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INFORMATION AND THE SOLAR CONSUMER

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ABSTRACT

The role of research, development and demonstration (RD&D) in the creation and diffusion of solar energy in the United States appears to be fairly well understood by federal policy makers. The role of information transfer is not nearly as well defined as evidenced by the fact that information programs are among the first items to be cut from the federal budget in periods of fiscal austerity. However, the relationship between the level of information about a new idea, such as solar technology, among potential adopters and that technology's ultimate adoption and use is clearly demonstrated in diffusion research.

1. INTRODUCTION

Solar technologies have been used continuously in the United States since before the turn of the 20th century. In 1897, more than 30% of the homes in Pasadena, California, had solar water heaters perched on the roofs. Today, tens of thousands of Americans still heat their hot water with solar energy; and some of these solar hot water heaters have been in service for more than 50 years. Before the Rural Electrification Administration (REA) was established in 1935, millions of windmills dotted this land. In 1981 nearly 150,000 of these pioneer wind machines still pump water or generate electricity.

Passive solar design was first used in North America nearly five centuries before the Pilgrims settled on this continent. The ancient Greeks used similar designs to heat, cool, and light their homes almost 2,500 years ago. In 1882, Edward Morse installed the first solar air heater in the Peabody Museum in Salem, Massachusetts (1). This heater was the forerunner of the solar air collectors installed in 1943 by George Löf on his home in Boulder, Colorado. When Löf and several associates founded Solaron Corporation in 1974, the first company in the business to go public, the corporation manufactured and sold solar hot air collector systems based upon Löf's early designs.

Table 1. Comparative Preferences For Energy Supply Sources

Here is a list of several energy sources available to us. Please rank the top three energy sources you would prefer to see developed to meet our future energy needs. (1 = most preferred, 2 = next most preferred, 3 = third most preferred.) Now, please indicate the source you least prefer.

Energy Source	Most Preferred (Percent)	Least Preferred (Percent)	In the Top 3 (Percent)
Solar energy	31	3	66
Energy conservation	14	4	45
Snyfuels	10	5	38
Water power from dams or falls (hydropower)	6	8	34
Coal	12	13	36
Oil and natural gas	14	12	34
Nuclear energy	8	45	27
Don't know	6	9	—
No answer	5	1	—

Table 1: Homeowners prefer solar energy over energy alternatives by two-to-one. Solar energy ranked first in the top 3, followed by energy conservation and synfuels. (Figures adapted from Solar Age, April 1981, pp. 22-26 based upon data from SERI.)

Far from being a new technology in the usual sense, solar energy is an old idea whose time has come with the changing circumstances of the 20th century. The diffusion of solar energy can best be viewed as the rebirth of an ancient technology stimulated by $36.00 a barrel imported crude oil and a belated recognition that the world's petroleum fuels will be depleted within 20-40 years (2).

2. ATTITUDES OF SOLAR CONSUMERS

Social scientists at the Solar Energy Research Institute (SERI) recently collected data for one of the largest studies of potential adopters of solar energy ever undertaken (3). During October and November of 1980, the Gallup Organization, on contract to SERI, conducted personal interviews with a national probability sample of more than 2,000 homeowners to determine their knowledge of solar energy, their attitudes toward using it in their homes, and whether or not they had decided to adopt solar energy in the near future.

When homeowners were asked to rank the top energy sources they wanted developed to meet future energy needs in the United States, they chose solar energy by more than two-to-one over the next alternative, as shown in Table 1. Solar energy ranked first by a three-to-one margin over synfuels and nuclear energy. As illustrated in Table 2, more than 77% of the homeowners surveyed by Gallup favored solar energy, while only 5% opposed using the Sun as an energy source.

Table 2. Position on Solar Use

Based on your understanding of solar energy for homes, how do you feel about it—do you strongly favor, favor, oppose, or strongly oppose its use?

Response	Percent	Percent
Strongly favor	32	77
Favor	45	
Unsure/neutral	18	—
Oppose	4	5
Strongly oppose	1	

Given what you know about solar energy right now, do you strongly favor, favor, oppose, or strongly oppose the idea of using it on your home?

Response	Percent	Percent
Strongly favor	21	58
Favor	37	
Unsure/neutral	22	—
Oppose	16	20
Strongly oppose	4	

Table 2: 77% of homeowners say they favor solar energy for use in homes and 58% report they favor solar energy for use in their homes.

More importantly, 58% of the homeowners favored using solar energy in their own homes, while only 20% were opposed. When asked if they thought solar energy systems actually work and are economically practical, 45% said "yes" as shown in Table 3.

Table 3. Perceived Feasibility

In general, solar energy systems are technically and economically practical today for homes.

Response	Percent	Percent
Strongly agree	10	45
Agree	35	
Unsure	35	—
Disagree	18	20
Strongly disagree	2	

Table 3: 45% of the homeowners surveyed by Gallup said they believed that solar energy is technically and economically practical for today's homes.

Despite the fact that solar technologies have been used continuously in the United States for nearly 100 years and that American beliefs about solar energy are positive, the diffusion of solar energy is at a very early stage in the marketing cycle. Estimates of residential solar energy adoptions in the United States vary from about 200,000 to 250,000 installed systems, or less than one-half of one percent of 80 million American homes.

If solar is perceived so favorably in the United States and has been available for more than 100 years, why is it taking so long to penetrate the consumer market? Perhaps part of the answer to this question lies in what R. Buckminister Fuller calls the "ignorance crisis" in the United States. In a recent speech, Fuller said that the United States operates at only 5% of energy efficiency. The energy emergency, said Fuller, results from bad design (4).

That poor design, which Fuller mentioned, is reflected in the buildings constructed all across America. It is generally known that by paying special attention to energy efficiency and design, contractors can construct buildings which use only one-third to one-twentieth as much energy per square foot as the typical American building. As Fuller suggests, the fact that we do not build those energy efficient buildings may be the result of the "ignorance crisis". Certainly a major barrier to the diffusion of solar energy is a lack of knowledge and understanding of solar technologies among potential adopters.

3. A THRESHOLD OF KNOWLEDGE

The importance of research, development, and demonstration (RD&D) in the creation and diffusion of solar energy appears to be fairly well understood by federal policy makers in the U. S.

Department of Energy (DOE). The role of information transfer in the dispersion and adoption of new ideas is not nearly as well defined among the managers of the solar program, since information dissemination is one of the first items to be cut from the federal budget in periods of fiscal austerity. However, the positive correlation between the level of information about an innovation and its ultimate adoption and use is clearly demonstrated in more than 3,500 diffusion studies.

Research shows that information or knowledge of an innovation preceeds at a faster rate than the actual adoption of that innovation. As the level of favorable knowledge about solar innovations increases, the corresponding social pressures on homeowners to adopt those innovations also increase (5). Consumer knowledge about solar energy reflects the amount of information about the technology available to the average individual. Since the current level of solar energy information, particularly on the near-term residential applications of passive design and domestic hot water and the accompanying solar influence is low in America, the probability of adoption is correspondingly low for any individual, whether builder, installer, retailer, or homeowner.

Until the level of solar knowledge increases to about 30% of the potential end users who have seriously considered the technology and plan to invest in it, adoptions of the technology will be limited. However, when the 30% knowledge threshold or critical mass is reached, added knowledge of solar energy among the potential adopters will produce increasing returns in applications of the technologies. Beyond the knowledge threshold shown in Figure 1, each increase in knowledge of solar energy among American consumers will result in a small increase in the use of the technology. This interaction process of people who have learned of an innvoative idea telling other people is often referred to as the "diffusion effect" (6). This effect is the increasing degree of influence on individuals to adopt or reject an innovation resulting from increased rates of knowledge of that idea in society.

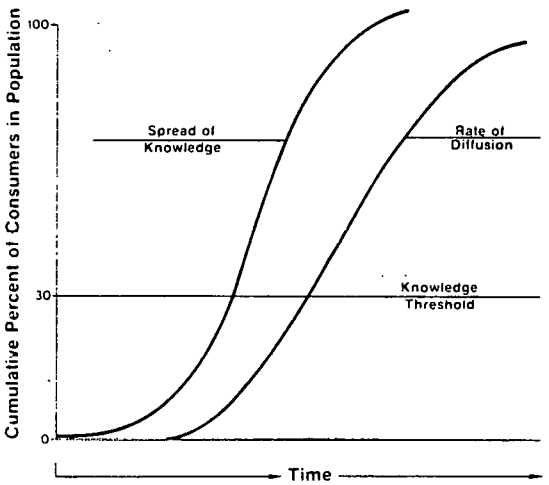

Figure 1. The Spread of Awareness Knowledge Versus the Rate of Adoption of an Innovation

Fig. 1: An information or knowledge threshold occurs when about 30% of the potential adopters in the population know about the innovation and understand how the technology relates to their lives.

Currently, 4% of U.S. homeowners report that they have considered investing in solar energy systems and plan to adopt in the next 2-3 years as shown in Table 4. Another 14% of homeowners surveyed by Gallup report that they have considered solar energy and may invest in the near future. However, 68% of all homeowners say they have not even considered solar energy systems for their homes. We have a long way to go before we reach that 30% knowledge threshold for solar energy.

Table 4. Behavioral Intention

To what extent, if any, have you considered investigating in a solar energy system of any kind for your house in the next 2-3 years?

Response	Percent
Have considered, definitely plan to invest (i.e., have obtained cost estimates and/or equipment)	4
Have considered, may invest	14
Have considered, and will not invest	13
Have not considered	68
Don't know	1

Table 4: About two-thirds of the homeowners reported to Gallup that they had not considered investing in solar energy. However, 18% said they were planning to invest in solar energy or were considering such an investment.

In terms of making a decision to use solar energy, the majority of American consumers are still in an ignorance or early awareness stage as demonstrated by the SERI study. Until homeowners and the managers of commercial buildings begin to understand solar energy and how it relates to their structures, they will not develop behavioral intentions to adopt. A major goal of any information transfer program should be to develop that 30% knowledge threshold necessary for the rapid diffusion of the technology.

4. THE "WHEAT GERM AND GRANOLA SET"

Current adopters of solar energy in the United States are sometimes characterized by non-adopters as the "wheat germ and granola set" or

less flattering names. Such labels indicate that these adopters are perceived by the average consumer as somehow different from other members of society. Diffusion research has carefully analyzed the differences between the first adopters of technological innovations and the nonadopting majority. Persons may be categorized on the basis of their time of adopting of a new idea or bundle of new ideas relative to adoption by the average member of that society.

In such a classification system, those who are the first to adopt any new ideas are labeled the "innovators". Innovators have played an important role in transfering solar RD&D. They have been the stimulators of knowledge about solar energy in this society and have provided the trials and demonstrations necessary to convince the majority of us that the idea is practical. However, innovators, who are described in the diffusion literature as the first 2.5% to adopt an innovation (see Figure 2), are often too venturesome, too deviant from the norms of the social system, and too much in advance of the majority to be accepted as role models by the average consumer.

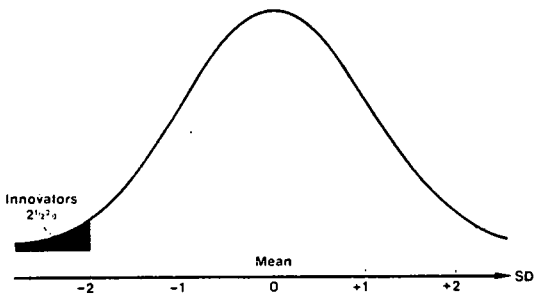

Figure 2. Solar Adopter Categories

Fig. 2: Innovators are commonly defined in the diffusion literature as the first 2.5% of the potential adopters to adopt a new idea. About one-half of one percent of American homeowners have adopted solar innovations.

Innovators build reference groups outside rather than within the communities where they live. They travel widely and are involved in decision making far beyond the boundaries of their own locale. They seek out others much like themselves for friends, and therefore, their social networks extend beyond the community or even the state and nation.

Innovators are better able to predict the consequences of present actions than are the average members of society. These adopters also have higher levels of achievement motivation, more favorable attitudes toward social change and risk, increased exposure to the specialized media of the technical magazines and periodicals, and more years of education than other persons. Innovators court risk, but they also are willing to accept an occasional setback when one of the new ideas they adopt proves unsuccessful. For this reason, innovators tend to have more favorable attitudes toward credit and buying on the installment plan than other consumers.

Innovators are less concerned with the initial costs of a new technology than they are with the status, prestige, and the social approval of peers to be gained from being the first to try out a new idea. The costs of a technology become increasingly important to those who follow the innovators in adopting new ideas (7).

5. EARLY ADOPTERS LEGITIMIZE NEW IDEAS

The second group in the innovativeness classification are the early adopters who are a more integrated part of the local community than the innovators (see Figure 3). They are considered by many persons as the people to consult before trying any new idea. Early adopters are sought for advice and information on new ideas because they are not too different from the average member of the community. Thus they serve as role models for other consumers and legitimize innovations for the rest of society.

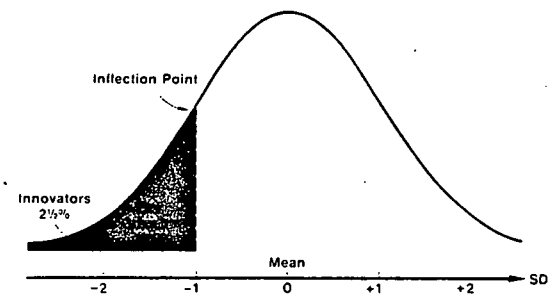

Figure 3. Solar Adopter Categories

Fig. 3: Potential adopters look to these local influentials or early adopters for advice and information about new ideas. These individuals legitimize solar innovations for society.

Early adopters are respected by members of the local community so they can influence others to adopt ideas that they favor. Once the early adopters accept a new idea, a powerful social influence begins working in the community, gradually incorporating the innovation into the lifestyle.

6. CHANNELS OF INFORMATION ON SOLAR ENERGY

Both adopters and nonadopters of solar energy systems report that interpersonal or face-to-face communication sources are most important in making decisions to adopt. Homeowners who have not adopted solar energy say that other people who already have solar technology systems in their homes are the best sources of information. This channel is closely followed by demonstration buildings and model solar homes as shown in Table 5. Solar homeowners rank equipment salespeople as their best source of information, followed closely by friends who have adopted solar energy systems, and by magazines.

In one California study, the best predictor of intent to purchase solar energy systems was the number of persons that the homeowner knew who already had such systems. Two other important predictors were the homeowner's awareness of California's solar tax credit and knowledge of the payback required for solar technologies (8).

7. CONCLUSIONS

This paper has emphasized the important role of information transfer in the diffusion of solar technologoies in the United States. When the risk of adopting a new technology is greatest, the need of potential adopters for good information on that technology is highest. Currently, a major barrier to the diffusion and adoption of solar energy in 80 million American homes is the owners' lack of information.

Homeowners can reduce the risks of adopting solar technologies and the uncertainties of buying and installing such innovations by obtaining additional

Table 5. Solar Information Sources

I'm going to read you a list of possible sources of information about solar energy. I would like you to indicate how likely it is that you would use each source to get information about solar energy, assuming these were available to you.

Sources	Likely (Percent)	Very Likely (Percent)	Likely Total (Percent)
People who have solar energy systems	43	37	80
Demonstration buildings or model solar homes	45	30	75
Books, journals, reports	47	26	73
Magazines and newspapers	51	19	70
Energy fairs, exhibits, home shows	48	18	66
Television and radio programs	48	17	65
Friends, relatives, neighbors, and acquaintances	37	16	53
Local contractors (heating, plumbing, etc.)	42	11	53
Homebuilders, architects	40	11	51
Home energy audits	36	10	46
Seminars/workshops	30	13	43
Adult education classes	27	9	36

Table 5: Interpersonal (face-to-face) information channels are most important to homeowners who have not adopted solar energy. They report they would be most likely to talk with homeowners who have adopted solar energy for information about the technology.

information. Manufacturers, builders, and installers of solar energy systems can ensure that information is available when potential adopters begin their search. According to SERI's national study, information most needed by homeowners is performance data or a clear explanation of the costs and benefits of solar technologies. Homeowners also want information on warranty coverage and the dependability of solar firms.

Diffusion research suggests that there is a knowledge threshold in the spread of solar technologies. When about 30% of all homeowners are knowledgeable about solar energy, the diffusion of solar technologies will increase substantially. Until this threshold or critical mass of knowledge is reached, solar energy will continue to diffuse to a few thousand homes each year.

In a classic article in Public Opinion Quarterly, Harold Mendelsohn, formerly chairman of the Department of Mass Communication at the University of Denver, asks the intriguing question: "Can information campaigns succeed?" (9) His response, and mine, is an enthusiastic "yes," but that information transfer must be:

- Carefully planned under the assumption that most of the consumers being addressed will be only slightly or not at all interested in what is communicated;
- Planned to achieve specific middle-range goals that can be reasonably accomplished in a short time;
- Targeted to answer "why" and "how" questions which are central to consumer decision making and are the most difficult for consumers to obtain valid answers to; and
- Focused upon specific segements of the population in terms of demographic and psychological attributes, life-styles, beliefs, and stages in the solar decision-making process.

All of this assumes, of course, that policy makers consider information transfer important enough to provide adequate support for it to happen for solar RD&D.

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