On the other hand, there were only two comments doubting the possibility of comparable initial costs among the sixteen comments in the very important--very desirable level.

In the highest level, there were four respondents who said that initial costs between systems will be made comparable in time and one person who said that costs are now comparable between systems on a cost-effective basis. Finally, there were 14 comments to the effect that the point of the action statement was significant, that it was definitely needed, that it was the number-one key factor, and that solar heating and cooling would develop when the initial costs of solar-energy systems were made comparable to those of conventional heating and cooling systems. Two financiers commented that lower initial costs would assist in making favorable financing decisions. One consumer said that people should have lower initial costs so they could afford to pay for their heating and/or cooling systems.

The overwhelming evidence from the comments suggests that the respondents regarded the initial cost as the most important factor, with little or no regard to future savings or cost effectiveness.

Provide More Information on Solar Energy

Comments were generally quite detailed on this action statement. The comments frequently concerned the need for more information:

"this is most important," "#1," "obvious," and "must be done." Many comments specified the nature of the information: "publicize new breakthroughs," "how will it benefit consumers," "how much it will cost," or "adobe can be modern."

Most comments referred to a lack of communication. Nearly half of the respondents remarked that the present information about solar-energy systems was too technical for the average citizen. There were comments to the effect that the present information was inaccurate, inappropriate, poorly written, and unreliable. Nine interview respondents felt that governmental agencies should be responsible for providing the public information about solar energy in order to assure that it is of the highest quality, while six respondents felt that colleges or universities could provide the best public information. Only four respondents included the commercial sector, manufacturers and utilities, as a source of usable information. One individual specified that promoters should not be allowed to provide public information. According to one source, public information about solar-energy systems should come through the news media. Another person said that public information should not be mailed. Several respondents suggested that grants should be made for the purpose of studying solar-energy systems and disseminating the right information at the proper levels.

Providing more information on solar energy was given the highest rating by all consumers and by four out of five architects and energy suppliers.

Design Solar Energy Systems with Long-Term Dependability

This statement was rated the same on both the statewide and personal rating scales by the significant majority of respondents.

Some respondents felt that solar-energy systems were actually more dependable than conventional energy systems. Others indicated that dependability was indicative of quality, that when a person is buying, he should try to select the best system, which is the one which will last. Four respondents said that solar-energy systems have to last a long time because of their high costs. Three interviewees said that the system should last as long as the house. One person said that a distributor cannot sell a solar-energy system and then just forget about it. Another respondent expressed a typical desperation-type statement of many consumers: "Nowadays, everything breaks down." Interestingly enough, two comments concerned the opinion that hot-air systems are more dependable than hot-water systems.

The trend in comments revealed that four out of five architects and energy suppliers ranked this item in the highest level of significance, while in the other groups, three out of five ranked this item in the highest level of significance. Contractors were the only ones to downgrade the significance of this action statement. Two contractors judged this action statement less significant personally than on a statewide basis, and one said that it was less significant on the statewide level than on the personal level.

Make Energy Consumption a Critical Factor in House Design

None of the respondents ranked this action statement lower than important--desirable. Many of the comments were concerned with this action being made into a law. Three energy suppliers and an architect were opposed to such a law, while two architects and two consumers favored such a law. There were five interviewees who commented that this action should be stressed or made a minimum requirement

in codes and/or Federal Housing Administration specifications. Reasons commonly cited for making this action statement into a law or requirement included that it was for the common good--making more energy available--and that people tended to build as cheaply as possible without concern toward energy-consumption levels. Another respondent felt that the action statement should apply only to new construction.

One interviewee mentioned that California has imposed insulation standards. Most respondents seemed to interpret this question in terms of insulation requirements, although one energy supplier commented that we would need to build smaller houses and an architect said that we would need passive solar-energy system designs.

Make Solar Heating and/or Cooling Units as Available as Conventional Units

Although the investigators had suspected this item would rank high, they were surprised to see that it ranked among the top five action statements. Seven out of seventeen interviewees equated the availability of solar heating and/or cooling systems with their costs. This group responded with comments on costs and the need to reduce costs. Several respondents indicated that progress was being made toward this action statement, although much experimentation and research remained to be done. Two persons commented that mass production was the answer to the problem of a shortage in the supply of solar heating and cooling units. All the energy suppliers gave this action statement the highest rating from a personal standpoint. Two energy suppliers gave a lower rating for the item on the statewide-importance scale than on the personal-desirability scale. Those people who rated this action statement low justified

their position by indicating that it would be far into the future before solar heating and/or cooling systems would be as available as conventional heating and/or cooling systems.

TRANSITIONAL ACTION STATEMENTS

On the average, the two transitional action statements were ranked one level lower than the initial cost item--the highest ranked action statement--from at least one perspective by all respondents. Four out of five respondents ranked the transitional action statements one level lower than the fifth-ranked action statement from at least one perspective.

Make Houses with Solar Heating and/or Cooling Systems as Attractive as Nonsolar Houses

As was expected, the highest ratings on this item came from architects, although only three of the five architects gave the item the highest rating. An architect said that in time people will come to accept the new solar look as they become accustomed to it. Among the very important--very desirable and important--desirable categories, consumers split evenly with only one consumer rating this action statement lower. One consumer interpreted this action statement as attractive in terms of cost. Another respondent remarked that the important thing is what the prospective buyer's wife thinks about the appearance of the house. As stated previously, concern was expressed that the use of solar heating and/or cooling systems might destroy the unique styles of appearances which many New Mexican dwellings have.

Use Solar Energy Systems to Reduce Pollution in New Mexico

Only two groups, consumers and governmental officials, were asked to respond to this action statement. The impact of an individual's attitude toward the pollution problem has already been discussed (see page 43). The remaining comments consisted of those made by the interviewee who gave the item the lowest rating: "It is too early to know if solar heating and cooling does reduce pollution." One consumer said that solar collectors would take up vast land areas and, therefore, would be polluting in one sense of the word.

MIDDLE RANGE ACTION STATEMENTS

A summary discussion of the comments relating to each of the middle range action statements is presented in the following section in descending order of their arithmetic mean composite ratings with the exception of the action statement dealing with major modifications in house construction which is discussed before the action statement dealing with reasonable temperatures and variations.

Emphasize the Possibility of an Energy Shortage to Stimulate the use of Solar Energy

The effect of the individual's attitude toward an energy shortage has been discussed previously (see page 44). Not many additional comments were made. Four of the five interviewees who rated this action statement low on a personal basis were concerned with the nature of this approach. One respondent said that the approach of the action statement was too commercialized, while another person said that it was like being beaten to death with a club. One interviewee said that fear advertising is wrong morally, and two others

said that there was too much emphasis on the energy shortage. Another interesting comment from an interviewee was that emphasis on an energy shortage might drive prices higher, although it would also stimulate research and development.

Develop Solar Systems with Lower Maintenance Cost than for Conventional Systems

Three respondents gave this action statement low ratings--one, unimportant; two, neutral--from the statewide perspective. One consumer felt that solar-system maintenance was an expected expense and was already quite low. The other two persons, who were energy suppliers, doubted that the maintenace costs for solar-energy systems could ever be lower than those for conventional systems.

Four respondents gave this action statement the highest rating on statewide importance. Three of the four respondents declared that this action was good, was a must, and was definitely needed. The fourth individual, an energy supplier, thought it would take a long time to achieve this action statement. Three respondents felt that maintenance costs for solar-energy systems were already lower than those for conventional heating and cooling systems. One respondent indicated that this action statement would be particularly important in low-income areas such as Northern New Mexico.

Four out of five financiers placed this action statement in the important category while three out of five consumers judged this item very important from the statewide perspective. Three out of five energy suppliers downgraded statewide importance in their ratings.

Make the Long-Term Cost (Payback Period) of Solar Heating and/or Cooling Systems Lower than for Conventional Systems

This action statement had the same composite score as the previous action statement. Although it had a lower personal appeal, it was placed higher on the statewide level than the maintenance item. The fact that this action is in the middle range area while the initial cost action statement was the highest rated item strongly indicates that those who were interviewed did not perceive the true economic relationships which are involved.

There was considerable variation among the respondents who ranked this action statement low. Of the eight respondents who judged the action statement as undesirable, unimportant, or neutral from one or both viewpoints, only two respondents rated it neutral from both perspectives and only one respondent rated it below the neutral response from both perspectives. One of these three respondents, an energy supplier, said that costs of the system should be tied to the cost of the house but that there should not be any governmental subsidy. Another interviewee, a governmental official, said that cost factors were unimportant at this time because more research and development is needed. The third individual, also a governmental official, remarked that he did not feel that Americans should interfere with the free-enterprise system.

Among the 11 respondents giving this action statement the highest rating from the statewide perspective and among the 12 respondents giving the item the highest rating from the personal perspective, there was great diversity in supporting arguments. For example, there were four respondents who strongly favored the action, even with governmental assistance. One person reasoned that since initial costs for a solar-energy system were higher, it

would take longer to pay back the costs. A consumer was opposed to the tradeoff of higher initial costs for lower fuel costs because he felt that things were already too high. An energy supplier indicated that if a solar-energy system were cheaper than a conventional one, it would create more problems. One interviewee indicated that a longer payback period would mean a larger interest payment.

Unexpectedly, all financiers rated this action statement as only desirable from their personal perspectives. Three out of five contractors and consumers rated this item in the very desirable category. There were seven interviewees who tended to downgrade the action statement in statewide importance. They gave as comments that they did not think this action would have much effect and that they doubted that the action statement could become a reality.

Once again, the inescapable conclusion may be drawn that respondents did not look beyond the initial, present-day costs of a solar-energy system.

Develop Solar Heating and/or Cooling Systems which Do Not Require Major Modifications in House Construction

This action statement had only one no comment response; otherwise, the lowest rating was neutral, with four coming from the statewide perspective and five coming from the personal perspective. Two of these respondents said that the design expenses would be too great to make the action statement feasible. Two others indicated that this problem will take care of itself in time. Two respondents did not believe in retrofitting. There were five interview respondents who gave this action statement the highest rankings in terms of statewide importance and/or personal desirability. Two of these

persons felt that the action statement would be easy to implement. The other three respondents remarked that this would be desirable for old houses, especially if it could preserve the adobe architecture and help to keep the costs of home improvements down.

Between these two extremes were some comments that revolved around the fact that the building is the system and that the structure comes first. There was one comment by a contractor who said that the house and system should reflect the style of living of the occupants. Interestingly, none of the comments concerning architecture were made by architects.

Three contractors and three financiers rated this action statement as desirable.

Design Heating and/or Cooling Systems with Reasonable Temperatures and Variations

This action statement actually had a slightly higher average composite score than the previous one. The action statement is placed here because its arithmetic average scores on the statewide and personal perspectives place it in the important--very desirable category. There were six respondents who gave this action statement a neutral ranking on the statewide-importance scale. Three of these individuals were contractors, and the remaining individuals were consumers. Two members of the former group agreed with the action statement and yet marked it with neutral ratings. The other contractor and one of the consumers said that wide temperature variations should be available, while another consumer thought that this item was a function of heat storage within the system. The other consumer said that temperature-variation matters would be solved through further research and development.

The five persons who judged this action statement highest on statewide importance, and on personal desirability included two architects, two energy suppliers, and one consumer. The architects were concerned with the usability of the heating and/or cooling system. The other three interviewees were concerned with the fact that people have little tolerance for temperature variations. One other comment was that this action was a design constraint of the system.

Five of the twenty respondents rated this item lower on statewide importance than on personal desirability, but no pattern emerged from their comments.

Issue Strong Warranties for Solar Heating and/or Cooling Systems

There were only three respondents who placed this action statement in the very unimportant and unimportant categories. These three persons believed that warranties should be issued, but judged this action as not very important because warranties are already a common practice. The group thought that if warranties were to be issued on unsatisfactory systems, this practice could lead to unenforceable warranties.

Almost half of the respondents placed this action statement in the very important--very desirable category. Most of the respondents justified this high placement by reasoning that strong warranties would suggest that solar heating and/or cooling systems are dependable. Several people emphasized that warranties should not be issued unless they could be enforced. Other interviewees commented that warranties should extend for as long as the life of the house, while another group of respondents thought that warranties should extend for a time period comparable to that of a water heater or a refrigerator. One interviewee stated that the poorest warranty

would be one issued by the government. Three out of five consumers and financiers placed this action statement in the very important--very desirable category.

Only two interviewees downgraded this action statement on a statewide basis, while one respondent downgraded it on a personal perspective. None of these interviewees gave significant responses.

Develop Solar Systems with Lower Repair Costs than for Conventional Systems

Since only three groups were asked to evaluate this action statement, the distribution is quite limited. One respondent placed this action statement in the unimportant category. He commented that repair costs for solar systems did not have to be lower than repair costs for conventional systems--but that the repair costs should be comparable. Four respondents placed this action statement in the very important category. The comments offered by these interviewees were not too revealing. One member of this group said that lower repair costs for solar systems than for conventional systems would help to relieve the fear of the unfamiliar system. Another interviewee stated that it would be some time before New Mexicans could abandon conventional heating and cooling systems.

Three of the five consumers rated this action statement as very desirable from a personal perspective, but only two members of this group rated this action statement as very important on a statewide basis. A different perspective was seen by three financiers: they rated this action statement important on a statewide basis. However, only two members of this group rated the action statement as desirable from a personal perspective. The three

respondents who downgraded this action statement on the statewide basis did not demonstrate a significant trend.

Change the Building Codes to Accommodate Solar Heating and/or Cooling Systems in Homes

There was only one unimportant rating and there was only one undesirable rating on this action statement. The person who gave the unimportant rating commented that other factors are more important than changing building codes, while the person who gave the undesirable rating commented that there is not enough information to change building codes. An energy supplier placed this action statement in the no comment category from the statewide perspective. This individual indicated that building codes have adequate scope.

Eight respondents placed this action statement in the very important category. Two contractors considered this action statement lower in personal desirability than in statewide importance. Six members of this group felt that building codes definitely needed to be changed. One of the remaining respondents, a contractor who had built 20 solar-energy homes without building-code conflicts, said that if there were any code-related conflicts, building codes would have to be modified. The other respondent also said that building codes would have to be changed if there were any conflicts, but he did not know whether or not these conflicts existed.

Three of the respondents commented that the present building codes are satisfactory. One of these individuals reported that there was not adequate information to modify the building codes. Another interviewee commented that building-code changes would come in the future. One respondent spoke against federal intervention in the changing of building codes; he indicated that this was already

happening. One individual commented that New Mexicans tend to exaggerate the need for changes.

Three of the five energy suppliers rated this action statement very important--very desirable. Three contractors rated this action statement desirable from a personal perspective.

There was some difference in opinion between the statewide and personal perspectives of the respondents, but the supporting details showed no consistent trends of thought.

LOWER RANGE ACTION STATEMENTS

The remaining eight action statements had arithmetic mean composite scores lower than 3.900. While all but one of these scores are not really low in themselves, they were, nevertheless, the lowest ranking arithmetic mean composite scores for the 23 action statements. The .85 range in the arithmetic mean composite scores of the lower range group is considerable. It corresponds to a one-level decrease in ranking on both the statewide and personal perspectives by more than two out of three respondents. As previously mentioned, there is a definite division between the upper five ratings in this category and the lower three ratings. The difference of .195 indicates that 40 percent of the respondents decreased their ratings on one of the perspectives by an additional level. The lowest ranked action statement is in a class by itself. Its unpopularity is indicated by the fact that its arithmetic mean composite score is .400 below that of the next lowest ranked action statement and .670 below that of the fifth ranked action statement in the lower range category. The comments relative to the action statements in this category will be discussed in the descending order of their arithmetic mean composite scores.

Emphasize that Solar Heating and/or Cooling Systems are Socially Acceptable to New Mexicans

A number of comments concerning the unimportant consequence of this action statement were given by the 11 interviewees who marked this item low. Two governmental officials said that the state probably was not interested in solar-energy systems or that the statewide viewpoint was unimportant. Three respondents felt that changes in acceptability would be based on other factors: economics, how warm the house was, or the quality of the system. Only two comments concerned status. One interviewee said this approach was wrong and another interviewee said it was hard to judge the effectiveness of social acceptability.

The comments made by those who judged this action statement as very important and/or very desirable had a different tone. Two respondents thought that solar systems are already socially acceptable. One person commented that the governor should show a personal interest in promoting solar-energy systems. One respondent related social acceptability to lifestyles. Another interviewee said that architectural designs will have to be made so that houses with solar-energy systems will look no different than conventional ones. A contractor who rated this action statement as very important in statewide importance but only neutral in personal desirability emphasized that the more solar-energy units people see, the more acceptable the units will become.

The three respondents who downgraded the statewide importance and the one person who downgraded personal desirability were the individuals who thought this action statement meant acceptance at the state governmental level. Three of the five energy suppliers gave this item the highest rating. Three out of five architects,

consumers, and governmental officials gave the action statement a desirable rating, although only two consumers considered it important on the statewide basis. Six out of eleven respondents in the important--desirable category commented that the appeal of social acceptance was meaningful.

Emphasize the Pride in Owning a Solar Heating and/or Cooling System

The interview respondents reacted to this action statement according to group types. Thus, of the six respondents who ranked this action statement neutral or lower on statewide importance, four were contractors; of the five respondents who ranked this action statement as important, four were architects. Another interesting finding is that three of those four architects had no other comments on this action statement. The fifth architect also responded with no verbalized comment. The other respondent who had given this action statement an important statewide rating also had no other comments. The significance of this pattern is not clear.

Those who rated this action statement highest on both scales generally commented that the pride in owning a solar heating and/or cooling system is a good technique. Two respondents felt that pride in solar-energy system ownership would stem from the demonstrated effectiveness of the solar heating and/or cooling system. On the other hand, the two individuals who rated this action statement low did not like this approach: "snob appeal is wrong." Another comment concerned the desirability of placing the emphasis on the back-to-nature idea, on the naturalness of solar energy.

The two interviewees who downgraded statewide importance relative to personal desirability were contractors. One contractor indicated that an owner should be proud of his solar heating and/or

cooling system. The other contractor was the individual who made the back-to-nature plea.

Award a Tax Subsidy for the Use of Solar Heating and/or Cooling Systems

This action statement had just as many high ratings of very important and/or very desirable as any other action statement. What lowered the arithmetic mean composite score was a rather large number of interviewees who gave this action statement low ratings of unimportant--undesirable and very unimportant--very undesirable.

As previously stated, the people who opposed this action statement did so because they opposed governmental action. All five interviewees who rated this action statement as undesirable on the personal scale did so on the basis of their opposition to governmental intervention. One respondent referred to governmental domination as socialism. Another interviewee compared the action to New York City's predicament. Two people declared that the government was already doing too much in the solar-energy area. Two interviewees who gave this action statement an unimportant statewide rating said that the money should be put into research rather than into subsidies.

A rather large number of those who rated this action statement as very important--very desirable gave altogether different comments. While many interviewees felt that this was not a highly effective action, they felt that the government was obliged to do it: "to encourage development," "to offset the negative subsidies of fossil fuels," and "because the energy problem is too critical to ignore."

Between these two extremes was an equally large group of interviewees. On the statewide-importance level, the respondents tended to go along with the action statement because they thought that it would be effective. However, those interviewees who rated the action statement as desirable on a personal basis tended to question the value of subsidies and the incentive approach. Another respondent stated that he did not think the long-term effect of the action statement would be desirable; he also indicated that such an action would be costly to taxpayers.

Six interviewees, or 20 percent, rated this action statement lower on statewide importance than on personal desirability. Three of these six individuals were financiers who strongly opposed subsidies and incentives. One consumer questioned the tax subsidy approach while the two other consumers were in favor of tax subsidies.

Three contractors and three energy suppliers gave this action statement the very desirable rating on the personal scale. Three governmental officials also judged the action statement as important from the statewide perspective, while the financiers rated the action statement from the neutral rating upward on the statewide perspective.

Make Solar Heating Systems that Require No Backup Systems

The difference between those who favored this action statement and those who did not were quite evident. Those interviewees who marked the action statement as undesirable on the personal scale indicated that the action statement was impossible to accomplish. The moderate respondents agreed that it would be possible to eliminate backup systems but that the cost of doing it was

prohibitive, while the interviewees who ranked this item highest doubted that backup systems could be eliminated eventually.

One energy supplier said that solar-energy systems should be considered as backups to conventional heating and cooling systems. Another interesting comment about this action statement was that progress would be delayed if the public waited until a solar-energy system without a backup could be devised. Another commentor approached the same point in a different manner: "the more requirements, the more delays in the total program." One of the interviewees reasoned that backup-system requirements are related to the geographic location of the heating and cooling system.

Group response patterns were quite clearly delineated on this action statement. At least three of the five members in the following groups responded accordingly: energy suppliers, undesirable; contractors, neutral; architects and consumers, desirable; financiers, very desirable.

Establish the Same Hookup Charge for Conventional and Solar Backup Systems

The responses on this action statement were so varied that they appeared to be almost patternless. For example, 16 of the 36 categories received at least one response, and 11 respondents gave lower ratings from one perspective than from the other perspective.

Two of the five interviewees who gave this action statement the low statewide ratings of unimportant and very unimportant said that a larger hookup charge should be levied against those with solar-energy backup systems so that conventional heating and cooling system users will not be subsidizing those using solar-energy backup systems. One respondent said that hookup charges for solar-energy

backup systems should not be higher because the higher charges will cause consumer resistance. While one person said that the emphasis should be placed on research, another interviewee said that the matter of hookup charges was not important to the state.

There was no clear-cut pattern of responses among the seven interviewees who gave the action statement the rating of very important--very desirable. There were two persons who referred to the lack of solar-energy system development. Gas or electrical utilities were mentioned in three responses. A contractor stated that Community Public Service was not interested in solar energy, while a financier said that Southern Union Gas was interested in solar energy. An architect who was sympathetic to gas companies indicated that gas companies should charge a higher hookup fee for solar-enegy backup systems but that electric companies should not charge a higher hookup fee for solar-energy backup systems. One respondent declared that "those guys are a monopoly with a guaranteed profit"; another stated that the "municipal government should be sensitive to this."

Between the extreme ratings, the commentors were sympathetic toward higher hookup charges for those with solar-energy systems which required backup systems. Four out of six respondents in the neutral category and five out of ten respondents in the important category shared this viewpoint. Other typical comments from this group included: "they (utilities) can't supply consumers now," and "(the statement is a) time-dependent question."

Some group-pattern responses were evident. Three out of five contractors rated the action statement as very desirable on the personal scale. Three out of five energy suppliers and governmental

officials rated the action statement in the personally desirable category. The seven respondents who downgraded statewide importance over personal desirability included two contractors, two energy suppliers, two governmental officials, one architect, and no consumers or financiers. Those interviewees who downgraded personal desirability showed no signficant response patterns. While two members of this group were financiers, neither gave a comment which was related to the economic aspects of different hookup charges.

Establish a Fund to Guarantee Mortgage Loans for Houses with Solar Heating and/or Cooling Systems

Of the three interviewees who indicated that this action statement was very unimportant from the statewide perspective, two of them said that this action statement was unnecessary because such guaranteed loans already exist. The third respondent expressed disfavor toward any special considerations for those people with solar-energy systems. On the other hand, the six interviewees who rated this action statement as very important included five people who thought that a fund to guarantee mortgage loans for solar heated and/or cooled houses was needed. The other respondent commented that the Federal Housing Administration could take care of this matter. One of the respondents, a contractor, listed nine other aspects of this topic because he felt that this action statement dealt with the most important factor in the home-building industry.

One respondent suggested that the action statement might be tied to a rebate to help reduce the down payment, for example. Another respondent was against this action statement because the fact that an individual's house has a solar heating and/or cooling

system does not make the house a good one. Another interviewee commented that solar systems have little or no resale value.

No significant group-response patterns were apparent. Among the three respondents who rated this action statement lower on a personal basis than on a statewide basis were two contractors. Both contractors thought that a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems was an attractive action.

Implement Manpower Training Programs for Solar-Related Jobs

Six interviewees rated this action statement as unimportant from the statewide perspective. Two members of this group were concerned with governmental involvement, while three members of the group felt that there was no need for special training programs for solar-energy system technicians. The sixth respondent said that the demand for trained personnel would not come until solar-energy systems had become more refined than they presently are.

There were three respondents who rated this action statement as very important on the statewide basis. These three commented rather extensively about the action statement. Some of their suggestions were that the training should be targeted toward young people and that this training could be introduced in high schools, in factories, or in apprenticeship programs.

Among the seven interviewees who rated this action statement as important from the statewide perspective were three people who did not think that manpower training was too important--that as more solar buildings are constructed, the necessary crafts will develop. Two respondents thought that this action statement might be necessary, and two respondents related the action statement to schools, especially state vocational schools.

Only one group, architects, had as many as three responses in the same category: important--desirable. Only three respondents rated the action statement lower from a statewide perspective than from a personal perspective. Two of these respondents said that there was no need for training. The other respondent commented that universities and vocational schools should promote solar-technology training.

Emphasize that Traditional Heating and Cooling Systems are Outmoded

This action statement elicited four no comment ratings from both perspectives. A concern of these respondents was the definition of the term "outmoded." One respondent said that conventional systems would be outmoded when there is no more oil and gas, and another respondent, an electrical energy supplier, declared that gas is outmoded. Two of the eight interviewees who rated this action statement as unimportant on a statewide basis made no comment, but all of the remaining members of the group, except one, denied that traditional heating and cooling systems are outmoded. Some of their arguments were: "millions of conventional systems are still in use," "coal is still in adequate supply," and "the problem is really in fuel cost." The other respondent in this category felt that solar-energy systems would sell themselves after they were fully developed.

Only three interviewees judged this action statement as very important on a statewide basis. Two consumers who were members of this group agreed that conventional heating and cooling systems are outmoded.

Interviewees tended to give lower personal ratings than statewide ratings on this action statement. One of the lower statewide ratings was given by an energy supplier who rated this action

statement as no comment on the statewide basis and neutral on the personal basis. He said that people could not call fireplaces outmoded when 99 percent of the homes in the Santa Fe area have fireplaces.

Of the four interviewees who downgraded the personal perspective, three disagreed with this approach because it was a negative approach. The fourth member of the group disagreed with the statement--not necessarily the approach. One person disagreed with the statement, although he indicated that he would change his mind if solar-energy systems could be proven.

Four out of five financiers rated the action statement as having neutral desirability. Three out of five architects and governmental officials rated the action statement in the undesirable category.

SUMMARY OF SOLAR-RELATED INTERVIEW DATA

An analysis of the interview data regarding solar-related attitudes yielded two types of data: (1) the placement of the action statements from the statewide and personal perspectives and (2) the reasoning behind these placements.

The action statements appeared to cluster around certain rankings, and they were grouped accordingly: The five highest ranking action statements comprise the upper range category. The next two action statements comprise the transitional action statements. Following these seven action statements are eight action statements which comprise the middle range category, while the eight lowest ranking action statements are referred to as the lower range action statements.

Action Statement Placement from the Interview Data

The five highest and closely clustered action statements had arithmetic mean composite ratings above 4.500. The highest rated action statement was: Make the initial cost of solar heating and/or cooling systems comparable to conventional systems. It ranked far above the other economic factors, such as reducing the long-term payback period, reducing maintenance costs, and reducing repair costs; these other economic items were placed in the middle range category.

The action statement rated second highest was: Provide more information on solar energy. This item was greatly desired by all key groups, especially consumers. Respondents said that they wanted higher quality information--less technical, more reliable, and more usable information. A number of respondents suggested that governmental agencies and universities should be the ones to provide more information about solar-energy systems.

Other upper range action statements included those dealing with the dependability of solar-energy systems, the making of energy consumption into a critical factor in house design, and the availability of solar heating and/or cooling units.

From the comments relating to the five previously mentioned action statements, a unified picture of the public's conceptualization of the need for solar-energy systems can be developed. Many of the respondents indicated that something needs to be done about the energy crisis. The respondents preferred a readily available and long-term dependable solar-energy system which would not cost more than conventional heating and/or cooling systems. The respondents were not sure that such a system now exists--perhaps because

they have not received suitable information about solar-energy systems.

The transitional action statements included making houses with solar heating and/or cooling systems as attractive as nonsolar houses and using solar-energy systems to reduce pollution. Both of these action statements were affected by the nonsolar attitudes toward aesthetics and pollution. This may account for the placement of these items between the upper range category and the middle range category.

Lower maintenance costs, lower long-term payback periods, and major modifications in house construction are economic considerations which fall in the middle range category. Stimulating the use of solar energy by emphasizing the energy shortage, reasonable temperatures and variations, strong warranties, lower repair costs, and building codes are other middle range factors which have a moderate impact on the diffusion of solar-energy technology.

The action statements which according to their placement appear to have a negative influence on the diffusion of solar-energy technology include those dealing with social acceptability, pride in ownership, tax subsidies, backup systems, hookup charges, guaranteed mortgage loans, manpower training programs, and the outmoded nature of traditional heating and cooling systems.

Comments and Attitudes from the Interview Data

Four general types of comments were expressed by the interview respondents. These included: (1) the state of the art--how much progress has been achieved in solar-energy development, (2) the need for further solar-energy research and development, (3) the attitudes toward factors which are specifically related to

solar-energy systems, and (4) the attitudes of a miscellaneous nature. Each of these types of comments are summarized below.

Respondents generally had one of two attitudes toward the present state of solar-energy system development. One of the attitudes was that solar-energy technology was sufficiently developed, that a person could now build a solar-energy system which would satisfactorily meet his heating and cooling needs. Not only would this system be efficient, but also it would be attractive, meet building codes, have long-term dependability, require only a normal backup system, and be socially acceptable, thus creating pride in the ownership of a solar-energy system.

The members of the other group expressed an opposing viewpoint. This group doubted that the initial costs of solar-energy systems could ever be made comparable to that of conventional systems, that solar-energy systems would be readily available for a very long time, that solar-energy systems could be functional without backup systems, and that solar-energy system repair costs would ever be very low.

A number of interview respondents remarked about solar-energy system research and development. Some interviewees expressed an attitude that most, if not all, of the problems associated with solar-energy technology could be solved in the not-too-distant future through additional research and development. The respondents commented that research and development activities should be directed toward the following: easing of pollution problems through the use of solar energy; decreasing the payback period for solar systems; designing systems which do not require major modifications in

construction techniques and which can adapt to variations in temperature requirements; differing utility hookup charges for solar and nonsolar users; modifying building codes to accommodate solar-energy technology; and training programs for solar-related workers.

A number of economic concerns relating to solar-energy systems were expressed by the interviewees. These comments included: emphasizing an energy shortage might drive up the price of fuels; low maintenance and repair costs of solar-energy systems are beneficial to low-income groups; long-term payback costs are directly related to the initial costs; initial costs of the heating and/or cooling system could be tied to the cost of the building; guaranteed-mortgage loans for solar systems are already available; social acceptability has economic connotations; subsidies are costly to the taxpayer; building a solar-energy system without a backup is possible, but the cost of doing so is prohibitive; and finally, the cost and availability of fuels is really what is making conventional heating and/or cooling systems outmoded.

The respondents often expressed a negative attitude toward some of the action statements. Typical of this approach was that emphasizing an energy shortage is a form of fear advertising, that social acceptability is a wrong approach, that pride in ownership is really a form of snob appeal, that stressing that conventional systems are outmoded is simply not a true statement, and that solar energy is nonpolluting is not true because its widespread use would pollute large land areas by covering them with collection equipment.

Some interviewees expressed belief or disbelief in ordinarily acceptable aspects of solar energy. Thus, one person said he did

not believe in retrofitting; another person declared that hot-air systems were more dependable than hot-water systems; one person commented that the use of long-term warranties was already the acceptable practice; an interviewee said that temperature variations with a solar-energy system are simply a design constraint.

Several statements made by respondents indicated keen insight. For example, one interviewee commented, regarding hookup charges, that gas companies should be grateful to solar-energy users because the gas companies do not have enough gas to supply their present customers. Another person suggested that the more requirements which are placed on a solar-energy system--such as the elimination of backup systems--the more delay there will be in the diffusion of solar-energy systems.

Concluding Statement

In conclusion, the analysis of comments revealed that each respondent brought to the interviews a set of attitudes and values, many of which influenced his responses. Members of each interview group tended to view the action statement in a similar manner from the statewide perspective, but they often disagreed with each other from the personal perspective. This fact suggests that no program of technology diffusion can be implemented without a thorough analysis of not only the individual characteristics of the members of the key groups but also the key-group characteristics as well.

CHAPTER V

ANALYSIS OF THE QUESTIONNAIRE FINDINGS

The main purpose of the questionnaire data was to verify the value placement of the action statements from the interview data. If the first objective was attained, then the second one was to statistically determine from the questionnaire data what factors were the influencing ones, how much influence did they have, and what differences existed among the key groups.

A total of 299 questionnaires were included in the study. This total included the following counts from the key groups: architects, 91; consumers, 60; contractors, 27; energy suppliers, 41; financiers, 43; and governmental officials, 37.

The questionnaire data were analyzed using several statistical methods in order to accomplish the objectives. Three types of analyses were used: (1) tabulation and descriptive statistics: arithmetic means, standard deviations, etc.; (2) crosstabulation, Chi-square, and Cramer's V values of relationship; and (3) analysis of variance and post-hoc tests, utilizing Duncan's multiple range test. Each of these types of analyses is discussed in the following sections.

The first type of analysis was aimed at the first objective, the second and third types of analyses were aimed toward the second objective.

Tabulation and Descriptive Statistics

The questionnaire responses were tabulated on each action statement for the total group and for each of the six key groups. In addition, the arithmetic means, standard deviations, and percentage of responses in each category were calculated for both the statewide and personal perspectives as well as the arithmetic mean composite score of the two perspectives. The tables reporting the results of these calculations are presented in Appendix H.

Utilizing the composite scores, the items were ranked in descending order of the scores for the total and for each key group. This information is presented in Table 2.

In order to compare the ranks of the questionnaire responses with interview responses, some adjustments had to be made in the interview rankings. The initial cost statement had been eliminated in favor of the long-term payback period item because the interviewers had reported that interviewees tended to view the long-term costs the same way as initial cost. Interviewers had also indicated that the maintenance action statement should be combined with the repair statement on the questionnaire. These interviewer-suggested changes were incorporated by the investigators into the questionnaire instruments. Therefore, to make rankings comparable, the ranking on the initial cost statement was not included, and the composite arithmetic scores of the maintenance and the repair statements were averaged, with the arithmetic mean score of 4.035 being placed in the adjusted interview rankings as number ten. The ranking of ten roughly corresponds to the average of the two rankings of eight and thirteen--the maintenance and repair items. The adjusted rankings are also presented in Table 2.

Table 2. Rating of Questionnaire Action Statements According to Total Groups and Each Key Group by Descending Order of Arithmetic Mean Composite Scores of Statewide Importance and Personal Desirability

Action Statement	Composite Score
TOTAL GROUPS	
Design Solar Systems with Long-Term Dependability	4.7055
Provide More Information on Solar Energy	4.6780
Make Energy Consumption a Critical Factor in House Design	4.5133
Make Solar Heating and/or Cooling Units as Available as Conventional Units	4.4425
Change the Building Codes to Accommodate Solar Heating and/or Cooling Systems in Homes	4.4390
Make Houses with Solar Heating and/or Cooling Systems as Attractive as Nonsolar Houses	4.3265
Develop Solar Heating and/or Cooling Systems Which do not Require Major Modifications in House Construction	4.3250
Develop Solar Systems with Lower Maintenance and Repair Costs than for Conventional Systems	4.2750
Issue Strong Warranties for Solar Heating and/or Cooling Systems	4.2195
Use Solar Energy Systems to Reduce Pollution in New Mexico	4.1595
Design Solar Heating and/or Cooling Systems with (Reasonable Temperatures) and Variations	4.1220
Make the Long-Term Cost (Payback Period) of Solar Heating and/or Cooling Systems Lower than for Conventional Systems	4.0490
Emphasize the Possibility of an Energy Shortage to Stimulate the Use of Solar Energy	4.0445

Table 2. Continued.

Action Statement	Composite Score
TOTAL GROUPS Continued	
Make Solar Heating Systems that Require No Backup Systems	4.0110
Emphasize that Solar Heating and/or Cooling Systems are Socially Acceptable to New Mexicans	3.8375
Establish the same (utility hookup charge) for conventional and solar backup systems	3.6215
Implement Manpower Training Programs for Solar-Related Jobs	3.6145
Emphasize the Pride in Owning A Solar Heating and/or Cooling System	3.5400
Award a Tax Subsidy for the Use of Solar Heating and/or Cooling Systems in Houses	3.4980
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	3.2710
Emphasize that Traditional Heating and Cooling Systems are Outmoded	2.9230
ARCHITECTS	
Provide More Information on Solar Energy	4.6345
Design Solar Systems with Long-Term Dependability	4.6150
Make Energy Consumption a Critical Factor in House Design	4.5330
Make Solar Heating and/or Cooling Units as Available as Conventional Units	4.4835
Make Houses with Solar Heating and/or Cooling Systems as Attractive as Nonsolar Houses	4.3635
Change the Building Codes to Accommodate Solar Heating and/or Cooling Systems in Homes	4.3000

Table 2. Continued.

Action Statement	Composite Score
ARCHITECTS Continued	
Develop Solar Heating and/or Cooling Systems Which do not Require Major Modifications in House Construction	4.2110
Make the Long-Term Cost (Payback Period) of Solar Heating and/or Cooling Systems Lower than for Conventional Systems	4.0855
Emphasize the Possibility of an Energy Shortage to Stimulate the Use of Solar Energy	4.0622
Issue Strong Warranties for Solar Heating and/or Cooling Systems	4.0285
Award a Tax Subsidy for the Use of Solar Heating and/or Cooling Systems in Houses	3.7080
Make Solar Heating Systems that Require No Backup Systems	3.6850
Emphasize that Solar Heating and/or Cooling Systems are Socially Acceptable to New Mexicans	3.6415
Design Solar Heating and/or Cooling Systems with (Reasonable Temperatures) and Variations	3.6085
Establish the same (utility hookup charge) for conventional and solar backup systems	3.5845
Implement Manpower Training Programs for Solar-Related Jobs	3.4885
Emphasize the Pride in Owning a Solar Heating and/or Cooling System	3.3885
Emphasize that Traditional Heating and Cooling Systems are Outmoded	2.8155

Table 2. Continued.

Action Statement	Composite Score
CONSUMERS	
Design Solar Systems with Long-Term Dependability	4.8000
Provide More Information on Solar Energy	4.7915
Develop Solar Systems with Lower Maintenance and Repair Costs than for Conventional Systems	4.5165
Make Solar Heating and/or Cooling Units as Available as Conventional Units	4.4835
Make Energy Consumption a Critical Factor in House Design	4.4745
Develop Solar Heating and/or Cooling Systems Which do not Require Major Modifications In House Construction	4.4080
Issue Strong Warranties for Solar Heating and/or Cooling Systems	4.3845
Design Solar Heating and/or Cooling Systems with (Reasonable Temperatures) and Variations	4.3245
Make the Long-Term Cost (Payback Period) of Solar Heating and/or Cooling Systems Lower than for Conventional Systems	4.2755
Make Houses with Solar Heating and/or Cooling Systems as Attractive as Nonsolar Houses	4.2750
Use Solar Energy Systems to Reduce Pollution in New Mexico	4.2640
Emphasize the Possibility of an Energy Shortage to Stimulate the Use of Solar Energy	4.2115
Make Solar Heating Systems that Require No Backup Systems	4.1405

Table 2. Continued.

Action Statement	Composite Score
CONSUMERS Continued	
Emphasize that Solar Heating and/or Cooling Systems are Socially Acceptable to New Mexicans	3.9545
Establish the same (utility hookup charge) for conventional and solar backup systems	3.7965
Award a Tax Subsidy for the Use of Solar Heating and/or Cooling Systems in Houses	3.7315
Emphasize the Pride in Owning a Solar Heating and/or Cooling System	3.6925
Establish a fund to guarantee mortgage loans for houses with solar heating and or cooling systems	3.6050
Emphasize that Traditional Heating and Cooling Systems are Outmoded	3.2440
CONTRACTORS	
Design Solar Systems with Long-Term Dependability	4.7410
Provide More Information on Solar Energy	4.6485
Develop Solar Heating and/or Cooling Systems Which do not Require Major Modifications in House Construction	4.6115
Change the Building Codes to Accommodate Solar Heating and/or Cooling Systems in Homes	4.5185
Make Solar Heating and/or Cooling Units as Available as Conventional Units	4.4650
Make Solar Heating Systems that Require No Backup Systems	4.4325
Make Energy Consumption a Critical Factor in House Design	4.4275

Table 2. Continued.

Action Statement	Composite Score
CONTRACTORS Continued	
Issue Strong Warranties for Solar Heating and/or Cooling Systems	4.3395
Design Solar Heating and/or Cooling Systems with (Reasonable Temperatures) and Variations	4.2080
Emphasize the Possibility of an Energy Shortage to Stimulate the Use of Solar Energy	4.0035
Emphasize that Solar Heating and/or Cooling Systems are Socially Acceptable to New Mexicans	3.9230
Establish the same (utility hookup charge) for conventional and solar backup systems	3.8890
Implement Manpower Training Programs for Solar-Related Jobs	3.8435
Make the Long-Term Cost (Payback Period) of Solar Heating and/or Cooling Systems Lower than for Conventional Systems	3.7935
Emphasize the Pride in Owning a Solar Heating and/or Cooling System	3.7265
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	3.2590
Award a Tax Subsidy for the Use of Solar Heating and/or Cooling Systems in Houses	3.2300
Emphasize that Traditional Heating and Cooling Systems are Outmoded	3.0030
ENERGY SUPPLIERS	
Design Solar Systems with Long-Term Dependability	4.6830

Table 2. Continued.

Action Statement	Composite Score
ENERGY SUPPLIERS Continued	
Provide More Information on Solar Energy	4.6345
Make Energy Consumption a Critical Factor in House Design	4.5625
Issue Strong Warranties for Solar Heating and/or Cooling Systems	4.3975
Make Solar Heating and/or Cooling Units as Available as Conventional Units	4.2500
Change the Building Codes to Accommodate Solar Heating and/or Cooling Systems in Homes	4.2180
Design Solar Heating and/or Cooling Systems with (Reasonable Temperatures) and Variations	4.1175
Develop Solar Systems with Lower Maintenance and Repair Costs than for Conventional Systems	4.0005
Emphasize that Solar Heating and/or Cooling Systems are Socially Acceptable to New Mexicans	3.8905
Make the Long-Term Cost (Payback Period) of Solar Heating and/or Cooling Systems Lower than for Conventional Systems	3.8845
Make Solar Heating Systems that Require No Backup Systems	3.7465
Implement Manpower Training Programs for Solar-Related Jobs	3.7050
Emphasize the Possibility of an Energy Shortage to Stimulate the Use of Solar Energy	3.6365
Establish the same (utility hookup charge) for conventional and solar backup systems	3.2415
Award a Tax Subsidy for the Use of Solar Heating and/or Cooling Systems in Houses	2.8460
Emphasize that Traditional Heating and Cooling Systems are Outmoded	2.6530

Table 2. Continued.

Action Statement	Composite Score
FINANCIERS	
Design Solar Systems with Long-Term Dependability	4.6710
Provide More Information on Solar Energy	4.6070
Make Houses with Solar Heating and/or Cooling Systems as Attractive as Nonsolar Houses	4.3195
Develop Solar Heating and/or Cooling Systems Which do not Require Major Modifications in House Construction	4.3190
Issue Strong Warranties for Solar Heating and/or Cooling Systems	4.2710
Develop Solar Systems with Lower Maintenance and Repair Costs than for Conventional Systems	4.1890
Emphasize that Solar Heating and/or Cooling Systems are Socially Acceptable to New Mexicans	3.8485
Make Solar Heating Systems that Require No Backup Systems	3.8440
Establish the same (utility hookup charge) for conventional and solar backup systems	3.8030
Make the Long-Term Cost (Payback Period) of Solar Heating and/or Cooling Systems Lower than for Conventional Systems	3.7320
Award a Tax Subsidy for the Use of Solar Heating and/or Cooling Systems in Houses	3.3380
Emphasize that Traditional Heating and Cooling Systems are Outmoded	2.9380
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	2.8135

Table 2. Continued.

Action Statement	Composite Score
GOVERNMENTAL OFFICIALS	
Design Solar Systems with Long-Term Dependability	4.8195
Provide More Information on Solar Energy	4.7500
Change the Building Codes to Accommodate Solar Heating and/or Cooling Systems in Homes	4.4720
Make the Long-Term Cost (Payback Period) of Solar Heating and/or Cooling Systems Lower than for Conventional Systems	4.3355
Make Solar Heating Systems that Require No Backup Systems	4.2000
Emphasize the Possibility of an Energy Shortage to Stimulate the Use of Solar Energy	4.1965
Issue Strong Warranties for Solar Heating and/or Cooling Systems	4.0635
Emphasize that Solar Heating and/or Cooling Systems are Socially Acceptable to New Mexicans	4.0145
Use Solar Energy Systems to Reduce Pollution in New Mexico	3.9730
Award a Tax Subsidy for the Use of Solar Heating and/or Cooling Systems in Houses	3.6860
Implement Manpower Training Programs for Solar-Related Jobs	3.6175
Establish the same (utility hookup charge) for conventional and solar backup systems	3.4805
Emphasize that Traditional Heating and Cooling Systems are Outmoded	2.9125

Table 2 reveals that the top six questionnaire rankings also include the top five ranking interview statements. These six action statements are:

Design solar systems with long-term dependability

Provide more information about solar energy

Make energy consumption a critical factor in house design

Make solar heating and/or cooling units as available as conventional units

Change the building codes to accommodate solar heating and/or cooling systems in homes

Make houses with solar heating and/or cooling systems as attractive as nonsolar houses

The table also reveals that the eight lower ranking items from the interviews are also the eight lower ranking items from the questionnaires, although the internal rankings are slightly altered. The coefficient of rank correlation was calculated based on the rankings from the interviews and from the questionnaire. The resulting coefficient rank of correlation is 0.88. This close correlation would be considerably closer if the wide variations on the rankings of the building codes action statement were eliminated. Close scrutiny reveals that 33.7 percent of the correlation weight can be assessed to the building codes statement.

The coefficient of rank correlation was also computed for each key group, although additional adjustments for items omitted from individual key-group questionnaires were necessary. The coefficients for each key group, plus the items with greatest correlation variance, the percentage of the variance explained by each key group, and the ranking direction of each group is presented in Table 3. The ranking direction column of the table is noteworthy because it

Table 3. Comparison of Coefficient of Rank Correlation for Key-Group Questionnaire Rankings to Total Interviewee Rankings

Key Group	Coefficient of Rank Correlation	Action Statements of Maximum Variability	Percent of Variance Explained	Ranking Direction
Architects	0.88	Change the building codes to accommodate solar heating and/or cooling systems in homes	22.3%	Higher
		Design solar heating and/or cooling systems with reasonable temperatures and variations (±10 degrees)	32.1%	Lower
Consumers	0:83	Develop solar systems with lower maintenance and repair costs than for conventional systems	25.5%	Higher
Contractors	0.69	Make solar heating systems that require no backup systems	21.1%	Higher
		Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	21.1%	Lower
Energy Suppliers	0.78	Emphasize the possibility of an energy shortage to stimulate the use of solar energy	42.7%	Lower
Financiers	0.83	Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	58.1%	Lower
Government Officials	0.76	Use solar energy systems to reduce pollution in New Mexico	40.9%	Lower

indicates the higher or acceptance factors and the lower or rejection factors for the various key groups.

As might be expected, the coefficients of rank correlation of the individual key groups were quite high, but not so high as that for the total group. Architects had the same coefficient of rank correlation as the total group. The coefficient of rank correlation was lowered a significant amount by only one or two items within each key group. Thus, 40 percent or more of the relationship is explained by these few action statements in all of the key groups except consumers. In this circumstance, five other action statements explained 65 percent of the relationship. Six of the nineteen action statements in the consumer questionnaire explain 80 percent of the relationship. Another interesting finding is that the action statement concerning long-term payback periods is the only one which appears in more than one key group's items of maximum variability.

Table 2 reveals that the total group had fourteen factors with composite scores above 4.00, which is considered at the acceptance level and only one which fell below 3.00, the rejection factor. Each of the key groups differed with the total on specific items. For example, consumers had no rejection factors but 13 acceptance factors. Table 4 compares the key groups with the number of acceptance and rejection factors.

The one rejection factor which was repeated for four key groups was: Emphasize that traditional heating and cooling systems are outmoded. The energy suppliers included: Award a tax subsidy for the use of solar heating and/or cooling systems in houses. Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems was the action statement ranked lowest by the financiers.

Table 4. The Number of Acceptance and Rejection Factors According to Questionnaire Key Groups

Key Group	Number of Acceptance Factors	Number of Rejection Factors
Architects	10	1
Consumers	13	0
Contractors	10	0
Energy Suppliers	8	2
Financiers	6	2
Governmental Officials	8	1

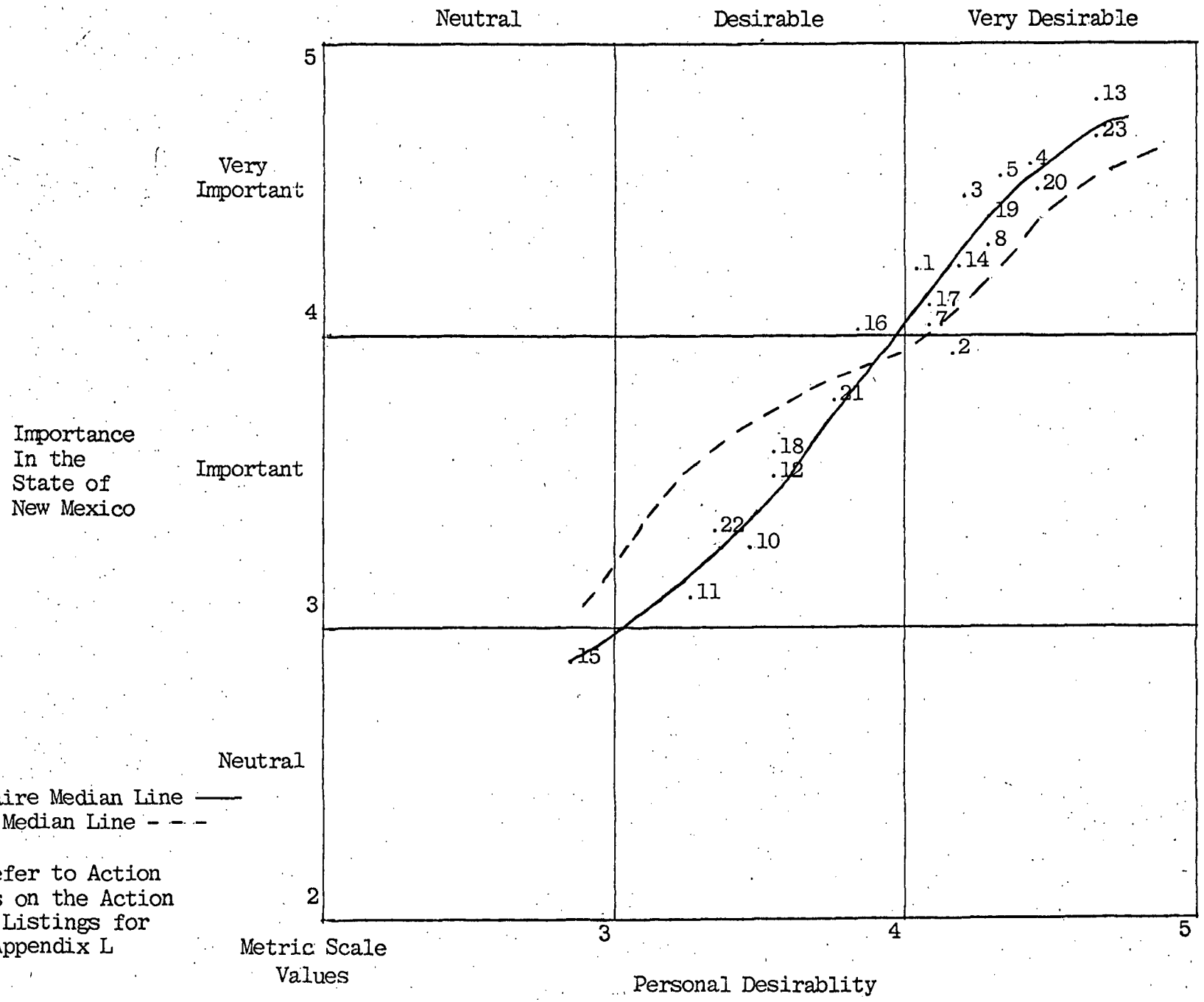
The arithmetic mean scores on each action statement were used to produce a scattergram for comparison with the one produced from the interview data. This scattergram is Figure 2. As might be expected from the high correlation between the interview and questionnaire data, the two scattergrams are quite similar in appearance. The most significant difference is revealed when one scattergram is placed over the other.

The scores on statewide importance are almost universally higher in the upper range for the questionnaire responses than for the interview responses. The questionnaire responses are slightly lower in the lower ranking categories.

A median line was drawn for each scattergram distribution. When the total responses--interview and questionnaire--are superimposed on one another, an angular rotation of about 20 degress at the cross-over point is evidenced as shown in Figure 2.

Differences in responses stated above are also evidenced by the number of items for which the statewide arithmetic mean score is greater than the personal arithmetic mean score as shown on pages 255-256. There are five action statements which have a least 0.1 higher arithmetic mean scores on the statewide perspective, but only three action statements have arithmetic mean scores on the personal perspective of 0.1 or higher. The scores on the other 13 action statements are within 0.1 units of each other. It may be recalled on the interviewee responses that the ratio strongly favored the personal perspective for the interviews, with seventeen action statements higher on a personal perspective and only four action statements having higher scores from the statewide perspective. Only

Figure 2. Scattergram of Arithmetic Mean Scores for each Questionnaire Action Statement by Statewide Importance and Personal Desirability and Questionnaire and Interview Median Lines



two action statements had the same ratings from both perspectives, thus, it appears that questionnaire respondents gave higher statewide ratings than interviewees did, but the questionnaire ratings tended to correspond to their personal ratings. The result was that a very large number of questionnaire ratings had an equal arithmetic mean from both the statewide and personal perspectives.

Summarizing the results of this phase of analysis, the investigators were able to conclude from the tabulations and from other descriptive statistics, the data from the questionnaires are extemely similar to the data from the interviews. Further analysis of the questionnaire data should yield conclusions which are also applicable to the interview data.

Crosstabulation Analyses

The Chi-square values were calculated to determine the strength of the relationship between each action statement and the responses from the key groups. It was assumed that where the calculated value of Chi-square exceeded the critical value, a person could be reasonably certain that a relationship existed between the group perceptions of the importance or desirability of that action statement.

The strength of this relationship measure, Phi or Cramer's V, was calculated for each crosstabulation table. These statistics provide a rough measure of the strength of the relationship between two variables and are, therefore, analogous to the coefficient of determination in regression analyses. As with the coefficient of determination, the strengths of Cramer's V measure the range between zero and one. Zero indicates no relationship and one reflects a perfect monotone relationship.

The tabulations showed that few responses fell into the lower

ratings of very unimportant, unimportant, very undesirable, and undesirable. Statistically, there is good reason for having at least five responses on each scale. To overcome this problem of having too few of the responses in the lower categories, collapsed-scale values were used, and additional computer analyses were performed. On the collapsed scale, neutral responses had a value of one; important and desirable responses had a value of two; and very important and very desirable responses had a value of three. Close scrutiny revealed that the second analysis was much more meaningful than the former analysis. Hence, the collapsed scale analysis was used.

Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems was the action statement with the highest significance level of 99.5 percent. Two other action statements were significant near the 98 percent level. A total of eight action statements had a significance level of 95 percent or greater. Two of these eight action statements had 95 percent significance from both perspectives. The six action statements which have a level of significance of greater than 95 percent from at least one perspective include five which rank in the lower half of the total response distribution and four which rank in the lower 25 percentile. This fact indicates that these items have a significant influence toward the rejection of solar systems. The statements, their level of significance, and the corresponding values for their alternate perspectives are shown in Table 5.

The action statements which had a significance level of 80 percent or greater (significance of less than .2000) are listed in Appendix I. Also listed in the appendix are the statements in

Table 5. Questionnaire Action Statements Having the Highest Significance According to Crosstabulation Analysis

Action Statement and Alternative Perspective Significance	Statewide Perspective Significance*	Personal Perspective Significance*
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	.0045	.0370
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	.0203	.1520
Develop solar systems with lower maintenance and repair costs than for conventional systems	.0554	.0212
Award a tax subsidy for the use of solar heating and/or cooling systems in houses	.0446	.1007
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	.0513	.3669
Establish the same utility hookup charge for conventional and solar backup systems	.0523	.1104
Make solar heating and/or cooling units as available as conventional units	.3020	.0967

*Multiply by 100 to convert to percent significance level.

descending order of the Cramer's V values. One may note that the first twelve items contain all six pairs from both perspectives. The six pairs of viewpoints apply to the following action statements:

Use solar energy systems to reduce pollution in New Mexico

Develop solar systems with lower maintenance and repair costs than for conventional systems

Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans

Establish the same utility hookup charge for conventional and backup systems

Award a tax subsidy for the use of solar heating and/or cooling systems in houses

Make the long-term cost (payback) of solar heating and/or cooling systems lower than for conventional systems

Coincidentally, the Cramer's V values of these items all exceed .16, which indicates a fairly strong relationship. It may be noted that none of the above-mentioned action statements are ranked in the upper third while one half of the action statements are ranked in the lower third, thus indicating their negative influence.

Analysis of Variance

Analysis of variance was performed to test approximately the same hypotheses as the crosstabulations, but in a different manner. For this calculation, the importance or desirability measures are treated as if they have a constant unit of metric measurement as opposed to a category which was used in the previous section's calculations. In each analysis of variance test, the key group is the independent variable and the importance or desirability is the dependent variable. If the calculated value of F exceeded the critical value, it was inferred that a difference in perception of importance or desirability existed somewhere among the key groups. In order to determine where the differences were located, a post-hoc

test was used to extend the basis for inference. The test chosen was Duncan's multiple-range test which investigates all possible pairs of subsamples for each item. The output lists the action statement, the relationships as F probabilities, and all the pairs where relationships or covariance were found.

To determine where significant differences existed, a table was constructed in which all of the combinations listed on the computer printout were marked; the blanks in the table were the data that was missing. The F probability, which is of the same order as significance level for Chi-square values, was also calculated, and this revealed how significant the differences in perception were.

Twenty variances in relationships were found to exist between at least two key groups on the statewide or personal perspectives. These statements, their F-probability values, and the relating pairs of key groups are listed in Appendix J. All values of the F probability indicate a significance at or above the 90 percent level. Four action statements had levels of significance at 99.5 percent, and twelve action statements had levels of significance above 95 percent. It may be noted that values for both viewpoints appear for the six action statements which have the highest significance values listed in Appendix J. These action statements include:

Award a tax subsidy for the use of solar heating and/or cooling systems in houses

Make the long-term cost (payback) of solar heating and/or cooling systems lower than for conventional systems

Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems

Develop solar systems with lower miantenance and repair costs than for conventional systems

Develop solar heating and/or cooling systems with reasonable temperatures and variations

Emphasize the possibility of an energy shortage to stimulate the use of solar energy

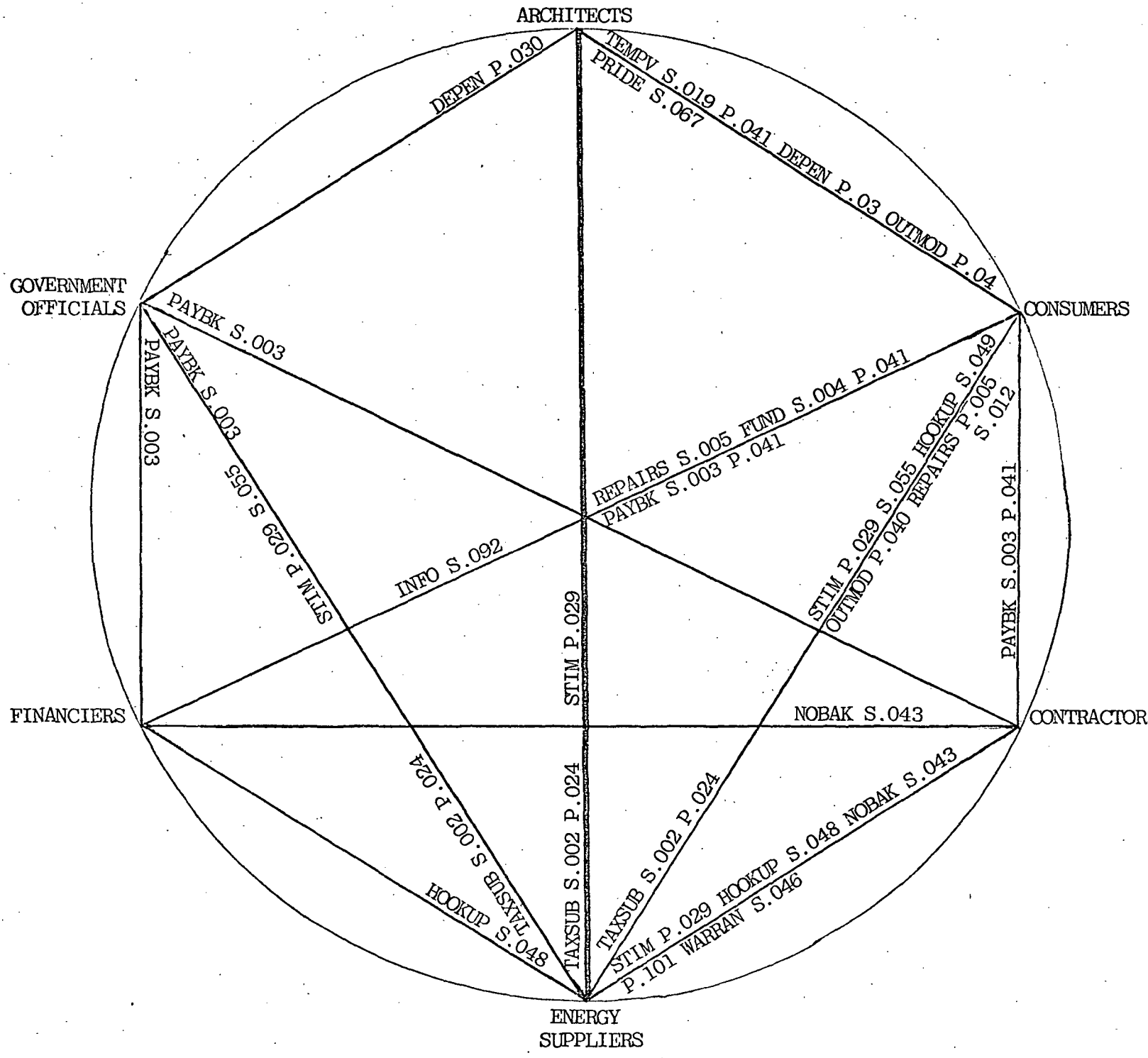
To obtain a more graphic picture of these relationships, the six key groups were inscribed on a construct and lines were drawn between groups where relationships were noted. The action statement key words and the F-probability values were written on the connecting lines. This construct is presented in Figures 3 and 3a.

A listing of how each group differed from the other groups was also made. This listing is presented in Appendix K. Note that a second column of values is given next to the F-probability values. The values in this second column are units of vector length for use in calculating the distance of separation between each group. The value given is the difference between the arithmetic mean values derived from each group's responses. For the purpose of scaling, each difference was multiplied by 15. The vector distances were used to plot a three-dimensional construct of the relationship among the key groups. A perspective rendering of this construct is displayed in Figure 4.

Concluding Statement

Comparing the groups across the first three phases of the statistical analysis, the action statements in Table 6 had the highest rankings on both the interview and questionnaire lists and are, therefore, regarded as the most important acceptance factors.

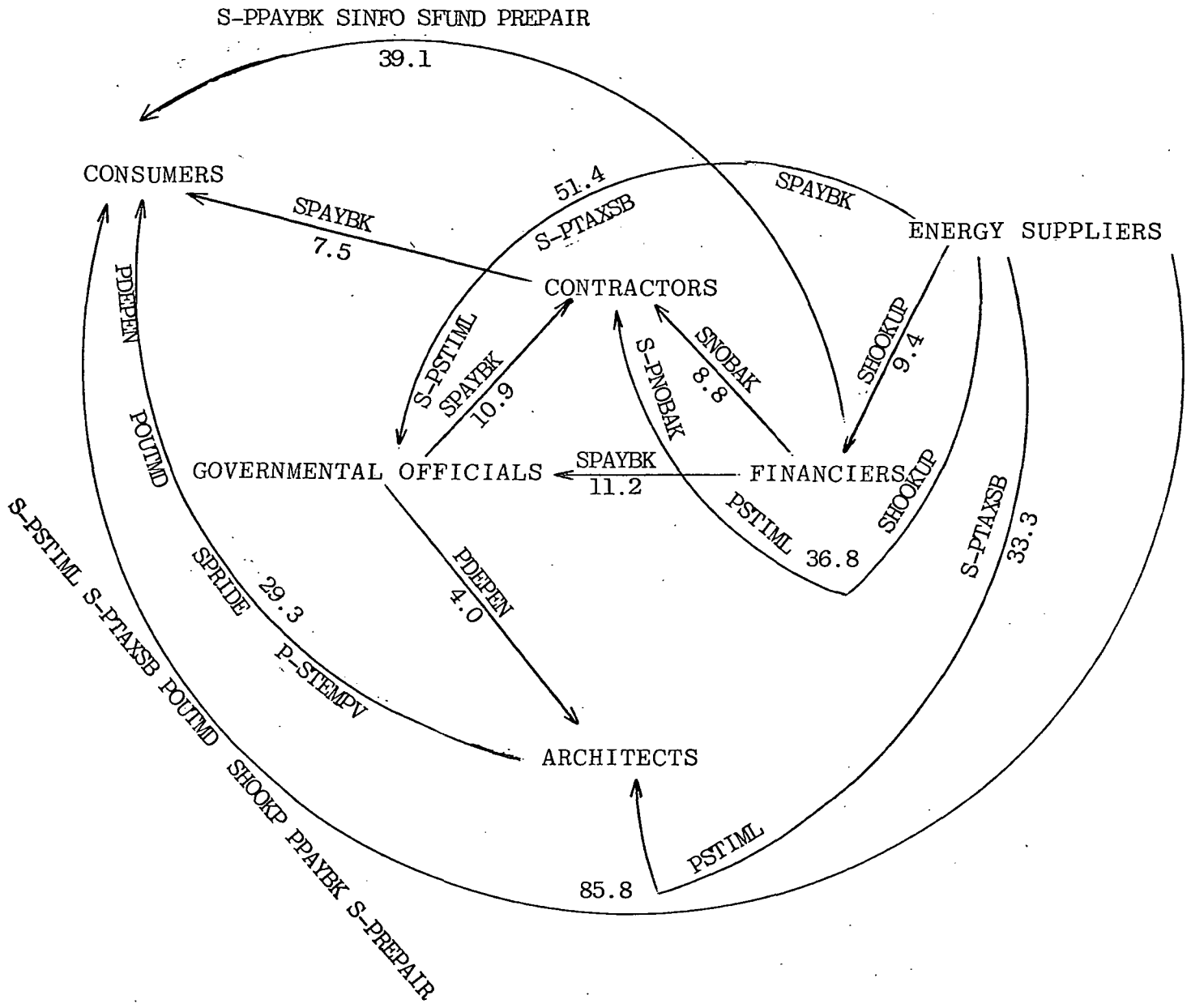
Figure 3. A Relationship Construct between Key Groups for Questionnaire Action Statements as Identified by Analysis of Variance



Letters Refer to Action Statements on the Action Statement Listings for Figures--Appendix L

Numbers Refer to Significance Derived From Analysis of Variance

Figure 3a. A Remoteness of Opinion Construct between Key Groups for Questionnaire Action Statements as Identified by Analysis of Variance

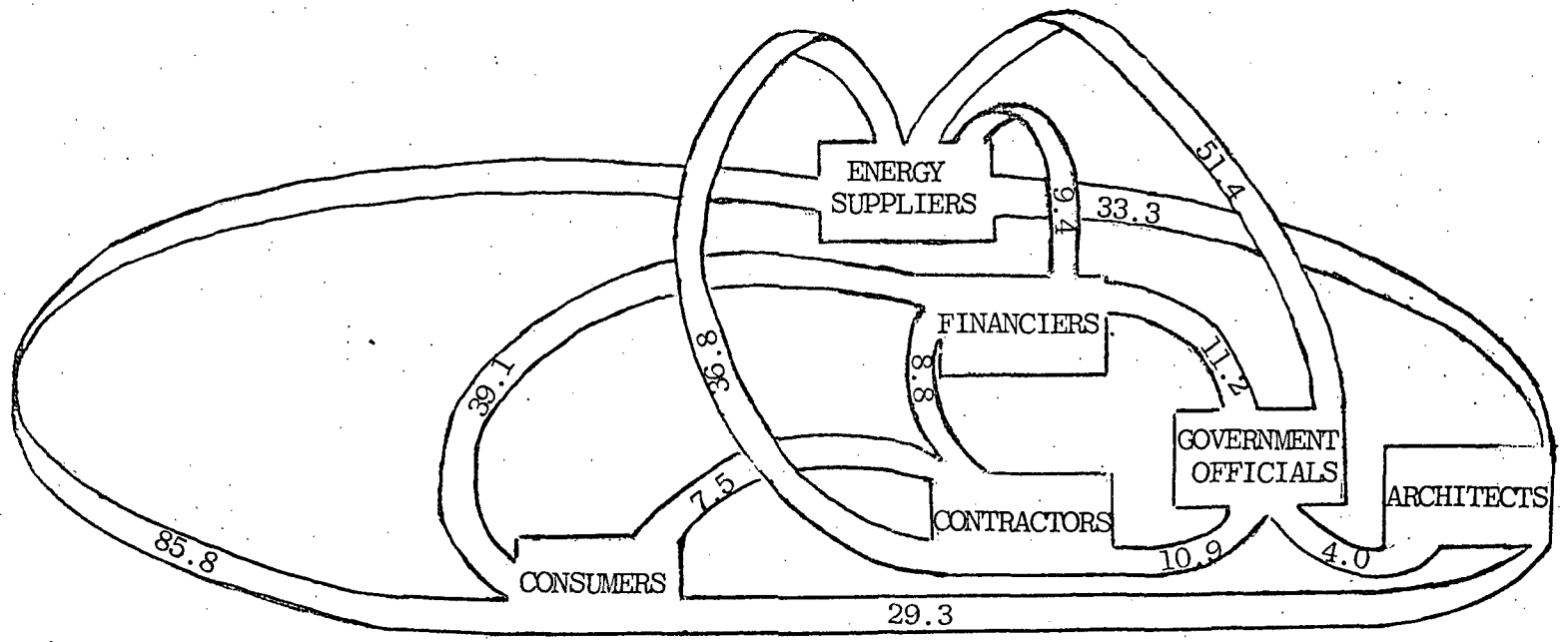


Letters Refer to Action Statements on the Action Statement Listings for Figures--Appendix L

Numbers Refer to Units of Remoteness Which is Difference Between Means x 15

Direction of Arrow Indicates Lower Arithmetic Mean Score

Figure 4. A Three-Dimensional Relationship Construct Between Key Groups for Questionnaire Action Statements using Vector Distances



Numbers are values of units of remoteness

Table 6. Comparison Rankings of Highest Ranking Action Statements for the Interview and for the Questionnaire

Interview Rank	Action Statement	Questionnaire Rank
1	Provide more information on solar energy	2
2	Design solar systems with long-term dependability	1
3	Make energy consumption a critical factor in house design	3
4	Make solar heating and/or cooling units as available as conventional units	4
5	Make houses with solar heating and/or cooling systems as attractive as nonsolar houses	6

The same seven action statements were rated lowest by both the interview and the questionnaire respondents although the rank orders were not the same. Low ranking statements may be considered as those covering neutral or rejection factors. The seven from the lowest to the highest ranking are given in Table 7.

Although two of the action statements are ranked in the middle range, analyses from the correlations, crosstabulations, and analysis of variance indicate that they have a strong influence on the perceptions of solar-energy technology. These action statements are:

Develop solar systems with lower maintenance and repair costs than for conventional systems

Make the long-term cost (payback) of solar heating and/or cooling systems lower than for conventional systems

The first phase of the statistical analysis determined that the eight action statements of lower range importance were exactly the same from the questionnaire and interview data. Four action statements included in this group were found to have a significant influence on an individual's perception of solar-energy technology according to the crosstabulation analysis. These four action statements are:

Award a tax subsidy for the use of solar heating and/or cooling systems in houses

Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems

Establish the same utility hookup charge for conventional and solar backup systems

Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans

The first two action statements were also revealed from analysis of variance.

Table 7. Comparison Rankings of Lowest Ranking Action Statements for the Interview and for the Questionnaire

Interview Rank	Action Statement	Questionnaire Rank
14	Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	15
15	Emphasize the pride in owning a solar heating and/or cooling system	18
16	Award a tax subsidy for the use of solar heating and/or cooling systems in houses	19
17	Make solar heating systems that require no backup systems	14
18	Establish the same (utility hookup charge) for conventional and solar backup systems	16
19	Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	20
20	Implement manpower training programs for solar-related jobs	17
21	Emphasize that traditional heating and cooling systems are outmoded	21

Finally, the analysis of the questionnaire data once again revealed the diversity of opinion which exists among key-group members, although the groups appeared to respond in a rather predictable manner. The various groups also displayed some degree of diversity, although each tended to mesh with the total response pattern toward the solar-energy statements.

CHAPTER VI

SUMMARY OF THE STUDY

Today, it is evident that energy from fossil fuels will be available for only a limited period of time. Alternative sources of energy must be found to supplement the deficit in the supply of fossil fuels. Even an effective conservation program coupled with increased domestic production and foreign imports cannot reverse the energy shortage in the United States. As an alternative energy source, solar energy is now gaining eminence.

Vigorous efforts to develop alternative energy technologies are necessary in view of the rapidly expanding energy needs of the United States. Solar energy is one untapped source for heating and cooling buildings. The rate of its diffusion into the housing industry is a major problem in the use of solar energy.

This study was concerned with the factors influencing the adoption of solar heating and cooling technology in the New Mexican housing industry. In addition, the study probed the factors which impede the acceptance and diffusion of solar heating and cooling technology.

The general objective of this project was to gather a data base of information relating to the acceptability of solar-energy technology in the New Mexican housing industry. More specifically, the study sought (1) to describe the factors which influence the adoption of solar-energy systems in the New Mexican housing industry;

(2) to determine the degree of acceptability of solar-related action statements among New Mexican consumers, architects, contractors, financiers, energy suppliers, and governmental officials; and (3) to acquaint New Mexican consumers, architects, contractors, financiers, energy suppliers, and governmental officials with the current attitudes toward the acceptability of solar-energy systems in the New Mexican housing industry.

A literature search produced many factors which influence the acceptability of solar heating and cooling systems. Among these solar-related factors were: building and safety codes, construction techniques, aesthetic considerations, long-term dependability, warranty specifications, repair and maintenance specifications, availability of trained solar technicians, temperature variations, backup system requirements, national energy requirements, cost considerations, solar unit availability, tax subsidies, guaranteed mortgages, hookup charges for backup systems, the outmoded nature of traditional systems, the social acceptability of solar systems, the environmental acceptability of solar systems, and the availability of information about solar systems.

An interview instrument was designed using the influential factors identified by the search of the literature. These factors were postulated to influence the diffusion of solar energy technology in the New Mexican housing industry. The investigators decided to rely to a large degree on the responses from a highly select group of people who were to be interviewed using a modified delphi technique. Those interviewed were asked to evaluate a series of action statements not only in terms of their own personal

perspectives but also in terms of the statewide perspectives. The respondents were queried closely regarding the information supporting their reactions to the action statements.

Six groups were selected for in-depth study because of their impact on the New Mexican housing industry. The groups included architects, consumers, contractors, energy suppliers, financiers, and governmental officials. After careful sample selection, five representatives from each key group were interviewed in detail by two well-trained interviewers.

The interview data collected by the interviewers were scrutinized thoroughly because of their importance in the study. Each comment was carefully analyzed from the standpoint of the nature of the item, the perspective of the interviewee, and its deviation from the norms. Twenty-three matrices were developed to illustrate the key-group response patterns on the various action statements. From the interview data, a composite picture was drawn which indicated those factors having acceptance, neutral, and rejection influence over the diffusion of solar-energy technology in the New Mexican housing industry.

After thoroughly scrutinizing the interview data, the investigators developed a mail questionnaire for each of the selected key groups to determine whether or not the interview responses of each key group were characteristic of the larger group from which they were selected. Most of the interview items were incorporated directly into the mail questionnaire instruments.

The mail questionnaire data were tabulated and analyzed. Cross-tabulations and Chi-square values were calculated. Cramer's V values

were also calculated to further substantiate the significance between key groups and action statements. Analysis of variance was performed to determine the amount of difference in the perception of importance and desirability by key groups on the various action statements.

An analysis of the interview data regarding solar-related attitudes yielded two types of data: (1) the placement of the action statements from the statewide and personal perspectives and (2) the reasoning behind these placements.

The two highest ranked action statements by the interviewees were: Make the initial cost of solar heating and/or cooling systems comparable to conventional systems and provide more information on solar energy. Other upper range action statements dealt with the dependability of solar-energy systems, the making of energy consumption into a critical factor in house design, and the availability of solar heating and/or cooling units.

Transitional action statements, which were affected by the nonsolar attitudes toward aesthetics and pollution, involved making homes with solar heating and/or cooling systems as attractive as nonsolar houses and using solar-energy systems to reduce pollution.

Lower maintenance costs, lower long-term payback periods, and major modifications in house construction are economic considerations which fell in the middle range category. Stimulating the use of solar energy by emphasizing the energy shortage, reasonable temperatures and variations, strong warranties, lower repair costs, and building codes were the other middle range factors which seem to have a moderate impact on the diffusion of solar-energy technology.

The action statements which according to their placement appear to have a negative--rejection influence on the diffusion of solar-energy technology were those dealing with social acceptability, pride in ownership, tax subsidies, backup systems, hookup charges, guaranteed mortgage loans, manpower training programs, and the outmoded nature of traditional heating and cooling systems.

Four general types of comments were expressed by the interview respondents. These included: (1) the state of the art--how much progress has been achieved in solar-energy development, (2) the need for further solar-energy research and development, (3) the attitudes toward economic factors which are specifically related to solar-energy systems, and (4) the attitudes of a miscellaneous nature. The latter type of attitudes included negative attitudes toward some of the action statements, belief or disbelief in ordinarily acceptable aspects of solar energy, and attitudes based on keen insight.

The analysis of comments revealed that each respondent brought to the interview a set of attitudes and values, many of which influenced his responses. Members of each interview group tended to view the action statements in a similar manner from the statewide and personal perspectives, but they also often disagreed with each other. This fact suggests that no program of technology diffusion can be implemented without a thorough analysis of not only the individual characteristics of the members of the key groups but also the key-group characteristics as well.

Almost 300 questionnaire responses were analyzed in order to determine (1) whether or not the responses were sufficiently related to the interview item ratings so that valid conclusions could be made

relative to the interview data and (2) on what action statements there were differences of importance or desirability, how strong were the differences in perception, with what key groups were the differences associated, and with what other key groups did the various key groups differ.

The data from interviews and questionnaires were found to be extremely closely related, with a coefficient of rank correlation of 0.88. The five highest ranking action statements from the interviews were found among the top six action statements from the questionnaires. The seven lowest ranked action statements were the same in both sets of data. Each key group was also found to have a high correlation coefficient, although not so high as that between the total groups because of one or two items about which a key group sharply differed from the other key groups. Of the seven action statements where diversity existed, only one was found in the lists of two key groups.

Thus, architects differed with other key groups on the action statements dealing with building codes and temperature variations. Consumers differed with the others on the repair and maintenance costs action statement. Contractors differed on the action statements concerning a reduced payback period and backup systems for solar-energy systems. Energy suppliers differed on the action statement which calls for emphasizing the energy shortage. Financiers differed on the action statement concerning a reduced payback period. Government officials differed with the other key groups on the action statement which dealt with stressing that solar energy is nonpolluting. From this group of seven action statements, the three acceptance factors were:

Change the building codes to accommodate solar heating and/or cooling systems in homes

Develop solar systems with lower maintenance and repair costs than for conventional systems

Make solar heating systems that require no backup systems

The other four action statements in this group were rejection factors.

The data was analyzed by crosstabulation to ascertain on what statements there were differences in perception of importance or desirability. Both Chi-square values and Cramer's V values were used for this purpose. Six action statements were identified with a difference at or above the 95 percent level. Five of these statements were in the lower half of the rankings, and four were in the lower 25 percentile, thus indicating that the influence of these factors was strongly negative. Five of the six action statements were repeated on a list of the items with the six highest Cramer's V values.

The four action statements regarded as having the most negative influence on the diffusion of solar-energy technology in the New Mexican housing industry are:

Award a tax subsidy for the use of solar heating and/or cooling systems in houses

Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems

Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans

Establish the same utility hookup charge for conventional and solar backup systems

An analysis of variance measured approximately the same characteristics as those mentioned above, but, in addition, was able to identify the groups between which differences exist on a pairwise

basis. Six action statements were identified where variance from both perspectives were found to exist at or above the 95 percent significance level. Two of these had also been identified from the crosstabulation analysis. These two action statements are:

Develop solar systems with lower maintenance and repair costs than for conventional systems

Award a tax subsidy for the use of solar heating and/or cooling systems in houses

The action statement establishing a fund to guarantee mortgage loans was a rejection factor which ranked number 20 out of 21 items. The other three influential factors were placed almost exactly in the middle of the rankings. These three statements were:

Design solar heating and/or cooling systems with reasonable temperatures and variations

Emphasize the possibility of an energy shortage to stimulate the use of solar energy

Make the long-term (payback) of solar heating and/or cooling systems lower than for conventional systems

Regarding the diffusion of solar-energy technology in the New Mexican housing industry, it is reasonable to assume that the key groups are made of members who have individual and group-response patterns as well as similarities to the total group. One might say that the whole solar-technology picture is made of the parts--but each part must be closely examined if an accurate assessment is to be made.

Recommendations

The investigators recommend that:

1. The interviewer determine, if possible, the specific perspective from which an interviewee's comment is made.
2. This study be replicated in other states.

3. Further study be made of the differing perceptions held by members of the six key groups.

4. Policy research be conducted based upon the findings of the study.

5. A descriptive model be developed after additional study of the relationships between and among the key groups and the degree of progress that the state has made toward the diffusion of solar-energy technology.

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APPENDIX A

INVENTORY OF STATE OF NEW MEXICO SOLAR HEATED AND/OR COOLED HOUSES

INVENTORY OF STATE OF NEW MEXICO SOLAR HEATED AND/OR COOLED HOUSES

Occupant or Owner	Location	Status	Size (If Available)
Jay Davis	Albuquerque	Completed 1974	
Barbara Francis	Albuquerque	Completed 1974	
Albert Utton	Albuquerque	Completed 1974	
Danny Martinez	Albuquerque	Completed 1975	2000 SF
Albuquerque Western Industries, Inc.	Albuquerque	Completed 1974	1200 SF
Frank Zanner	Albuquerque	Completed 1975	
Meyer Home	Albuquerque	In Progress	
Fred Hopman	Arroya Seco	Completed 1972	
Roberts Home	Chimayo	Completed 1975	
Steve Baer	Corrales	Completed 1971	1925 SF
Paul Davis	Corrales	Completed 1972	1000 SF
Dick Henry	Corrales	Completed 1974	
Stan Crawford	Dixon	Retrofitted 1975	
Peter Van Dresser	El Rito	Completed 1950	
Jack Sales	Las Cruces	Completed Mid 50's	1100 SF
New Mexico State University Home	Las Cruces	Completed 1975	1950 SF
Michael Coca	Las Vegas	Completed 1974	800 SF
Herman Barkman	Nambe	Completed 1974	350 SF

Occupant or Owner	Location	Status	Size (If Available)
Robert Scholes	Rodeo	Completed 1975	
Peter Van Dresser	Santa Fe	Completed 1958	500 SF
Carolyn Allers	Santa Fe	Completed 1974	500 SF
Wayne Nichols	Santa Fe	Completed 1974	400 SF addition
David Wright	Santa Fe	Completed 1974	1100 SF
Alfred Dasburg	Santa Fe	In Progress	1400 SF
Karen Terry	Santa Fe	Completed 1975	850 SF
Senator John Irick	Santa Fe	In Progress	
Mudd Home	Santa Fe	Completed 1975	
Wayne Nichols	Seton Village	Completed 1974	2000 SF
Tip Cowan	Silver City	Completed 1975	2700 SF
Richard Brock	Silver City	In Progress	
Carl Davis	Silver City	In Progress	
Mike Reynolds	Taos	Completed 1973	
Hamilton Migel	Tesuque	Completed 1975	2680 SF
Robert Reines	Tijeras	Completed 1973	
Charles Mattox	15 miles SW of Zuni National Monument	Completed 1975	555 SF

APPENDIX B

SENATE BILL 1, 32nd LEGISLATURE, SPECIAL SESSION,
1975 LAWS, CHAPTER 12
INTRODUCED BY SENATOR FRED A. GROSS, JR.

The Legislature

of the

State of New Mexico

32nd Legislature, Special Session

LAWS 1975

CHAPTER 12

SENATE BILL 1, with emergency clause

Introduced by

SENATOR FRED A. GROSS, JR.

GREAT SEAL OF THE STATE OF NEW MEXICO * 1912 *

AN ACT

RELATING TO TAXATION; PROVIDING FOR A CREDIT AGAINST PERSONAL INCOME TAX DUE FOR CONVERSION TO OR CONSTRUCTION OF SOLAR ENERGY SYSTEM; PROVIDING FOR REFUND TO TAXPAYER IF CREDIT ALLOWED EXCEEDS TAX LIABILITY; DECLARING AN EMERGENCY.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF NEW MEXICO:

Section 1. A new Section 72-15A-11.2 NMSA 1953 is enacted to read:

"72-15A-11.2. CREDIT AGAINST PERSONAL INCOME TAX--REFUND.--

A. Any resident who files an individual New Mexico income tax return and who is not a dependent of another taxpayer may claim a tax credit not to exceed one thousand dollars ($1,000) in an amount equal to twenty-five percent of the cost of equipment used in the taxpayer's principal residence for solar heating, cooling or heating and cooling if the residence is located in New Mexico. The person furnishing the equipment shall furnish the taxpayer with an accounting of the cost to the taxpayer.

B. A taxpayer may claim the credit provided by the provisions of this section only once in a taxable year, and only once for a given principal residence.

C. A taxpayer may not claim the credit provided by the provisions of this section if he has claimed on his federal income tax return a credit, deduction, exemption or exclusion for solar heating, cooling or heating and cooling equipment installed in his principal

residence.

D. A husband and wife who file separate returns for a taxable year in which they could have filed a joint return may each claim only one-half of the tax credit that would have been allowed on a joint return.

E. For the purpose of this section, the term, "solar heating, cooling or heating and cooling equipment" means any heating, cooling or heating and cooling equipment which meets the definitive performance criteria prescribed pursuant to the provisions of the Solar Heating and Cooling Demonstration Act of 1974 (42 U.S.C.A. S.S.5506), or any amendments thereto.

F. The credit provided by this section may only be deducted from the taxpayer's New Mexico income tax liability for the taxable year in which the equipment was installed in the taxpayer's residence. If the tax credit exceeds the taxpayer's income tax liability, the excess shall be refunded to the taxpayer."

Section 2. APPLICABILITY.--The provisions of this act apply to taxable years beginning on or after January 1, 1975.

Section 3. EMERGENCY.--It is necessary for the public peace, health and safety that this act take effect immediately.

SB 1
Page 2

s/ Robert E. Ferguson
Robert E. Ferguson, President
Senate

s/ Juanita Pino
Juanita Pino, Chief Clerk
Senate

s/ Walter K. Martinez
Walter K. Martinez, Speaker
House of Representatives

s/ Albert Romero
Albert Romero, Chief Clerk
House of Representatives

Approved by me this 10th day of April, 1975.

s/ Jerry Apodaca
Jerry Apodaca, Governor
State of New Mexico

APPENDIX C

INTERVIEWEE INTRODUCTORY LETTER

WESTERN NEW MEXICO UNIVERSITY

SILVER CITY, NEW MEXICO 88061

OFFICE OF ECONOMIC, SOCIAL AND POPULATION RESEARCH

November 11, 1975

Address

Dear :

The Office of Economic, Social, and Population Research at Western New Mexico University was recently awarded a grant from the National Aeronautics and Space Administration to study the acceptability of solar heating and/or cooling systems in the New Mexico housing industry. As part of this study, a number of New Mexicans such as yourself will be interviewed to determine their reactions toward solar heating and cooling systems.

You have been selected as an interview candidate. Our staff would like to schedule an interview with you at your convenience. Within a few days, a representative from our office will call to determine when you will be available for an interview.

We have enclosed for your consideration a brief overview of the status of solar energy at the present time.

Our staff looks forward to meeting with you in the near future.

Cordially yours,

OFFICE OF ECONOMIC, SOCIAL, AND POPULATION RESEARCH

Craig R. Lundahl, Ph.D., Director

lg

Enclosure

APPENDIX D

INTERVIEW GUIDE

NASA GRANT NSG-902

INTERVIEW GUIDE

- (Place interviewee's initials in blank on interview form.)

- Hello, I am _____ (give interviewee your business card) with the Office of Economic, Social, and Population Research at Western New Mexico University in Silver City.

- We are conducting a study funded by the National Aeronautics and Space Administration to determine the acceptability of solar heating and cooling of houses in New Mexico. Through interviews with people such as yourself we will gather information relating to the acceptability of solar heating and cooling systems in New Mexico housing.

- Specifically, through interviews, our study seeks:

  (1) to determine the degree of acceptability of solar heating and cooling systems among New Mexican consumers, architects, contractors, financiers, energy suppliers, and governmental officials;

  (2) to describe the incentives and barriers to the adoption of solar heating and cooling systems in New Mexico housing; and

  (3) to acquaint New Mexican consumers, architects, contractors, financiers, energy suppliers, and governmental officials with the current attitudes toward the acceptability of solar heating and cooling systems in New Mexico housing.

- To get started may I ask you a few questions about yourself?
  (Fill in demographic information sheet)

- (Present the respondent with the Solar Energy Scenario and ask him to comment on the scenario.)

- (Lay out your interview matric board and explain each response category.)

Directions to be given to the respondent:

We would like you to look at a series of cards describing actions which might influence the development of solar energy usage in New Mexico housing. These cards are meant to stimulate discussion on the desirability and importance of various actions regarding solar energy in houses. As you place these cards, please explain your reasons for each card placement and discuss any assumptions you are making. If the statement is not worded clearly, please say so and I will re-word it if necessary.

Look at the cards across the top of the matrix and place each "action" statement in the column which best describes its desirability, in your opinion.

At the same time, place the card in the row which best describes the importance of the action in the State of New Mexico. In other words, this second judgment about the importance of the action is <u>independent</u> of the desirability you think it has.

By "importance" we mean the extent to which a given action will effect the development of solar energy usage in houses in the State of New Mexico.

You may put as many cards as you like in each category. If you choose not to discuss any particular action statement, please put it under "no comment." If in the process of sorting these cards you change your mind about an earlier card placement, please feel free to change the position of the card.

- WHAT TO WATCH FOR DURING CARD SORTING:

No discussion. Be sure to ask questions conducive to discussion. Force comments if necessary.

Confusion about separation of judgments.

Extreme judgments (to ask about later in the interview).

- (After the respondent has completed the card sorting, leave those cards which he judged in the extreme boxes. Remove the rest of the cards.)

Pose the following questions:

Are there other actions which should have been included?

For these actions, what would be their cost to the state?

Would they be beneficial to the State?

How could they be implemented?

- Summary discussion

(In order to obtain an overview of the respondent's perception of New Mexico's energy policy:)

- Do you think, with respect to solar energy development, that the New Mexico State Government is following an appropriate policy?

- Do you agree with them?

- Do you see them changing?

- (Thank respondent for his participation and cooperation, indicating the importance of his comments for the study. When the study is completed, a copy of the study results will be sent to him.)

- (Write your summary of the interview.)

Interview No. _____

Referent's Initials _____

NASA GRANT NSG-902 INTERVIEW

DEMOGRAPHIC INFORMATION

Sex:

_____ male
_____ female

Race or Color:

_____ Black American
_____ Indian or Native American
_____ Other nonwhite American
_____ Mexican American
_____ Other White American

Occupation:

_____ professional, technical, and kindred workers (engineers, dentists, teachers, etc.)
_____ managers and administrators, except farm (sales managers, superintendents, etc.)
_____ sales workers (salesmen)
_____ clerical and kindred workers (bookkeepers, secretaries, clerks, etc.)
_____ craftsmen, foremen, and kindred workers (automobile mechanics, carpenters, etc.)
_____ operatives, except transport (garage workers, assemblers, butchers, mine operatives, gas station attendants, etc.)
_____ transport equipment operatives (bus drivers, deliverymen, railroad brakemen, etc.)
_____ laborers, except farm (construction laborers, garbage collectors, groundskeepers)
_____ farmers and farm managers
_____ farm laborers and farm foremen
_____ service workers, except private household (maids, food service workers, health service workers, nurses, personal service workers, protective service workers)
_____ private household workers (child care, cooks, maids)
_____ other _____ (please specify)

Marital status:

_____ never married
_____ married
_____ divorced
_____ widowed
_____ separated

Age:

_____ under 18
_____ 18 - 30
_____ 31 - 49
_____ 50 - 74
_____ 75 and over

Years of school completed:

_____ 1 - 7 years elementary school
_____ completed elementary school
_____ 1 - 3 years high school
_____ completed high school
_____ 1 - 3 years college
_____ completed college
_____ college graduate work

Income category:

_____ $15,000 and over
_____ $10,000 to $14,999
_____ $7,000 to $9,999
_____ $3,000 to $6,999
_____ under $3,000

ARCHITECTS

What type of building do you most frequently design?

_____ single family dwellings
_____ multi-family dwellings
_____ schools
_____ commercial buildings
_____ office or professional buildings
_____ other (specify) _____

CONTRACTORS

What type of building do you most frequently design?

_____ single family dwellings
_____ multi-family dwellings
_____ schools
_____ commercial buildings
_____ office or professional buildings
_____ other (specify) _____

What types of materials do you most frequently use for construction?

_____ frame
_____ concrete block
_____ brick
_____ adobe
_____ other (specify) _____

What is the price range of the type of housing you build most frequently?

_____ up to $20,000
_____ $20,000 to $29,000
_____ $30,000 to $39,000
_____ $40,000 to $49,000
_____ $50,000 and over

ENERGY SUPPLIERS

What kind of energy do you supply?

_____ natural gas
_____ L.P. gas (bottled)
_____ oil
_____ electricity
_____ other (specify) _____

How many people does your company employ? _____

Does your company install heating units? Yes _____ No _____

Does your company install air conditioning units? Yes _____ No _____

Does your company sell heating units? Yes _____ No _____

Does your company sell air conditioning units? Yes _____ No _____

What is the number of units your company services each year?

Heating _____ Air Conditioning _____

(Power Companies) How many meters do you supply? _____

Does your company contemplate an increased charge for the hookup of a backup system for a solar heating and/or cooling installation?

Yes _____ No _____

Does your company contemplate leasing solar heating and/or cooling systems for houses in New Mexico? Yes _____ No _____

FINANCIERS

What type of building do you mainly provide financing for?

_____ single family dwellings
_____ multi-family dwellings
_____ schools
_____ commercial buildings
_____ office or professional buildings
_____ other (specify) _____

SOLAR ENERGY

As the energy demands in the United States continue to soar, interest in solar energy grows. Solar energy shows promise as an alternate energy source to depletable fossil fuels on which mankind has relied for many years.

Essentially, a solar energy system transforms sunlight into heat, electricity, or other forms of energy which can then be used to provide for various needs. Solar energy is presently being used to heat and cool houses in many parts of the country. More complex systems such as the conversion of collected solar heat into mechanical and electrical energy and the direct conversion of sunlight through solar cells into electricity have been demonstrated in prototype and laboratory applications. Other concepts, although technically possible today, await further experimentation and refinement.

If existing technological developments in solar energy were readily available in many parts of the country, these developments could supply approximately seventy percent of the electrical and thermal requirements for residences and for certain types of commercial, institutional, and industrial structures. Backup systems of conventional means would be necessary to supplement solar systems during periods of several days of cloudy weather.

Solar energy systems offer a number of distinct advantages over conventional fossil fuel energy systems. While fossil fuel supplies are rapidly being depleted around the world, the sun's rays offer us a virtually inexhaustible source of energy. Solar energy is free from foreign controls which now infringe heavily on the fossil-fuel markets. In addition, solar energy is environmentally safe; there is no degradation of land, air, and other forms which are usually associated with the more traditional forms of energy.

RESPONSE TO SOLAR ENERGY SCENARIO

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

USE SOLAR ENERGY SYSTEMS TO REDUCE POLLUTION IN NEW MEXICO

Importance In The State	Personal Desirability					
	VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

EMPHASIZE THE POSSIBILITY OF AN ENERGY SHORTAGE TO STIMULATE THE USE OF SOLAR ENERGY

Importance In The State	Personal Desirability					
	VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

MAKE HOUSES WITH SOLAR HEATING AND/OR COOLING SYSTEMS AS ATTRACTIVE AS NONSOLAR HOUSES

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

MAKE ENERGY CONSUMPTION A CRITICAL FACTOR IN HOUSE DESIGN

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

MAKE SOLAR HEATING AND/OR COOLING UNITS AS AVAILABLE AS CONVENTIONAL UNITS

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

MAKE THE INITIAL COST OF SOLAR HEATING AND/OR COOLING SYSTEMS COMPARABLE TO CONVENTIONAL SYSTEMS

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

MAKE THE LONG-TERM COST (PAYBACK PERIOD) OF SOLAR HEATING AND/OR COOLING SYSTEMS LOWER THAN FOR CONVENTIONAL SYSTEMS

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

DEVELOP SOLAR SYSTEMS WITH LOWER MAINTENANCE COSTS THAN FOR CONVENTIONAL SYSTEMS

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

DEVELOP SOLAR SYSTEMS WITH LOWER REPAIR COSTS THAN FOR CONVENTIONAL SYSTEMS

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

AWARD A TAX SUBSIDY FOR THE USE OF SOLAR HEATING AND/OR COOLING SYSTEMS IN HOUSES

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

ESTABLISH A FUND TO GUARANTEE MORTGAGE LOANS FOR HOUSES WITH SOLAR HEATING AND/OR COOLING SYSTEMS

Importance In The State	Personal Desirability					
	VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

ESTABLISH THE SAME UTILITY HOOKUP CHARGE FOR CONVENTIONAL AND SOLAR BACKUP SYSTEMS

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

DESIGN SOLAR SYSTEMS WITH LONG-TERM DEPENDABILITY

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

ISSUE STRONG WARRANTIES FOR SOLAR HEATING AND/OR COOLING SYSTEMS

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

EMPHASIZE THE TRADITIONAL HEATING AND COOLING SYSTEMS ARE OUT-MODED

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

MAKE SOLAR HEATING SYSTEMS THAT REQUIRE NO BACKUP SYSTEMS

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

DESIGN SOLAR HEATING AND/OR COOLING SYSTEMS WITH REASONABLE TEMPERATURES AND VARIATIONS

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

IMPLEMENT MANPOWER TRAINING PROGRAMS FOR SOLAR-RELATED JOBS

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

DEVELOP SOLAR HEATING AND/OR COOLING SYSTEMS WHICH DO NOT REQUIRE MAJOR MODIFICATIONS IN HOUSE CONSTRUCTION

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

CHANGE THE BUILDING CODES TO ACCOMMODATE SOLAR HEATING AND/OR COOLING SYSTEMS IN HOMES

Importance In The State	Personal Desirability: VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

EMPHASIZE THAT SOLAR HEATING AND/OR COOLING SYSTEMS ARE SOCIALLY ACCEPTABLE TO NEW MEXICANS

Importance In The State	Personal Desirability					
	VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

EMPHASIZE THE PRIDE IN OWNING A SOLAR HEATING AND/OR COOLING SYSTEM

Importance In The State	Personal Desirability					
	VD	D	N	U	VU	NC
VI						
I						
N						
U						
VU						
NC						

PROVIDE MORE INFORMATION ON SOLAR ENERGY

SUMMARY OF INTERVIEW

APPENDIX E

INTERVIEW MATRICES

Matrix 1. Interviewee Responses for the Action Statement: Use Solar Energy Systems to Reduce Pollution in New Mexico

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	K M N O W					
Important		V Y				
Neutral			X			
Unimportant			L			
Very Unimportant	U					
No Comment						

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - Z[\]^_

Matrix 2. Interviewee Responses for the Action Statement: Emphasize the Possibility of an Energy Shortage to Stimulate the Use of Solar Energy

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	A E V H K W Q T X	F		C		
Important	D S	G I Y J O R U		N		
Neutral			P			
Unimportant				B L		
Very Unimportant						
No Comment					M	

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - EDCBA

Matrix 3. Interviewee Response for the Action Statement: Make Houses With Solar Heating and/or Cooling Systems as Attractive as Nonsolar Houses

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	A B C K N					
Important	E	V D D E M O				
Neutral		B				
Unimportant				L		
Very Unimportant						
No Comment						C

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - EDCBA

Matrix 4. Interviewee Responses for the Action Statement: Make Energy Consumption a Critical Factor in House Design

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	A C E G H H K L P Q R T	O				
Important	J	B D I F N M S				
Neutral						
Unimportant						
Very Unimportant						
No Comment						

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - EDCBA

Matrix 5. Interviewee Responses for the Action Statement: Make Solar Heating and/or Cooling Units as Available as Conventional Units

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	A B E F H I K M O Q S T					
Important	P	C D G J				
Neutral			N			
Unimportant			L			
Very Unimportant						
No Comment	R					

Personal Desirability

Respondent Codes
Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - ZYXWV

Matrix 6. Interviewee Responses for the Action Statement: Make the Initial Cost of Solar Heating and/or Cooling Systems Comparable to Conventional Systems

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	A B C Q E F G T H I J U K M N Y					
Important	C E O P S W	D V				
Neutral		V L				
Unimportant						
Very Unimportant						
No Comment	R					A X D

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - EDCBA

Matrix 7. Interviewee Responses for the Action Statement: Make the Long-term Cost (Payback Period) of Solar Heating and/or Cooling Systems Lower than for Conventional Systems

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	B E H K M O Q T U Y		A			
Important	G J	Ƃ Ɑ Ǝ C D F I L R V				
Neutral		∀ Ɔ	N P	X		
Unimportant			W	S		
Very Unimportant						
No Comment						

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - ZƎƆϽƎ

Matrix 8. Interviewee Responses for the Action Statement: Develop Solar Systems with Lower Maintenance Costs than for Conventional Systems

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	B K N O					
Important	O P	A C D E L T				
Neutral			R S			
Unimportant			M			
Very Unimportant						
No Comment						

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - VBDCE

Matrix 9. Interviewee Responses for the Action Statement: Develop Solar Systems with Lower Repair Costs than for Conventional Systems

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	B K N O					
Important	C O	A E P T				
Neutral			D L R S			
Unimportant			M			
Very Unimportant						
No Comment						

Personal Desirability

Respondent Codes
Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - ZYXWV

Matrix 10. Interviewee Responses for the Action Statement: Award a Tax Subsidy for the Use of Solar Heating and/or Cooling Systems in Houses

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	A B F G H K Q R	ꓭ				
Important	T U	C D I N V X Y			M	
Neutral		ↄ Ǝ J	E O P			
Unimportant				⅁ L S W		
Very Unimportant				∀		
No Comment						

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - ZƎↄꓭƎH

Matrix 11. Interviewee Responses for the Action Statement: Establish a Fund to Guarantee Mortgage Loans for Houses with Solar Heating and/or Cooling Systems

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	B G H K N	I				
Important		O		M	F	
Neutral			C E J			
Unimportant				D		
Very Unimportant				A	L	
No Comment						

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - BDCEA

Matrix 12. Interviewee Responses for the Action Statement: Establish the Same (Utility Hookup Charge) for Conventional and Solar Backup Systems

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	E A E G H K N	B				
Important	I	C O R S T V Y	M		F	
Neutral	P Q	J	C D	V		
Unimportant		U	W	C		
Very Unimportant				B	L	
No Comment						X

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - EDCBA

Matrix 13. Interviewee Responses for the Action Statement: Design Solar Systems with Long-term Dependability

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	∀ ᗺ Ǝ A B C D F K N O Q R S T W X Y	G I				
Important	J	Ↄ ᗡ E H M P V				
Neutral		L U				
Unimportant						
Very Unimportant						
No Comment						

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - ∀ᗺƆDƎ

Matrix 14. Interviewee Responses to the Action Statement: Issue Strong Warranties for Solar Heating and/or Cooling Systems

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	A B F K N O T X Y	G				
Important		C D M P S W				
Neutral		U	E H J L Q V			
Unimportant		I		D		
Very Unimportant					R	
No Comment						

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - VBCDE

Matrix 15. Interviewee Responses for the Action Statement: Emphasize that Traditional Heating and Cooling Systems are Out-moded

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	K O T					
Important		E H I V	Ǝ	B		
Neutral			V Ɔ F G Y	U	N	
Unimportant			Ǝ	⅁ C D J R W X		
Very Unimportant						
No Comment			P			A M Q S

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - ƎDƆBA

Matrix 16. Interviewee Responses for the Action Statement: Make Solar Heating Systems that Require no Backup Systems

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	C D E M U					
Important		A C D E K N O P Q W X				
Neutral	A	J	B F G H			
Unimportant			I Y	B		
Very Unimportant				L		
No Comment						R S T V

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - EDCBA

Matrix 17. Interviewee Responses for the Action Statement: Design Solar Heating and/or Cooling Systems with (Reasonable Temperatures) and Variations

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	A B K Q T					
Important	F	C D E J N P R				
Neutral		G I M	H L O			
Unimportant						
Very Unimportant						
No Comment		S				

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - ZBCDE

Matrix 18. Interviewee Responses for the Action Statement: Implement Manpower Training Programs for Solar-Related Jobs

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	G P Q					
Important		A B E H I S Y				
Neutral		W	C D U			
Unimportant			F T	J R V X		
Very Unimportant						
No Comment						

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - EDCBA

Matrix 19. Interviewee Responses for the Action Statement: Develop Solar Heating and/or Cooling Systems Which do not Require Major Modifications in House Construction

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	E B K N		G			
Important	C	A B D C E H I J O				
Neutral			D F L M			
Unimportant						
Very Unimportant						
No Comment						A

Personal Desirability

Respondent Codes
Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - ZABCD

Matrix 20. Interviewee Responses for the Action Statement: Change the Building Codes to Accomodate Solar Heating and/or Cooling Systems in Homes

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	A P Q T U Y	F	G			
Important		C H J W		B		
Neutral			D E I R V			
Unimportant			X			
Very Unimportant						
No Comment			S			

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - EDCBA

Matrix 21. Interviewee Responses for the Action Statement: Emphasize that Solar Heating and/or Cooling Systems are Socially Acceptable to New Mexicans

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	A B H K P Q R		G			
Important		C D E J L O S V X				
Neutral		U	T Y			
Unimportant		M				
Very Unimportant			W			
No Comment						

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - [illegible]

Matrix 22. Interviewee Responses for the Action Statement: Emphasize the Pride in Owning a Solar Heating and/or Cooling System

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	H K N					
Important		B C D E O				
Neutral	G	I	A J L			
Unimportant				F		
Very Unimportant						
No Comment						M

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - Z[\]^_

Matrix 23. Interviewee Responses for the Action Statement: Provide More Information on Solar Energy

Importance In the State of New Mexico	Very Desirable	Desirable	Neutral	Undesirable	Very Undesirable	No Comment
Very Important	A B C E G I K L M N O P Q S T W X	D				
Important	J	F R V Y				
Neutral						
Unimportant	U					
Very Unimportant						
No Comment						

Personal Desirability

Respondent Codes

Architects - ABCDE
Contractors - FGHIJ
Consumers - KLMNO
Energy Suppliers - PQRST
Governmental Officials - UVWXY
Financiers - [illegible]

APPENDIX F

QUESTIONNAIRE INSTRUMENTS

Energy Questionnaire For Architects

tion statements which might influence the development of solar xico housing industry. Please read each action statement care- one box on the left of the statement which best describes its . Then place an "X" in one box on the right of the statement st describes the importance of the action in New Mexico. By extent to which a given action will effect the development of in New Mexico. Please make two X's for each action statement.

IMPORTANCE IN THE STATE OF NEW MEXICO

	Very Important	Important	Neutral	Unimportant	Very Unimportant	No Opinion
ssibility of an energy shortage to stimulate the use						
solar heating and/or cooling systems as attractive as						
mption a critical factor in house design						
and/or cooling units as available as conventional units						
cost (payback period) of solar heating and/or cooling for conventional systems						
y for the use of solar heating and/or cooling systems						
utility hookup charge for conventional and solar back-						
ms with long-term dependability						
r) warranties for solar heating and/or cooling systems						
aditional heating and cooling systems are out-moded						
g systems that require no backup systems						
ng and/or cooling systems with reasonable tempera- s (±10 degrees)						
wer training programs for solar-related jobs						
ing and/or cooling systems which do not require major ouse construction						
g codes to accommodate solar heating and/or cooling						
lar heating and/or cooling systems are socially accept- ans						
ide in owning a solar heating and/or cooling system						
rmation on solar energy						

Please continue on the back side

r Energy Questionnaire For Consumers

tion statements which might influence the development of solar xico housing industry. Please read each action statement care- one box on the left of the statement which best describes its . Then place an "X" in one box on the right of the statement st describes the importance of the action in New Mexico. By extent to which a given action will effect the development of in New Mexico. Please make two X's for each action statement.

IMPORTANCE IN THE STATE OF NEW MEXICO

	Very Important	Important	Neutral	Unimportant	Very Unimportant	No Opinion
stems to reduce pollution in New Mexico						
sibility of an energy shortage to stimulate the use						
olar heating and/or cooling systems as attractive as						
mption a critical factor in house design						
and/or cooling units as available as conventional units						
cost (payback period) of solar heating and/or cooling for conventional systems						
ems with lower maintenance and repair costs than stems						
y for the use of solar heating and/or cooling systems						
guarantee mortgage loans for houses with solar heating ems						
utility hookup charge for conventional and solar back-						
ns with long-term dependability						
) warranties for solar heating and/or cooling systems						
ditional heating and cooling systems are out-moded						
systems that require no backup systems						
ng and/or cooling systems with reasonable tempera- s (±10 degrees)						
ng and/or cooling systems which do not require major use construction						
ar heating and/or cooling systems are socially accept- ans						
de in owning a solar heating and/or cooling system						
mation on solar energy						

Please continue on the back side

Energy Questionnaire For Contractors

ion statements which might influence the development of solar xico housing industry. Please read each action statement care- ne box on the left of the statement which best describes its Then place an "X" in one box on the right of the statement st describes the importance of the action in New Mexico. By extent to which a given action will effect the development of in New Mexico. Please make two X's for each action statement.

IMPORTANCE IN THE STATE OF NEW MEXICO

	Very Important	Important	Neutral	Unimportant	Very Unimportant	No Opinion
sibility of an energy shortage to stimulate the use						
mption a critical factor in house design						
and/or cooling units as available as conventional units						
cost (payback period) of solar heating and/or cooling for conventional systems						
ly for the use of solar heating and/or cooling systems						
uarantee mortgage loans for houses with solar heating ems						
utility hookup charge for conventional and solar back-						
ns with long-term dependability						
) warranties for solar heating and/or cooling systems						
ditional heating and cooling systems are out-moded						
systems that require no backup systems						
g and/or cooling systems with reasonable tempera- s (±10 degrees)						
wer training programs for solar-related jobs						
ng and/or cooling systems which do not require major use construction						
g codes to accommodate solar heating and/or cooling						
ar heating and/or cooling systems are socially accept- ans						
de in owning a solar heating and/or cooling system						
mation on solar energy						

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Please continue on the back side

nergy Questionnaire For Energy Suppliers

ion statements which might influence the development of solar xico housing industry. Please read each action statement care- ne box on the left of the statement which best **describes its** Then place an "X" in one box on the right of the statement t **describes the importance of the action in New Mexico.** By extent to which a given action will effect the development of in New Mexico. Please make two X's for each action statement.

IMPORTANCE IN THE STATE OF NEW MEXICO

	Very Important	Important	Neutral	Unimportant	Very Unimportant	No Opinion
sibility of an energy shortage to stimulate the use						
mption a critical factor in house design						
and/or cooling units as available as conventional units						
cost (payback period) of solar heating and/or cooling for conventional systems						
ems with lower maintenance and repair costs than stems						
ly for the use of solar heating and/or cooling systems						
utility hookup charge for conventional and solar back-						
ns with long-term dependability						
r) warranties for solar heating and/or cooling systems						
ditional heating and cooling systems are out-moded						
systems that require no backup systems						
ng and/or cooling systems with reasonable tempera- ns (± 10 degrees)						
wer training programs for solar-related jobs						
g codes to accommodate solar heating and/or cooling						
ar heating and/or cooling systems are socially accept- ans						
rmation on solar energy						

Please continue on the back side

ar Energy Questionnaire For Financiers

tion statements which might influence the development of solar exico housing industry. Please read each action statement care- one box on the left of the statement which best describes its n. Then place an "X" in one box on the right of the statement est describes the importance of the action in New Mexico. By e extent to which a given action will effect the development of s in New Mexico. Please make two X's for each action statement.

IMPORTANCE IN THE STATE OF NEW MEXICO

	Very Important	Important	Neutral	Unimportant	Very Unimportant	No Opinion
n solar heating and/or cooling systems as attractive as						
rm cost (payback period) of solar heating and/or cooling an for conventional systems						
stems with lower maintenance and repair costs than systems						
sidy for the use of solar heating and/or cooling systems						
o guarantee mortgage loans for houses with solar heating stems						
ne utility hookup charge for conventional and solar back-						
tems with long-term dependabiiity						
ear) warranties for solar heating and/or cooling systems						
traditional heating and cooling systems are out-moded						
ng systems that require no backup systems						
ating and/or cooling systems which do not require major house construction						
solar heating and/or cooling systems are socially accept- icans						
formation on solar energy						

Please continue on the back side

ɾgy Questionnaire For Government Officials

ion statements which might influence the development of solar
xico housing industry. Please read each action statement care-
one box on the left of the statement which best describes its
Then place an "X" in one box on the right of the statement
st describes the importance of the action in New Mexico. By
extent to which a given action will effect the development of
in New Mexico. Please make two X's for each action statement.

IMPORTANCE IN THE STATE OF NEW MEXICO

	Very Important	Important	Neutral	Unimportant	Very Unimportant	No Opinion
ystems to reduce pollution in New Mexico						
ssibility of an energy shortage to stimulate the use						
n cost (payback period) of solar heating and/or cooling n for conventional systems						
dy for the use of solar heating and/or cooling systems						
utility hookup charge for conventional and solar back-						
ms with long-term dependability						
r) warranties for solar heating and/or cooling systems						
ditional heating and cooling systems are out-moded						
g systems that require no backup systems						
wer training programs for solar-related jobs						
g codes to accommodate solar heating and/or cooling						
lar heating and/or cooling systems are socially accept- ans						
rmation on solar energy						

Please continue on the back side

BACKSIDE PAGE OF ALL KEY-GROUP QUESTIONNAIRES

Please give us some information about yourself. Place an X in the box beside the appropriate answer for each question.

1. Your sex:
   - ☐ male
   - ☐ female

2. Your marital status:
   - ☐ never married
   - ☐ married
   - ☐ divorced
   - ☐ widowed
   - ☐ separated

3. Your age:
   - ☐ under 18
   - ☐ 18 to 30
   - ☐ 31 to 49
   - ☐ 50 to 74
   - ☐ 75 and over

4. Number of years of school you completed:
   - ☐ 1 to 7 years elementary school
   - ☐ completed elementary school
   - ☐ 1 to 3 years high school
   - ☐ completed high school
   - ☐ 1 to 3 years college
   - ☐ completed college
   - ☐ college graduate work

5. Your occupational classification:
   - ☐ professional, technical, and kindred workers (engineers, dentists, teachers, etc.)
   - ☐ managers and administrators, except farm (sales managers, superintendents, etc.)
   - ☐ sales workers (salesmen)
   - ☐ clerical and kindred workers (bookkeepers, secretaries, clerks, etc.)
   - ☐ craftsmen, foremen, and kindred workers (automobile mechanics, carpen-

APPENDIX G

QUESTIONNAIRE RESPONSE CARD AND COVER LETTER, FOLLOW-UP LETTERS, AND QUESTIONNAIRE COVER LETTER

QUESTIONNAIRE RESPONSE CARD

Postage Will Be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY ENVELOPE

First Class Permit No. 5 Sec. 34.9 P.L.&R. Silver City, New Mexico

Office of Economic, Social and Population Research
Western New Mexico University
Silver City, New Mexico 88061

Please indicate your preference concerning participation in this important project by checking the appropriate box and indicating your name and address.

☐ YES. I wish to participate; please send me the questionnaire.

☐ NO. I do not want to respond to a questionnaire. Please remove my name from your mailing list.

NAME: _____

STREET: _____

CITY, STATE: _____

ZIP CODE: _____

WESTERN NEW MEXICO UNIVERSITY

SILVER CITY, NEW MEXICO 88061

OFFICE OF ECONOMIC, SOCIAL AND POPULATION RESEARCH

QUESTIONNAIRE RESPONSE CARD COVER LETTER

March 2, 1976

Dear Respondent:

The Office of Economic, Social, and Population Research at Western New Mexico University was recently awarded a grant from the National Aeronautics and Space Administration to study the acceptability of solar heating and/or cooling systems in the New Mexico housing industry.

Would you be willing to take approximately ten minutes of your time to complete a very simple and brief questionnaire?

If your answer is "yes", check the box on the enclosed preaddressed, stamped postcard and place it in the mail. You will then receive a questionnaire within a few weeks.

If your answer is "no", check that box on the enclosed preaddressed, stamped postcard and place it in the mail. You will not receive a questionnaire nor any further correspondence.

Cordially yours,

OFFICE OF ECONOMIC, SOCIAL, AND POPULATION RESEARCH

Craig R. Lundahl, Ph.D., Director

Enclosure

WESTERN NEW MEXICO UNIVERSITY

SILVER CITY, NEW MEXICO 88061

OFFICE OF ECONOMIC, SOCIAL AND POPULATION RESEARCH

FIRST FOLLOW-UP LETTER

March 15, 1976

Dear Respondent:

We all get a lot of mail these days. So, it's not surprising that a small request, such as the one we sent you a couple weeks ago, could have been overlooked or misplaced.

To refresh your memory: we asked if you will be willing to take about ten minutes of your time to complete a very important questionnaire regarding the feasibility of using solar energy technology in New Mexico. We have enclosed a postage-paid card so that you may indicate your willingness to participate or to have your name removed from our mailing list.

We hope to hear from you in the very near future.

Cordially yours,

OFFICE OF ECONOMIC, SOCIAL, AND POPULATION RESEARCH

Craig R. Lundahl

Craig R. Lundahl, Ph.D., Director

Enclosure

WESTERN NEW MEXICO UNIVERSITY

SILVER CITY, NEW MEXICO 88061

OFFICE OF ECONOMIC, SOCIAL AND POPULATION RESEARCH

SECOND FOLLOW-UP LETTER

March 29, 1976

Dear Respondent:

We hate to keep writing you; but we have not heard from you about your willingness to complete a ten-minute questionnaire regarding the feasibility of using solar energy technology in New Mexico. At this time, we have heard from 80 percent of the people we contacted. Sixty percent have agreed to help in our survey by completing a short ten-minute questionnaire. The others have asked to have their names removed from our mailing list.

We would like you to participate; but if you do not want to participate, we would also like to know that. All you have to do is check the appropriate box and supply your name on the enclosed postage-paid card.

We would appreciate you giving attention to this matter.

Cordially yours,

OFFICE OF ECONOMIC, SOCIAL, AND POPULATION RESEARCH

Craig R. Lundahl, Ph.D., Director

Enclosure

WESTERN NEW MEXICO UNIVERSITY

SILVER CITY, NEW MEXICO 88061

OFFICE OF ECONOMIC, SOCIAL AND POPULATION RESEARCH

QUESTIONNAIRE COVER LETTER

Dear Respondent:

Enclosed is the questionnaire which you agreed to complete concerning attitudes toward solar heating and cooling systems.

The items to which you will respond are stated in terms of particular actions which might be necessary for the widespread use of solar heating and cooling systems. For each action statement, indicate your personal preference by placing an X in the square on the left-hand side scale which best indicates your personal viewpoint. On the right-hand scale, make another X to indicate the importance of the action from a statewide viewpoint.

When you have completed the questionnaire, please double-check to be sure that you have placed an X on both the left- and right-hand scales for each action statement. Then insert the questionnaire in the preaddressed and stamped envelope and place it in the mail.

Cordially yours,

THE OFFICE OF ECONOMIC, SOCIAL, AND POPULATION RESEARCH

Craig R. Lundahl, Ph.D., Director

Enclosures

APPENDIX H

QUESTIONNAIRE ACTION STATEMENTS' ARITHMETIC MEANS, STANDARD DEVIATIONS, NUMBER OF VALUED RESPONSES, AND MODES BY STATEWIDE IMPORTANCE AND PERSONAL DESIRABILITY, AND STATEWIDE IMPORTANCE-PERSONAL DESIRABILITY COMPOSITE SCORES FOR KEY GROUPS

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Architects

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Use solar energy systems to reduce pollution in New Mexico	-	-	-	-	-
Emphasize the possibility of an energy shortage to stimulate the use of solar energy	3.978	.953	91	4	4.062
Make houses with solar heating and/or cooling systems as attractive as nonsolar houses	4.516	.673	91	5	4.3635
Make energy consumption a critical factor in house design	4.582	.668	91	5	4.5330
Make solar heating and/or cooling units as available as conventional units	4.560	.618	91	5	4.4835
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	4.103	.963	91	4	4.0855
Develop solar systems with lower maintenance and repair costs than for conventional systems	-	-	-	-	-
Award a tax subsidy for the use of solar heating and/or cooling systems in houses	3.652	1.280	91	5	3.708
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	-	-	-	-	-

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Architects (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Establish the same utility hookup charge for conventional and solar backup systems	3.541	1.053	91	4	3.5845
Design solar systems with long-term dependability	4.692	.464	91	5	4.6150
Issue strong warranties for solar heating and/or cooling systems	4.068	.992	91	4	4.0285
Emphasize that traditional heating and cooling systems are outmoded	2.790	1.140	91	2	2.8155
Make solar heating systems that require no backup systems	3.978	1.005	91	4	3.6830
Design solar heating and/or cooling systems with reasonable temperatures and variations	4.000	.807	91	4	3.6085
Implement manpower training programs for solar-related jobs	3.512	1.166	91	4	3.4885
Develop solar heating and/or cooling systems which do not require major modifications in house construction	4.239	.897	91	4	4.2110
Change the building codes to accommodate solar heating and/or cooling systems in homes	4.506	.761	91	5	4.3000
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	3.678	1.215	91	5	3.6415

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Architects (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Emphasize the pride in owning a solar heating and/or cooling system	3.375	1.187	91	3	3.3885
Provide more information on solar energy	4.629	.551	91	5	4.6345

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Architects

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Use solar energy systems to reduce pollution in New Mexico	-	-	-	-	-
Emphasize the possibility of an energy shortage to stimulate the use of solar energy	4.146	.924	91	5	4.0620
Make houses with solar heating and/or cooling systems as attractive as nonsolar houses	4.211	.814	91	5	4.3635
Make energy consumption a critical factor in house design	4.484	.751	91	5	4.5330
Make solar heating and/or cooling units as available as conventional units	4.407	.789	91	5	4.4835
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	4.068	.907	91	4	4.0855
Develop solar systems with lower maintenance and repair costs than for conventional systems	-	-	-	-	-
Award a tax subsidy for the use of solar heating and/or cooling systems in houses	3.764	1.252	91	5	3.7080
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	-	-	-	-	-

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Architects (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Establish the same utility hookup charge for conventional and solar backup systems	3.628	1.085	91	4	3.5845
Design solar systems with long-term dependability	4.538	.602	91	5	4.6150
Issue strong warranties for solar heating and/or cooling systems	3.989	.977	91	4	4.0285
Emphasize that traditional heating and cooling systems are outmoded	2.841	1.144	91	3	2.8155
Make solar heating systems that require no backup systems	3.388	.994	91	4	3.6830
Design solar heating and/or cooling systems with reasonable temperatures and variations	3.217	.881	91	4	3.6085
Implement manpower training programs for solar-related jobs	3.465	1.271	91	4	3.4885
Develop solar heating and/or cooling systems which do not require major modifications in house construction	4.183	.927	91	4	4.2110
Change the building codes to accommodate solar heating and/or cooling systems in homes	4.094	.861	91	5	4.3000
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	3.605	1.304	91	5	3.6415

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Architects (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Emphasize the pride in owning a solar heating and/or cooling system	3.402	1.316	91	5	3.3885
Provide more information on solar energy	4.640	.569	91	5	4.6345

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Consumers

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Use solar energy systems to reduce pollution in New Mexico	4.390	.695	60	5	4.2640
Emphasize the possibility of an energy shortage to stimulate the use of solar energy	4.203	.961	60	5	4.2115
Make houses with solar heating and/or cooling systems as attractive as nonsolar houses	4.350	.685	60	4	4.2750
Make energy consumption a critical factor in house design	4.525	.653	60	5	4.4745
Make solar heating and/or cooling units as available as conventional units	4.550	.649	60	5	4.4835
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	4.241	.904	60	5	4.2755
Develop solar systems with lower maintenance and repair costs than for conventional systems	4.533	.676	60	5	4.5165
Award a tax subsidy for the use of solar heating and/or cooling systems in houses	3.621	1.226	60	4,5	3.7315
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	3.596	1.178	60	4	3.6050

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Consumers (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Establish the same utility hookup charge for conventional and solar backup systems	3.807	1.060	60	4	3.7965
Design solar systems with long-term dependability	4.783	.454	60	5	4.8000
Issue strong warranties for solar heating and/or cooling systems	4.424	.747	60	5	4.3845
Emphasize that traditional heating and cooling systems are outmoded	3.148	1.123	60	3	3.2440
Make solar heating systems that require no backup systems	4.208	1.026	60	5	4.1405
Design solar heating and/or cooling systems with reasonable temperatures and variations	4.373	.554	60	4	4.3245
Implement manpower training programs for solar-related jobs	-	-	-	-	-
Develop solar heating and/or cooling systems which do not require major modifications in house construction	4.383	.783	60	5	4.4080
Change the building codes to accommodate solar heating and/or cooling systems in homes	-	-	-	-	-
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	4.020	.883	60	4	3.9545

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Consumers (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Emphasize the pride in owning a solar heating and/or cooling system	3.764	.922	60	3	3.6925
Provide more information on solar energy	4.833	.418	60	5	4.7915

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Consumers

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Use solar energy systems to reduce pollution in New Mexico	4.138	.981	60	5	4.2640
Emphasize the possibility of an energy shortage to stimulate the use of solar energy	4.220	.832	60	4	4.2115
Make houses with solar heating and/or cooling systems as attractive as nonsolar houses	4.200	.798	60	4	4.2750
Make energy consumption a critical factor in house design	4.424	.675	60	5	4.4745
Make solar heating and/or cooling units as available as conventional units	4.417	.696	60	5	4.4835
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	4.310	.730	60	4	4.2755
Develop solar systems with lower maintenance and repair costs than for conventional systems	4.500	.651	60	5	4.5165
Award a tax subsidy for the use of solar heating and/or cooling systems in houses	3.842	1.099	60	5	3.7315
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	3.614	1.146	60	4	3.6050

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Consumers (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Establish the same utility hookup charge for conventional and solar backup systems	3.786	1.057	60	4	3.7965
Design solar systems with long-term dependability	4.817	.390	60	5	4.8000
Issue strong warranties for solar heating and/or cooling systems	4.345	.739	60	5	4.3845
Emphasize that traditional heating and cooling systems are outmoded	3.340	1.055	60	3,4	3.2440
Make solar heating systems that require no backup systems	4.073	.997	60	4	4.1405
Design solar heating and/or cooling systems with reasonable temperatures and variations	4.276	.586	60	4	4.3245
Implement manpower training programs for solar-related jobs	-	-	-	-	-
Develop solar heating and/or cooling systems which do not require major modifications in house construction	4.433	.767	60	5	4.4080
Change the building codes to accommodate solar heating and/or cooling systems in homes	-	-	-	-	-
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	3.889	1.110	60	4	3.9545

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Consumers (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Emphasize the pride in owning a solar heating and/or cooling system	3.621	1.137	60	5	3.6925
Provide more information on solar energy	4.750	.571	60	5	4.7915

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Contractors

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Use solar energy systems to reduce pollution in New Mexico	-	-	-	-	-
Emphasize the possibility of an energy shortage to stimulate the use of solar energy	3.815	1.360	27	5	4.0035
Make houses with solar heating and/or cooling systems as attractive as nonsolar houses	-	-	-	-	-
Make energy consumption a critical factor in house design	4.411	.643	27	5	4.4275
Make solar heating and/or cooling units as available as conventional units	4.411	.580	27	5	4.4650
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	3.741	1.196	27	5	3.7935
Develop solar systems with lower maintenance and repair costs than for conventional systems	-	-	-	-	-
Award a tax subsidy for the use of solar heating and/or cooling systems in houses	3.037	1.675	27	5	3.2300
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	3.074	1.466	27	3	3.2590

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Contractors (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Establish the same utility hookup charge for conventional and solar backup systems	3.841	1.214	27	4	3.8435
Design solar systems with long-term dependability	4.815	.396	27	5	4.7410
Issue strong warranties for solar heating and/or cooling systems	4.410	.821	27	5	4.3395
Emphasize that traditional heating and cooling systems are outmoded	2.968	1.126	27	3	3.0030
Make solar heating systems that require no backup systems	4.432	.647	27	5	4.4325
Design solar heating and/or cooling systems with reasonable temperatures and variations	4.208	.658	27	4	4.2080
Implement manpower training programs for solar-related jobs	3.778	1.191	27	4	3.8890
Develop solar heating and/or cooling systems which do not require major modifications in house construction	4.667	.620	27	5	4.6115
Change the building codes to accommodate solar heating and/or cooling systems in homes	4.444	.751	27	5	4.5185
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	4.000	.849	27	3,5	3.9230

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Contractors (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Emphasize the pride in owning a solar heating and/or cooling system	3.761	.970	27	3	3.7265
Provide more information on solar energy	4.630	.629	27	5	4.6485

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Contractors

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Use solar energy systems to reduce pollution in New Mexico	-	-	-	-	-
Emphasize the possibility of an energy shortage to stimulate the use of solar energy	4.192	.801	27	4	4.0035
Make houses with solar heating and/or cooling systems as attractive as nonsolar houses	-	-	-	-	-
Make energy consumption a critical factor in house design	4.444	.681	27	5	4.4275
Make solar heating and/or cooling units as available as conventional units	4.519	.580	27	5	4.4650
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	3.846	1.084	27	5	3.7935
Develop solar systems with lower maintenance and repair costs than for conventional systems	-	-	-	-	-
Award a tax subsidy for the use of solar heating and/or cooling systems in houses	3.423	1.447	27	5	3.2300
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	3.444	1.311	27	3,4,5	3.2590

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Contractors (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Establish the same utility hookup charge for conventional and solar backup systems	3.846	1.008	27	4	3.8435
Design solar systems with long-term dependability	4.667	.679	27	5	4.7410
Issue strong warranties for solar heating and/or cooling systems	4.269	.874	27	5	4.3395
Emphasize that traditional heating and cooling systems are outmoded	3.038	.916	27	2	3.0030
Make solar heating systems that require no backup systems	4.333	.734	27	5	4.4325
Design solar heating and/or cooling systems with reasonable temperatures and variations	4.208	.721	27	4	4.2080
Implement manpower training programs for solar-related jobs	4.000	1.131	27	5	3.8890
Develop solar heating and/or cooling systems which do not require major modifications in house construction	4.556	.801	27	5	4.6115
Change the building codes to accommodate solar heating and/or cooling systems in homes	4.593	.636	27	5	4.5185
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	3.846	1.084	27	5	3.9230

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Contractors (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Emphasize the pride in owning a solar heating and/or cooling system	3.692	1.158	27	5	3.7265
Provide more information on solar energy	4.667	.555	27	5	4.6485

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Energy Suppliers

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Use solar energy systems to reduce pollution in New Mexico	-	-	-	-	-
Emphasize the possibility of an energy shortage to stimulate the use of solar energy	3.615	1.206	41	4	3.6365
Make houses with solar heating and/or cooling systems as attractive as nonsolar houses	-	-	-	-	-
Make energy consumption a critical factor in house design	4.625	.740	41	5	4.5625
Make solar heating and/or cooling units as available as conventional units	4.300	.723	41	4	4.2500
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	3.846	.875	41	4	3.8845
Develop solar systems with lower maintenance and repair costs than for conventional systems	4.051	1.050	41	4	4.0005
Award a tax subsidy for the use of solar heating and/or cooling systems in houses	2.692	1.280	41	2	2.8460
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	-	-	-	-	-

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance—Personal Desirability Composite Scores for Energy Suppliers (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Establish the same utility hookup charge for conventional and solar backup systems	3.175	1.174	41	3	3.2415
Design solar systems with long-term dependability	4.732	.449	41	5	4.6830
Issue strong warranties for solar heating and/or cooling systems	4.487	.644	41	5	4.3975
Emphasize that traditional heating and cooling systems are outmoded	2.711	1.088	41	2,3	2.6530
Make solar heating systems that require no backup systems	3.763	1.324	41	5	3.7465
Design solar heating and/or cooling systems with reasonable temperatures and variations	4.184	.652	41	4	4.1175
Implement manpower training programs for solar-related jobs	3.692	1.217	41	4	3.7050
Develop solar heating and/or cooling systems which do not require major modifications in house construction	-	-	-	-	-
Change the building codes to accommodate solar heating and/or cooling systems in homes	4.231	.959	41	5	4.2180
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	3.889	.785	41	4	3.8905

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Energy Suppliers (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Emphasize the pride in owning a solar heating and/or cooling system	-	-	-	-	-
Provide more information on solar energy	4.610	.542	41	5	4.6345

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Energy Suppliers

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Use solar energy systems to reduce pollution in New Mexico	-	-	-	-	-
Emphasize the possibility of an energy shortage to stimulate the use of solar energy	3.658	1.122	41	4	3.6365
Make houses with solar heating and/or cooling systems as attractive as nonsolar houses	-	-	-	-	-
Make energy consumption a critical factor in house design	4.500	.816	41	5	4.5625
Make solar heating and/or cooling units as available as conventional units	4.200	.758	41	4	4.2500
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	3.923	.957	41	4	3.8845
Develop solar systems with lower maintenance and repair costs than for conventional systems	3.950	1.085	41	4	4.0005
Award a tax subsidy for the use of solar heating and/or cooling systems in houses	3.000	1.433	41	2	2.8460
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	-	-	-	-	-

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Energy Suppliers (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Establish the same utility hookup charge for conventional and solar backup systems	3.308	1.030	41	3	3.2415
Design solar systems with long-term dependability	4.634	.536	41	5	4.6830
Issue strong warranties for solar heating and/or cooling systems	4.308	.800	41	4	4.3975
Emphasize that traditional heating and cooling systems are outmoded	2.595	1.092	41	2	2.6530
Make solar heating systems that require no backup systems	3.730	1.194	41	4	3.7465
Design solar heating and/or cooling systems with reasonable temperatures and variations	4.051	.759	41	4	4.1175
Implement manpower training programs for solar-related jobs	3.718	1.255	41	4	3.7050
Develop solar heating and/or cooling systems which do not require major modifications in house construction	-	-	-	-	-
Change the building codes to accommodate solar heating and/or cooling systems in homes	4.205	1.005	41	5	4.2180
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	3.892	1.075	41	4	3.8905

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Energy Suppliers (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Emphasize the pride in owning a solar heating and/or cooling system	-	-	-	-	-
Provide more information on solar energy	4.659	.530	41	5	4.6345

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Financiers

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Use solar energy systems to reduce pollution in New Mexico	-	-	-	-	-
Emphasize the possibility of an energy shortage to stimulate the use of solar energy	-	-	-	-	-
Make houses with solar heating and/or cooling systems as attractive as nonsolar houses	4.476	.552	43	5	4.3195
Make energy consumption a critical factor in house design	-	-	-	-	-
Make solar heating and/or cooling units as available as conventional units	-	-	-	-	-
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	3.725	1.132	43	4	3.7320
Develop solar systems with lower maintenance and repair costs than for conventional systems	4.238	.692	43	4	4.1890
Award a tax subsidy for the use of solar heating and/or cooling systems in houses	3.128	1.559	43	1,5	3.3380
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	2.675	1.403	43	2	2.8135

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Financiers (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Establish the same utility hookup charge for conventional and solar backup systems	3.800	.868	43	4	3.8030
Design solar systems with long-term dependability	4.714	.457	43	5	4.6710
Issue strong warranties for solar heating and/or cooling systems	4.286	.673	43	4	4.2710
Emphasize that traditional heating and cooling systems are outmoded	2.949	1.123	43	3	2.9380
Make solar heating systems that require no backup systems	3.878	1.029	43	4	3.8440
Design solar heating and/or cooling systems with reasonable temperatures and variations	-	-	-	-	-
Implement manpower training programs for solar-related jobs	-	-	-	-	-
Develop solar heating and/or cooling systems which do not require major modifications in house construction	4.405	.665	43	5	4.3190
Change the building codes to accommodate solar heating and/or cooling systems in homes	-	-	-	-	-
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	3.795	1.005	43	4	3.8485

Questionnaire Action Statements: Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Financiers (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Emphasize the pride in owning a solar heating and/or cooling system	-	-	-	-	-
Provide more information on solar energy	4.595	.544	43	5	4.6070

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Financiers

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Use solar energy systems to reduce pollution in New Mexico	-	-	-	-	-
Emphasize the possibility of an energy shortage to stimulate the use of solar energy	-	-	-	-	-
Make houses with solar heating and/or cooling systems as attractive as nonsolar houses	4.163	.871	43	4	4.3195
Make energy consumption a critical factor in house design	-	-	-	-	-
Make solar heating and/or cooling units as available as conventional units	-	-	-	-	-
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	3.738	1.149	43	4	3.7320
Develop solar systems with lower maintenance and repair costs than for conventional systems	4.140	.804	43	4	4.1890
Award a tax subsidy for the use of solar heating and/or cooling systems in houses	3.548	1.418	43	4	3.3380
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	2.952	1.464	43	1,2,5	2.8135

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Financiers (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Establish the same utility hookup charge for conventional and solar backup systems	3.806	.951	43	4	3.8030
Design solar systems with long-term dependability	4.628	.578	43	5	4.6710
Issue strong warranties for solar heating and/or cooling systems	4.256	.693	43	4	4.2710
Emphasize that traditional heating and cooling systems are outmoded	2.927	1.170	43	3	2.9380
Make solar heating systems that require no backup systems	3.810	.943	43	4	3.8440
Design solar heating and/or cooling systems with reasonable temperatures and variations	-	-	-	-	-
Implement manpower training programs for solar-related jobs	-	-	-	-	-
Develop solar heating and/or cooling systems which do not require major modifications in house construction	4.233	.895	43	5	4.3190
Change the building codes to accommodate solar heating and/or cooling systems in homes	-	-	-	-	-
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	3.902	1.136	43	5	3.8485

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Financiers (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Emphasize the pride in owning a solar heating and/or cooling system	-	-	-	-	-
Provide more information on solar energy	4.619	.582	43	5	4.6070

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Government Officials

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Use solar energy systems to reduce pollution in New Mexico	4.057	.802	37	4	3.9730
Emphasize the possibility of an energy shortage to stimulate the use of solar energy	4.171	.828	37	4	4.1965
Make houses with solar heating and/or cooling systems as attractive as nonsolar houses	-	-	-	-	-
Make energy consumption a critical factor in house design	-	-	-	-	-
Make solar heating and/or cooling units as available as conventional units	-	-	-	-	-
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	4.471	.662	37	5	4.3355
Develop solar systems with lower maintenance and repair costs than for conventional systems	-	-	-	-	-
Award a tax subsidy for the use of solar heating and/or cooling systems in houses	3.629	1.003	37	3,4	3.6860
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	-	-	-	-	-

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Government Officials (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Establish the same utility hookup charge for conventional and solar backup systems	3.480	1.159	37	3	3.4805
Design solar systems with long-term dependability	4.833	.378	37	5	4.8195
Issue strong warranties for solar heating and/or cooling systems	4.156	.920	37	4	4.0635
Emphasize that traditional heating and cooling systems are outmoded	2.882	1.038	37	2,3,4	2.9125
Make solar heating systems that require no backup systems	4.257	.852	37	5	4.2000
Design solar heating and/or cooling systems with reasonable temperatures and variations	-	-	-	-	-
Implement manpower training programs for solar-related jobs	3.588	1.131	37	4	3.6175
Develop solar heating and/or cooling systems which do not require major modifications in house construction	-	-	-	-	-
Change the building codes to accommodate solar heating and/or cooling systems in homes	4.500	.663	37	5	4.4720
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	4.000	1.111	37	5	4.0145

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Government Officials (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Emphasize the pride in owning a solar heating and/or cooling system	-	-	-	-	-
Provide more information on solar energy	4.778	.422	37	5	4.7500

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Government Officials

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Use solar energy systems to reduce pollution in New Mexico	3.889	.979	37	4	3.9730
Emphasize the possibility of an energy shortage to stimulate the use of solar energy	4.222	.866	37	5	4.1965
Make houses with solar heating and/or cooling systems as attractive as nonsolar houses	-	-	-	-	-
Make energy consumption a critical factor in house design	-	-	-	-	-
Make solar heating and/or cooling units as available as conventional units	-	-	-	-	-
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	4.200	.994	37	5	4.3355
Develop solar systems with lower maintenance and repair costs than for conventional systems	-	-	-	-	-
Award a tax subsidy for the use of solar heating and/or cooling systems in houses	3.743	.980	37	4	3.6860
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	-	-	-	-	-

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Government Officials (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Establish the same utility hookup charge for conventional and solar backup systems	3.481	1.014	37	3	3.4805
Design solar systems with long-term dependability	4.806	.401	37	5	4.8195
Issue strong warranties for solar heating and/or cooling systems	3.971	1.248	37	5	4.0635
Emphasize that traditional heating and cooling systems are outmoded	2.943	.998	37	3	2.9125
Make solar heating systems that require no backup systems	4.143	.912	37	4	4.2000
Design solar heating and/or cooling systems with reasonable temperatures and variations	-	-	-	-	-
Implement manpower training programs for solar-related jobs	3.647	1.454	37	5	3.6175
Develop solar heating and/or cooling systems which do not require major modifications in house construction	-	-	-	-	-
Change the building codes to accommodate solar heating and/or cooling systems in homes	4.444	.909	37	5	4.472
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	4.029	1.224	37	5	4.0145

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Government Officials (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Emphasize the pride in owning a solar heating and/or cooling system	-	-	-	-	-
Provide more information on solar energy	4.722	.513	37	5	4.7500

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Total Groups

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Use solar energy systems to reduce pollution in New Mexico	4.266	.750	94	5	4.1595
Emphasize the possibility of an energy shortage to stimulate the use of solar energy	3.984	1.053	250	4	4.0445
Make houses with solar heating and/or cooling systems as attractive as nonsolar houses	4.456	.653	193	5	4.3265
Make energy consumption a critical factor in house design	4.562	.672	217	5	4.5135
Make solar heating and/or cooling units as available as conventional units	4.500	.646	218	5	4.4425
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	4.053	.965	285	4	4.0490
Develop solar systems with lower maintenance and repair costs than for conventional systems	4.312	.891	141	5	4.2750
Award a tax subsidy for the use of solar heating and/or cooling systems in houses	3.383	1.359	287	5	3.4980
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	3.185	1.370	124	4	3.2710

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Total Groups (continued)

Questionniare Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Establish the same utility hookup charge for conventional and solar backup systems	3.599	1.090	267	4	3.6215
Design solar systems with long-term dependability	4.747	.443	297	5	4.7055
Issue strong warranties for solar heating and/or cooling systems	4.274	.845	285	5	4.2195
Emphasize that traditional heating and cooling systems are outmoded	2.900	1.140	281	3	2.9230
Make solar heating systems that require no backup systems	4.057	1.030	283	5	4.0110
Design solar heating and/or cooling systems with reasonable temperatures and variations	4.166	.708	205	4	4.1220
Implement manpower training programs for solar-related jobs	3.602	1.159	186	4	3.6145
Develop solar heating and/or cooling systems which do not require major modifications in house construction	4.364	.800	217	5	4.3250
Change the building codes to accommodate solar heating and/or cooling systems in homes	4.439	.790	187	5	4.4390
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	3.858	1.033	274	4,5	3.8375

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Statewide Importance, and Statewide Importance-Personal Desirability Composite Scores for Total Groups (continued)

Questionniare Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Emphasize the pride in owning a solar heating and/or cooling system	3.560	1.087	168	3	3.5400
Provide more information on solar energy	4.681	.522	295	5	4.6780

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Total Groups

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Use solar energy systems to reduce pollution in New Mexico	4.043	.983	94	4	4.1595
Emphasize the possibility of an energy shortage to stimulate the use of solar energy	4.105	.929	248	4	4.0445
Make houses with solar heating and/or cooling systems as attractive as nonsolar houses	4.197	.818	193	4	4.3265
Make energy consumption a critical factor in house design	4.465	.726	217	5	4.5135
Make solar heating and/or cooling units as available as conventional units	4.385	.736	218	5	4.4425
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	4.045	.960	288	4	4.0490
Develop solar systems with lower maintenance and repair costs than for conventional systems	4.238	.864	143	5	4.2750
Award a tax subsidy for the use of solar heating and/or cooling systems in houses	3.613	1.282	287	5	3.4980
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	3.357	1.317	126	4	3.2710

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Total Groups (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Establish the same utility hookup charge for conventional and solar backup systems	3.644	1.045	270	4	3.6215
Design solar systems with long-term dependability	4.664	.546	298	5	4.7055
Issue strong warranties for solar heating and/or cooling systems	4.165	.910	291	5	4.2195
Emphasize that traditional heating and cooling systems are outmoded	2.946	1.101	280	3	2.9230
Make solar heating systems that require no backup systems	3.965	.992	285	4	4.0110
Design solar heating and/or cooling systems with reasonable temperatures and variations	4.078	.776	205	4	4.1220
Implement manpower training programs for solar-related jobs	3.627	1.288	185	4	3.6145
Develop solar heating and/or cooling systems which do not require major modifications in house construction	4.286	.873	220	5	4.3250
Change the building codes to accommodate solar heating and/or cooling systems in homes	4.439	.877	189	5	4.4390
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	3.817	1.184	279	5	3.8375

Questionnaire Action Statements' Arithmetic Means, Standard Deviations, Number of Valued Responses, and Modes by Personal Desirability, and Statewide Importance-Personal Desirability Composite Scores for Total Groups (continued)

Questionnaire Action Statement	Arithmetic Mean	Standard Deviation	Number of Valued Responses	Mode	Composite Score
Emphasize the pride in owning a solar heating and/or cooling system	3.520	1.234	171	5	3.5400
Provide more information on solar energy	4.675	.556	295	5	4.6780

APPENDIX I

RELATIONSHIPS OF QUESTIONNAIRE ACTION STATEMENTS TO KEY GROUP RESPONSES ACCORDING TO LEVEL OF SIGNIFICANCE AND CRAMER'S V AND QUESTIONNAIRE ACTION STATEMENTS RANKED IN DESCENDING ORDER OF CRAMER'S V

Relationships of Questionnaire Action Statements to Key Group Responses According to Level of Significance and Cramer's V

ACTION STATEMENT	SIGNIFICANCE	CRAMER'S V
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems (S)	.0045	.21156
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans (S)	.0203	.19633
Develop solar systems with lower maintenance and repair costs than for conventional systems (P)	.0212	.20084
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems (P)	.0370	.18291
Award a tax subsidy for the use of solar heating and/or cooling systems in houses (S)	.0446	.18037
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems (S)	.0513	.19493
Establish the same (utility hookup charge) for conventional and solar backup systems (S)	.0523	.18442
Develop solar systems with lower maintenance and repair costs than for conventional systems (S)	.0554	.18100
95 percent significance level		
Make solar heating and/or cooling units as available as conventional units (P)	.0967	.15696
90 percent significance level		
Award a tax subsidy for the use of solar heating and/or cooling systems in houses (P)	.1007	.16675
Establish the same (utility hookup charge) for conventional and solar backup systems (P)	.1104	.17018

Relationships of Questionnaire Action Statements to Key Group Responses According to Level of Significance and Cramer's V

ACTION STATEMENT	SIGNIFICANCE	CRAMER'S V
Use solar energy systems to reduce pollution in New Mexico (S)	.1389	.20496
Design solar heating and/or cooling systems with reasonable temperatures and variations (P)	.1501	.15178
Design solar heating and/or cooling systems with reasonable temperatures and variations (S)	.1508	.15166
Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans (P)	.1520	.16112
Implement manpower training programs for solar-related jobs (P)	.1542	.15907
Issue strong warranties for solar heating and/or cooling systems (P)	.1640	.15621
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems (S)	.1699	.15766
Design solar systems with long-term dependability (P)	.1796	.15248
Provide more information on solar energy (S)	.1871	.15238
Emphasize the possibility of an energy shortage to stimulate the use of solar energy (P)	.1991	.14923
80 percent significance level		
Issue strong warranties for solar heating and/or cooling systems (S)	.2043	.15309
Change the building codes to accommodate solar heating and/or cooling systems in houses (P)	.2084	.14932

(S) refers to Statewide Importance
(P) refers to Personal Desirability

Questionnaire Action Statements Ranked in Descending Order of Cramer's V

Cramer's V	Action Statement
.21156	Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems (S)
.20496	Use solar energy systems to reduce pollution in New Mexico (S)
.20084	Develop solar systems with lower maintenance and repair costs than for conventional systems (P)
.19633	Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans (S)
.18442	Establish the same (utility hookup charge) for conventional and solar backup systems (S)
.18291	Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems (P)
.18100	Develop solar systems with lower maintenance and repair costs than for conventional systems (S)
.18037	Award a tax subsidy for the use of solar heating and/or cooling systems in houses (S)
.17218	Use solar energy systems to reduce pollution in New Mexico (P)
.17018	Establish the same (utility hookup charge) for conventional and solar backup systems (P)
.16675	Award a tax subsidy for the use of solar heating and/or cooling systems in houses (P)
.16112	Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans (P)
.15907	Implement manpower training programs for solar-related jobs (P)
.15766	Make solar heating systems that require no backup systems (S)
.15696	Make solar heating and/or cooling units as available as conventional units (P)
.15621	Issue strong warranties for solar heating and/or cooling systems (P)
.15309	Issue strong warranties for solar heating and/or cooling systems (S)
.15248	Design solar systems with long-term dependability (P)

Questionnaire Action Statements Ranked in Descending Order of Cramer's V (continued)

Cramer's V	Action Statement
.15238	Provide more information on solar energy (S)
.15184	Emphasize that traditional heating and cooling systems are outmoded (P)
.15178	Design solar heating and/or cooling systems with (reasonable temperatures) and variations (P)
.15166	Design solar heating and/or cooling systems with (reasonable temperatures) and variations (S)

(S) refers to Statewide Importance
(P) refers to Personal Desirability

APPENDIX J

DIFFERENCES OF PERCEPTIONS ON QUESTIONNAIRE ACTION STATEMENTS BETWEEN KEY GROUPS AS INDICATED BY F PROBABILITY VALUES

Differences of Perceptions on Questionnaire Action Statements between Key Groups as Indicated by F Probability Values

Action Statement	F Probability Value	Key Group Pairs
Award a tax subsidy for the use of solar heating and/or cooling systems in houses (S)	0.002	Energy--Architect Energy--Consumer Energy--Government
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems (S)	0.003	Consumer--Contractor Government--Contractor Government--Energy Government--Financier Government--Financier
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems (S)	0.004	Consumer--Financier
Develop solar systems with lower maintenance and repair costs than for conventional systems (P)	0.005	Consumer--Energy Consumer--Financier
Develop solar systems with lower maintenance and repair costs than for conventional systems (S)	0.012	Energy--Consumer
Design solar heating and/or cooling systems with reasonable temperatures and variatons (S)	0.019	Architect--Consumer
Award a tax subsidy for the use of solar heating and/or cooling systems in houses (P)	0.024	Energy--Architect Energy--Consumer Energy--Government
Emphasize the possibility of an energy shortage to stimulate the use of solar energy (P)	0.029	Energy--Architect Energy--Contractor Energy--Consumer Energy--Government

Differences of Perceptions on Questionnaire Action Statements between Key Groups as Indicated by F Probability Values (continued)

Action Statement	F Probability Value	Key Group Pairs
Design solar systems with long-term dependability (P)	0.030	Architect--Consumer Architect--Government
Emphasize that traditional heating and cooling systems are outmoded (P)	0.040	Consumer--Architect Consumer--Energy
Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems (P)	0.041	Energy--Consumer Financier--Consumer
Design solar heating and/or cooling systems with reasonable temperatures and variations (P)	0.041	Architect--Consumer
Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems (P)	0.041	Consumer--Financier
Make solar heating systems that require no backup systems (S)	0.043	Contractor--Energy Contractor--Financier
Issue strong warranties for solar heating and/or cooling systems (S)	0.046	Energy--Contractor
Establish the same (utility hookup charge) for conventional and solar backup systems (S)	0.048	Energy--Contractor Energy--Consumer Energy--Financier
Emphasize the possibility of an energy shortage to stimulate the use of solar energy (S)	0.055	Energy--Consumer Energy--Government
Emphasize the pride in owning a solar heating and/or cooling system (S)	0.067	Architect--Consumer
Provide more information on solar energy (S)	0.092	Consumer--Financier
Make solar heating systems that require no backup systems (P)	0.101	Energy--Contractor

(S) refers to Statewide Importance
(P) refers to Personal Desirability

APPENDIX K

DIFFERENCES AMONG KEY GROUPS ON QUESTIONNAIRE ACTION STATEMENTS AS INDICATED BY F PROBABILITY VALUES

Differences Among Key Groups on Questionnaire Action Statements as Indicated by F Probability Values (continued)

Key Groups	Action Statements	F Probability Values	Remoteness Vector Value
	Architects Tend To Differ From:		
Consumers on	Design solar heating and/or cooling systems with reasonable temperatures and variations	S.019 P.041	.3729 .3592
	Design solar systems with long-term dependability	P.030	.2782
	Emphasize that traditional heating and cooling systems are out-moded	P.040	.5551
	Emphasize the pride in owning a solar heating and/or cooling system	S.067	.3886
Government Officials on	Design solar systems with long-term dependability	P.030	.2671
Energy Suppliers on	Award a tax subsidy for the use of solar heating and/or cooling systems in houses	S.002 P.024	-.9647* -.7640
	Emphasize the possibility of an energy shortage to stimulate the use of solar energy	P.029	-.4882
	Consumers Tend To Differ From:		
Architects on	Design solar heating and/or cooling systems with reasonable temperatures and variations	S.019 P.041	-.3729 -.3592
	Design solar systems with long-term dependability	P.030	-.2782

*A negative value indicates that the reference group had a lower arithmetic mean score.

Differences Among Key Groups on Questionnaire Action Statements as Indicated by F Probability Values (continued)

Key Groups	Action Statements	F Probability Values	Remoteness Vector Value
	Emphasize that traditional heating and cooling systems are out-moded	P.040	-.5551
	Emphasize the pride in owning a solar heating and/or cooling system	S.067	-.3886
Financiers on	Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	S.003 P.041	.5164 .5722
	Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	S.004	-.9215
	Develop solar systems with lower maintenance and repair costs than for conventional systems	P.005	-.3605
	Provide more information on solar energy	S.092	.2381
Energy Suppliers on	Award a tax subsidy for the use of solar heating and/or cooling systems in houses	S.002 P.024	-.9284 -.8421
	Develop solar systems with lower maintenance and repair costs than for conventional systems	P.005 S.012	-.5500 -.4820
	Emphasize the possibility of an energy shortage to stimulate the use of solar energy	P.029 S.055	-.5624 .5880
	Emphasize that traditional heating and cooling systems are out-moded	P.040	-.7450
	Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	P.041	-.3872

Differences Among Key Groups on Questionnaire Action Statements as Indicated by F Probability Values (continued)

Key Groups	Action Statements	F Probability Values	Remoteness Vector Values
	Establish the same utility hookup charge for conventional and solar backup systems	S.048	-.6320
Contractors on	Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	S.003	-.5007
	Contractors Tend To Differ From:		
Consumers on	Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	S.003	.5007
Government Officials on	Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	S.003	.7299
Financiers on	Make solar heating systems that require no backup systems	S.043	-.5835
Energy Suppliers on	Make solar heating systems that require no backup systems	S.043 P.101	-.6983 -.6036
	Emphasize the possibility of an energy shortage to stimulate the use of solar energy	P.029	-.5344
	Issue strong warranties for solar heating and/or cooling systems	S.046	.0472
	Establish the same utility hookup charge for conventional and solar backup systems	S.048	-.6650

Differences Among Key Groups on Questionnaire Action Statements as Indicated by F Probability Values (continued)

Key Groups	Action Statements	F Probability Values	Remoteness Vector Value
	Energy Suppliers Tend to Differ From:		
Contractors on	Make solar heating systems that require no backup systems	S.043 P.101	.6983 .6036
	Emphasize the possibility of an energy shortage to stimulate the use of solar energy	P.029	.5344
	Issue strong warranties for solar heating and/or cooling systems	S.046	-.0472
	Establish the same utility hookup charge for conventional and solar backup systems	S.048	.6650
Consumers on	Award a tax subsidy for the use of solar heating and/or cooling systems in houses	S.002 P.024	.9284 .8421
	Develop solar systems with lower maintenance and repair costs than for conventional systems	P.005 S.012	.5500 .4820
	Emphasize the possibility of an energy shortage to stimulate the use of solar energy	P.029 S.055	.5624 .5880
	Emphasize that traditional heating and cooling systems are outmoded	P.040	.7450
	Establish the same utility hookup charge for conventional and solar backup systems	S.048	.6320

Differences Among Key Groups on Questionnaire Action Statements as Indicated by F Probability Values (continued)

Key Groups	Action Statements	F Probability Values	Remoteness Vector Value
Architects on	Award a tax subsidy for the use of solar heating and/or cooling systems in houses	S.002 P.024	.9647 .7640
	Emphasize the possibility of an energy shortage to stimulate the use of solar energy	P.029	.4882
Government Officials on	Award a tax subsidy for the use of solar heating and/or cooling systems in houses	S.002 P.024	.9363 .7429
	Emphasize the possibility of an energy shortage to stimulate the use of solar energy	P.029 S.055	.5643 .5560
	Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	S.003	.6244
Financiers on	Establish the same utility hookup charge for conventional and solar backup systems	S.048	.6250
	Financiers Tend to Differ From:		
Energy Suppliers on	Establish the same utility hookup charge for conventional and solar backup systems	S.048	-.6250
Contractors on	Make solar heating systems that require no backup systems	S.043	.5835

Differences Among Key Groups on Questionnaire Action Statements as Indicated by F Probability Values (continued)

Key Groups	Action Statements	F Probability Values	Remoteness Vector Value
Consumers on	Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	S.003 P.041	.5164 .5722
	Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	S.004	.9215
	Develop solar systems with lower maintenance and repair costs than for conventional systems	P.005	.3605
	Provide more information on solar energy	S.092	.2381
Government Officials on	Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	S.003	.7456
	Government Officials Tend to Differ From:		
Financiers on	Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	S.003	-.7456
Contractors on	Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	S.003	-.7299
Energy Suppliers on	Award a tax subsidy for the use of solar heating and/or cooling systems in houses	S.002 P.024	-.9363 -.7429

Differences Among Key Groups on Questionnaire Action Statements as Indicated by F Probability Values (continued)

Key Groups	Action Statements	F Probability Values	Remoteness Vector Values
	Emphasize the possibility of an energy shortage to stimulate the use of solar energy	P.029 S.055	-.5643 -.5560
	Make the long-term (payback period) of solar heating and/or cooling systems lower than for conventional systems	S.003	-.6244
Architects on	Design solar systems with long-term dependability	P.030	-.2671

APPENDIX L

ACTION STATEMENT LISTINGS FOR FIGURES

Action Statement Listings for Figures

Statement Number	Action Statement	Action Statement Abbreviation*
1	Use solar energy systems to reduce pollution in New Mexico	POLUT
2	Emphasize the possibility of an energy shortage to stimulate the use of solar energy	STIML
3	Make houses with solar heating and/or cooling systems as attractive as non-solar houses	ATRAC
4	Make energy consumption a critical factor in house design	CRITL
5	Make solar heating and/or cooling units as available as conventional units	AVAIL
7	Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems	PAYBK
8	Develop solar systems with lower maintenance and repair costs than for conventional systems	REPAR
10	Award a tax subsidy for the use of solar heating and/or cooling systems	TAXSB
11	Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems	FUND
12	Establish the same utility hookup charge for conventional and solar backup systems	HOKUP
13	Design solar systems with long-term dependability	DEPEN
14	Issue strong warranties for solar heating and/or cooling systems	WARAN
15	Emphasize that traditional heating and cooling systems are outmoded	OUTMD
16	Make solar heating systems that require no backup systems	NOBAK

Action Statement Listings for Figures (continued)

Statement Number	Action Statement	Action Statement Abbreviation*
17	Design solar heating and/or cooling systems with reasonable temperatures and variations	TEMPV
18	Implement manpower training programs for solar-related jobs	TRAIN
19	Develop solar heating and/or cooling systems which do not require major modifications in house construction	NOMOD
20	Change the building codes to accommodate solar heating and/or cooling systems in homes	CODE
21	Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans	SOCIAL
22	Emphasize the pride in owning a solar heating and/or cooling system	PRIDE
23	Provide more information on solar energy	INFO

*P before the abbreviation refers to Personal Desirability
S before the abbreviation refers to Statewide Importance

APPENDIX M

ACTION STATEMENT LISTING FOR FIGURE 1

Statement Number	Action Statement
1.	Use solar energy systems to reduce pollution in New Mexico
2.	Emphasize the possibility of an energy shortage to stimulate the use of solar energy
3.	Make houses with solar heating and/or cooling systems as attractive as nonsolar houses
4.	Make energy consumption a critical factor in house design
5.	Make solar heating and/or cooling units as available as conventional units
6.	Make the initial cost of solar heating and/or cooling systems comparable to conventional systems
7.	Make the long-term cost (payback period) of solar heating and/or cooling systems lower than for conventional systems
8.	Develop solar systems with lower maintenance costs than for conventional systems
9.	Develop solar systems with lower repair costs than for conventional systems
10.	Award a tax subsidy for the use of solar heating and/or cooling systems in houses
11.	Establish a fund to guarantee mortgage loans for houses with solar heating and/or cooling systems
12.	Establish the same utility hookup charge for conventional and solar backup systems
13.	Design solar systems with bng-term dependability
14.	Issue strong warranties for solar heating and/or cooling systems
15.	Emphasize that traditional heating and cooling systems are outmoded
16.	Make solar heating systems that require no backup systems
17.	Design solar heating and/or cooling systems with reasonable temperatures and variations
18.	Implement manpower training programs for solar-related jobs
19.	Develop solar heating and/or cooling systems which do not require major modifications in house construction.

Action Statement Listing for Figure 1 (continued)

Statement Number	Action Statement
20.	Change the building codes to accommodate solar heating and/or cooling systems in homes
21.	Emphasize that solar heating and/or cooling systems are socially acceptable to New Mexicans
22.	Emphasize the pride in owning a solar heating and/or cooling system
23.	Provide more information on solar energy