

MARKET SIMULATION AS A METHOD TO ASSESS MARKET POTENTIAL FOR SOLAR DOMESTIC HOT WATER PROGRAM IN WISCONSIN

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Introduction

The Public Service Commission of Wisconsin (PSCW) required the state's Class A electric utilities "finance and participate in a collaborative effort to study the feasibility of a statewide program to promote the use of solar water heating in Wisconsin" As part of the Advance Plan 7 process. An ad hoc Solar Water Working Committee (the Committee) comprised of utility, state, commission and solar interests was established to address this issue. The Committee soon realized that the low penetration of solar domestic water heaters (SDHW) is a market problem, not a technical one.

To address the market issues, the Committee chose to conduct market research to identify market barriers to the installation of SDHW systems and determine key program elements of a program that could overcome the barriers and maximize participation. In light of the restructured electric utility industry, a critical directive from the PSCW was to develop a program that was "provider neutral." In other words, the Committee was directed to focus on a program design that did not assume program delivery would be by a utility company or a utility subsidiary.

In this paper we discuss the results of a statewide market simulation. We conducted the simulation to test a program design and assess the effect of different program delivery agents on participation. The market simulation provided interesting (if not encouraging) results, as well as pointing out some problems inherent in this type of market simulation.

The Market Assessment Project

The Energy Center of Wisconsin (ECW) was assigned the task of working with the Committee to manage the research agenda. In summer 1996, the ECW prepared a request for proposals to conduct a market assessment. The resulting project included the following six components:

1. A review of national SDHW programs,
2. Interviews with trade allies,
3. Focus groups with electric water heater customers
4. Interviews with solar water heater customers,,
5. A market simulation and survey of statewide electric water heater customers to

- test a SDHW product concept for use in developing a participation forecasts, and
6. A business analysis of the solar product business.

The research was structured so that each step informed the subsequent steps. Thus, the program review was used to identify key issues for discussions with trade allies and consumers. Similarly, the interviews with trade allies and review of program experience were used to identify a viable SDHW product concept.

We used the focus groups with electric water heater owners and the interviews with solar water heater owners to help define changes to the product concept and to identify key issues for analysis in the market simulation and the business analysis of the model solar product. Finally, we used the market simulation to estimate market potential, and in conjunction with the business analysis, to identify barriers to a successful SDHW business.

Market Simulations

A key component of the statewide survey was to test the difference in market acceptance across five different program deliverers. This was essential given the PSCW's directive to develop a program that was "provider neutral." An early step was to identify the potential providers or delivery agents for a Wisconsin SDHW product. We identified seven possible options for delivery agent. These included:

1. A local utility company,
2. An electric or gas utility company other than the local distribution company,
3. An energy services company,
4. A nationally known company like Honeywell or Culligan,
5. A local solar contractor,
6. A local plumbing contractor, or
7. The State of Wisconsin.

We eventually selected five of these for the market simulation. We excluded the energy services company and the local solar contractor believing that these were both more difficult to explain and tended to be subsumed under one of the other five. Specifically, energy service companies is similar to a services company with a national name

and local solar contractor is similar to a local plumbing contractor.

Market Simulations

Measuring customer choice, setting prices, and estimating market penetration can be done using a variety of techniques. The key options range from asking people to state their preferences, to asking people about their behaviors, to examining consumer behavior and response to market offerings.

Market researchers and economist prefer to examine these preferences within the market place. For instance, to measure the difference between two delivery agents' market performance we might compare the sales performance of seller A to that of seller B. In the case of a new product, however, sales data are not available. In these cases, one generally asks consumers to state their preferences using hypothetical choices or to identify their past behaviors. Alternatively, one can implement a market simulation and ask consumers to make a choice. We chose the market simulation approach.

A review of the various solar programs offered throughout the United States indicated that a SDHW product offering using a lease, rather than outright purchase, seemed to have the highest probability of success. In addition, one of the five utilities supporting the project had conducted a market test in their own service territory for a lease-based solar product.

We constructed a market simulation using the lease-based product concept developed by the Wisconsin utility as a starting point. A black and white glossy brochure describing the program was mailed to a sample of electric water heater customers in Wisconsin. Sent in an ECW return addressed envelope, the packet contained a letter informing the consumer that they would be contacted by a research firm to obtain their views on the program.

We randomly assigned survey respondents to receive marketing materials from one of the five potential delivery agents and included descriptions of the selected delivery agents' role in the program. This provided the framework for testing reactions to the program concept, as well as the different delivery agent.

There were, however, three aspects of the market simulation that were necessary in order to conduct the test statewide and to test the five different delivery agent options. These were:

1. We could not use a company name for any of the delivery agents, but had to use a description for each.
2. We were not actually offering a product, only a test, so we could not include any specific details on how to enroll in the lease program.
3. Since the delivery agent was a description, the material was mailed from the ECW not from the delivery agent.

Market Simulation Results

We mailed 1,500 copies of the brochure and letter to consumers identified as electric hot water heating customers by the five investor owned utilities in Wisconsin. We anticipated obtaining 70 completions per type of delivery agent for a total of 350 responses. The results were much lower than expected, 185 consumers completed the survey. Table 1 displays the disposition of the market simulation survey.

Reviewing the table we can learn several things about using utility databases to conduct energy service product tests. For instance, 27% of the uncompleted surveys suggest problems with the utility databases: 10% were undeliverable, 8% of the phone numbers were wrong, 5% had been disconnected, 1% of the phone numbers were computer tones instead of voice numbers, and 3% were business or government numbers not residential (most likely small businesses with residential accounts).

Among those we were able to talk to, we found many consumers we expected to be members of the target population, were not. The reasons for ineligibility where that they either did not have electric hot water (20%) or were not home owners (10%).

Table 1: Survey Disposition

Result	Number	Percent of Total Sample (n=1,500)	Percent of Eligible (n=449)	Response Rate (n=932)
Complete	185	12.3%	41.2%	19.8%
Eligible - not completed	264	17.6%	58.8%	28.3%
Did not recall or read materials	144	9.6	32.1	
Refused because survey on solar	105	7.0	23.4	
Break-off	15	1.00	3.3	
Eligibility Undetermined	483	32.2%		51.8%
Undeliverable or wrong number	191	12.7		
NA/Answering machine/Busy	126	8.4		
Call-back	90	6.0		
Initial refusal	62	4.1		
Language problems	14	0.93		
Not Eligible	568	37.8%		
Non-elec. Water heating	292	19.5		
Not a homeowners	144	9.6		
Disconnected	67	4.5		
Bus/Government	45	3.0		
Computer ton	11	0.1		
Five units or more	5	*		
Duplicate	2	*		
Nor a Wisconsin resident	2	*		

- Less than ½ of .01 percent.

These problems account for 57% of the list of 1,500 potentially eligible utility customers. Clearly it is difficult to identify a target population, even when there is fairly good information available, i.e. we had utility records to use in identifying electric water heater customers. However, in the case of electric water heating two factors make it difficult to identify the market with precision:

1. Electric water heating is a declining market, so correct identification of water heating fuel customers is difficult to maintain;
2. Even without the changes in the market place, it is difficult to accurately identify the end-use configuration of each individual account. In the case of the five Wisconsin investor owned utilities, three used a marker to identify electric water heater customers in their database, two did not. The two with no marker developed an algorithm based on usage to identify electric water heating customers.

Finally, even when one can reach a consumer, there are other problems with completing a survey. Nearly 10% of the eligible had not kept the materials or could not remember the materials, even though the materials included a letter asking the consumer to participate in the survey. And among those with undetermined eligibility, just over 4% either refused to talk to the interviewers because they “don’t do surveys” or were an initial refusal with no reason given. Another 4% refused to talk to the interviewers because they are opposed to solar.

Not surprisingly, with such a low completion rate, our ability to use the market simulation to estimate the response to different delivery agents was compromised. Table 2 shows the number of survey completions by delivery agent. We had hoped that we could identify differences in response rate or in program interest associated with delivery agent. Though there are apparent differences in response rate across delivery agent, the differences are not significant when tested using a Chi-square test. Similarly, we found no differences in response to the program based on which delivery agent the consumer was told would deliver the solar product.

Table 2: Survey Completions by Delivery Agent

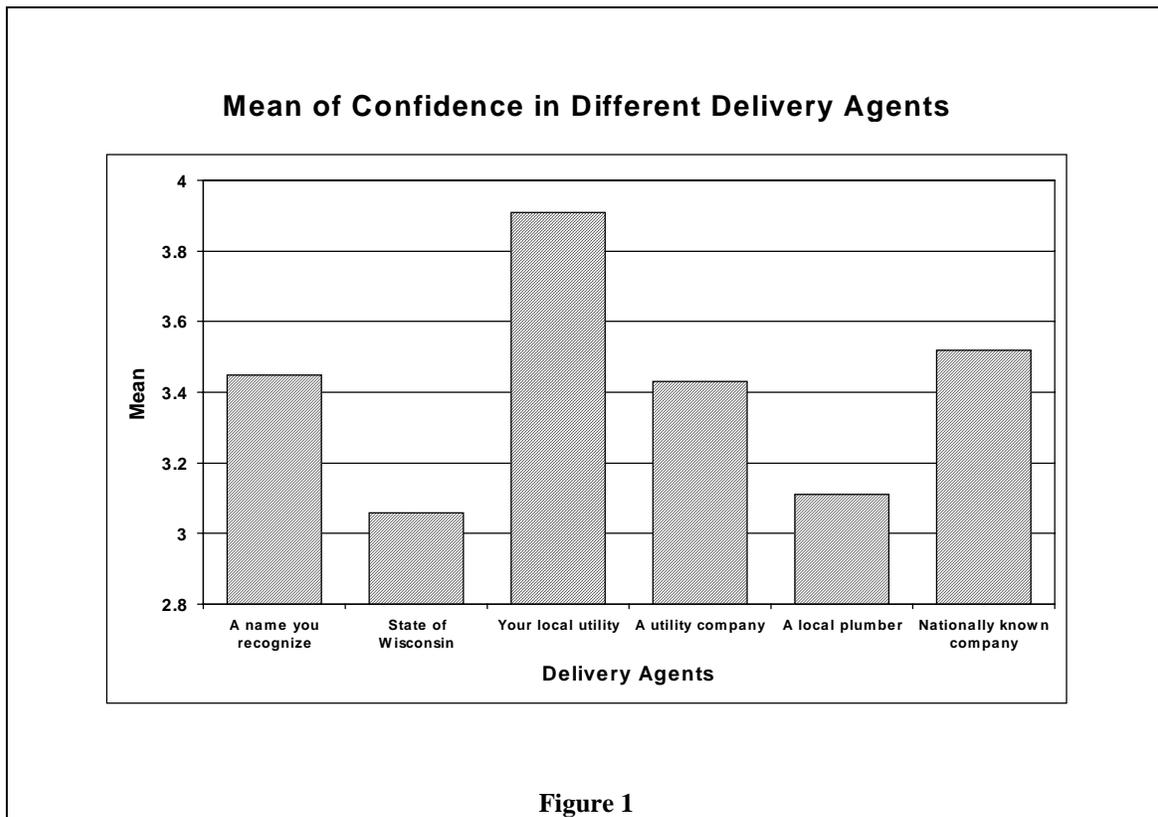
Delivery Agent	Local Utility	An electric or gas utility	A nationally known company	A local plumbing contractor	The State of Wisconsin	Total
Original Goal	70	70	70	70	70	350
Reduced Rate Goal Achieved	37	37	37	37	37	185
	45	37	26	37	40	185

Fortunately, we also included a question asking customers their confidence in different delivery agents. For this exercise we gave respondents six agents. Figure 1 displays the mean level of confidence the consumer placed on each of the different types of delivery agents.

Respondents report a significantly higher level of confidence in a local utility than in any other delivery agent. They were followed by nationally known companies such as Honeywell or Culligan, “a name you recognize,” and a utility company, with no significant difference between these three agents. The ratings for these delivery agents seem consistent: both the nationally known company and the local utility are names the consumer is likely to recognize. “A utility company,” while rated somewhat

lower than the other delivery agents, was not significantly lower. Thus, it would likely receive higher ratings if the name of the utility company were recognizable.

The State of Wisconsin and local plumbers, whose ratings were not significantly different from each other, received the lowest confidence ratings. We believe this reflects consumer concerns about these two potential delivery agents. The low rating for the State of Wisconsin may reflect the belief expressed in the focus groups that the State should not be offering programs and that government should be kept small. The low rating for local plumbers likely reflects uncertainty about who that might be.



The simulation did provide sufficient information to calculate market potential for the lease-based SDHW product. Table 3 displays these calculations. Two proce-

dures were used to calculate a high and low estimate for market potential. The base estimate of electric water heating customers (including investor owned utilities and co-

Table 3: Calculation of Market Potential

Estimation Procedure A	Five IOUs	Co-ops
Base estimate of electric water heater customers	514,000	86,000
Overestimate of electric water heaters by 0%	0	-0
Not qualified - not a homeowner 10% (See Table 1.)	-51,400	-8,600
Not interested in solar - 23% ¹	<u>-118,220</u>	<u>-19,780</u>
	344,380	57,620
Total Potential Market (344,380 + 57,620)	402,000	
Total Potential participants 6% ²	24,120	

Estimation Procedure B	Five IOUs	Co-ops
Base estimate of electric water heater customers	514,000	86,000
Overestimate of electric water heaters by 14% ³ (See Table 1.)	-71,960	-0
Not qualified - not a homeowner 10% (See Table 1.)	-51,400	-8,600
Not interested in solar - 23% ¹	<u>-118,220</u>	<u>-19,780</u>
	272,420	57,620
Total Potential Market (272,420 + 57,620)	330,040	
Total Potential participants 6% ²	19,802	

¹These are households that refused to participate in the survey because they said they are not interested in solar (see Table 1). The survey was not completed with them.

²This is based upon the number of people that said that they are “very likely” to participate in the program. This estimate was used to approximate the expected number of completions for two reasons. First, some of the open-ended responses from these customers indicated that they did not understand the question and were unlikely to participate. However, it is possible that some respondents indicating that they are “somewhat likely to participate” might do so. We did not increase the estimate beyond six percent given historical evidence of participation. (see Table 3).

³This is applied to the Investor Owned Utilities only. The survey was not conducted with co-op customers and it is unclear whether this overestimate would occur in that population. Derived from Table 1.

ops) is 600,000 for the State of Wisconsin, based on residential appliance saturation survey data. The sample for the five utilities used in this study, however, was drawn based on their ability to identify electric water heating customers.

Given that the utilities do not reconcile their appliance saturation survey results with their customer databases, we used Procedure A to estimate market potential without any adjustments for misidentification of electric water heaters. Nonetheless, the number of electric water heater customers is declining due to increased availability of gas. Therefore we used Procedure B to estimate market potential with an adjustment for misidentification of electric water heaters.

We used a single approach for estimating the market potential for co-op customers. This approach did not require an adjustment for misidentification of electric water heating customers because, as we assumed, the likelihood of switching to gas remains low for co-op customers.

To estimate potential market penetration of the lease-based SDHW program we calculated 6%¹ of the market potential estimated by each procedure. This yielded an estimated range for market penetration from 20,000-24,000 participants.

Problems with Market Simulations

Upon review of the market simulation we identified two research concerns. The first concern pertains to the nature of market simulations and how well results approximate market conditions. The second pertains to the lack of consumer awareness and knowledge of a product as a barrier to conducting market simulations and product introduction.

¹ Six percent is the number of consumers who responded to the market simulation survey that they were “very likely” to participate in the program.

Simulation Versus Real Market Conditions

Market simulations are just that—simulations. One hopes that the simulation will closely approximate the consumer's experience of a real product offering. In this case the cover letter indicated the hypothetical nature of the product offering. Sampled customers were told that the offer was part of a survey (about an upcoming program.) Each sampled customer was also told that the program would be offered by one of five delivery agents. The description of each delivery agent was vague—a local utility, a well known service company such as Honeywell or Culligan—which may have reduced the legitimacy of the offer.

The changes also reduced comparability of the statewide market test to the utility test. The utility market simulation offered an actual program and the marketing materials contained the utility logo. For several years prior to the utility market test the utility had been promoting solar energy to its customers. Our qualitative research efforts indicated that these customers were more aware and knowledgeable about solar energy than customers elsewhere in the state. We could not test this concern directly from the data. The original market test, however, had a higher response rate and a larger percentage of customers interested in the program. Our response rate was lower for two known reasons:

- The identification of electric water heater customers was less accurate than when the utility conducted its own study.
- Customers of this utility are more knowledgeable about solar technologies due to promotional activities on the part of the utility.

We still believe that some of the non-response is due to the simulation issues discussed above.

Consumer Awareness and Knowledge

The second concern regards consumer's knowledge and understanding of solar technologies. Both the interviews with trade allies and focus groups with consumers strongly indicated that consumers have both limited knowledge and limited understanding of solar. In the 1970s, many people were exposed to solar water heating. This occurred through sales calls and public information associated with the solar tax credit programs. Since the

cessation of the solar tax credit in the early 1980s public discussion of solar has waned.

Our findings suggest that consumers experienced this lack of discussion as an indication that solar failed to perform, rather than as a change in government policy. Thus, while knowledge was clearly identified as a barrier to SDHW products in Wisconsin, it also proved to be a barrier to the market simulation. We suspect that consumers were sufficiently unfamiliar with the product such that they had difficulty making informed statements about the product offering.

Additionally, many trade allies are limited in their knowledge regarding solar technologies and admittedly need much education if they are to promote it to their customers. Contractors expressed a variety of opinions and attitudes about SDHW and the likelihood of creating a viable SDHW market. Most contractors, including most SDHW contractors, were not very optimistic about the future of SDHW in Wisconsin. Many felt that without a substantial effort to increase customer awareness and knowledge of SDHW there would be little activity.

Residential electric water heater owners participating in focus groups were generally unaware of the potential for solar and shared many misconceptions regarding the viability of solar in Wisconsin. Comments regarding the cold climate in Wisconsin, fear of pipes freezing and "ugly collectors," and a sense that homes could not be retrofitted for solar, were commonly raised. Although the cold climate of Wisconsin does necessitate freeze prevention in solar systems, the amount of solar insolation, even in the winter, is more than sufficient to operate a solar domestic water heater.

The market simulation confirmed the findings from the preliminary and qualitative research with trade allies and customers. Of the consumers contacted for the survey, 23% refused to participate in the survey because they had negative attitudes toward solar energy or solar programs.

The most telling finding regarding the lack of knowledge about solar was in response to our question regarding the practicality of solar water heating in Wisconsin. As Figure 2 shows, there is a normal distribution on this question, with over 40% of the consumers indicating their uncertainty by saying it "may be or may not be practical." Just under 30% believe that it is either "practical" or "very practical."

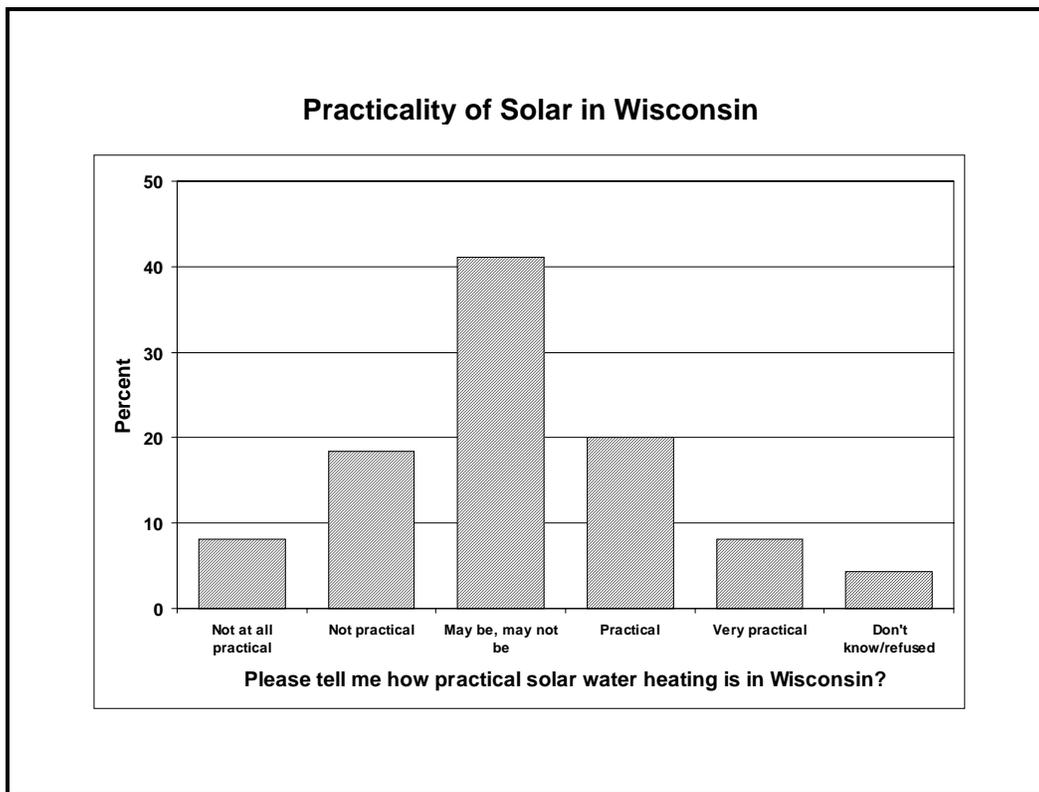


Figure 2

To better understand their responses, we asked those who did not think solar was practical why they had responded that way. Of the 46 responding to this question, 34 (74%) said that climate was a concern, five (11%) said they were specifically thinking of their own home, not Wisconsin, and seven (15%) gave other responses.

Finding a normal distribution in response to a question is somewhat unusual. Typically, if respondents feel they have information, responses skew in one direction or the other—most would either think it is or it is not practical. We take the normal distribution in responses to this question as an additional reflection of the lack of knowledge regarding solar in Wisconsin.

Having a degree of certainty regarding the practicality of solar in Wisconsin is a prerequisite to judging a SDHW program. As shown in Table 4, we found that responses to questions about the practicality of solar water heating in Wisconsin and responses to questions on the initial appeal of the solar program were highly correlated with the likelihood of participation in the program. As Table 4 shows, our analysis revealed that likely participation (Q12 new) correlates strongly with responses regarding the initial appeal of the program (Q3 new) and opinion about the practicality of solar water heating (Q2 new) in Wisconsin.

Table 4: Correlation Matrix for Participation, Appeal and Practical (n=185)

Spearman's Rho	Q12 New Participate	Q2 New Practical	Q3 New Appeal
Q12 New	1.00		
Q2 New	.414**	1.00	
Q3 New	.601**	.536**	1.00

** Correlation is significant at the .01 level (2-tailed).

Given these correlations, we hypothesize—what is perhaps obvious—that a consumer must see SDHW as practical (in addition to the program having initial appeal) before the consumer will state that they are likely or very likely to participate. For the SDHW program, this suggests that the extent to which consumers believe in the practicality of solar water heating and how initially appealing the solar program is to them will drive their decision to participate.

This also reflects on other new product concepts that might be market tested. If the concept is new and unfamiliar to the consumer, it is unlikely that consumers will be able to accurately assess their likelihood of participation. Only as they become familiar and knowledgeable about the product concept will they be sufficiently informed to know their own willingness to adopt the product or service.

Suggestions for Effective Use of Market Simulations

The two issues discussed above are noteworthy because they are inherent in market tests of new energy service products. The telecommunications industry spent many years and dollars exploring call waiting, call forwarding, and voice messaging. Eventually, the public had enough awareness and knowledge to respond realistically in the research setting. Hypothetical products can be market tested, but the introduction of the product may result in a different response than that identified in the market test. Based on our experience we believe there may be some ways to reduce the gap between simulation and market results.

- The market simulation should be designed to be as real world as possible. Using a name consumers will recognize is critical to obtaining good response rates. Utilities have had this advantage in the past, but new energy service products may be offered by an entity that has little brand equity. Clearly, building brand equity can be part of a process of new product entry, but it must proceed the product test in order for the test to provide realistic results.
- Pay close attention to sampling issues, especially as they relate to your target market. A carefully selected sample will provide a better estimate of market potential, and at a lower cost. We anticipate, however, that this will be increasingly more difficult as the electric utility industry changes. When samples cannot be pre-screened, the market simulation can provide valuable information on the true size of your target market. Design your survey screening questions to obtain this information and pre-test them, if possible, to get a better estimate of the required sample base for successful implementation of the test.
- Timing of the market simulation is important on two fronts. First, the market simulation of a solar domestic water heating program in Wisconsin may have been premature, relative to consumer awareness of solar energy. The research results showed a lack of knowledge regarding solar, as well as the need for knowledge regarding its practicality in order to choose to purchase it. Any market simulation in the absence of information to the potential consumer may suffer. Whenever possible, market simulation studies should be pre-

ceded by educational efforts to reduce problems associated with a lack of information, or misinformation.

Second, the seasonal timing of the market test probably increased the negative response to the practicality of solar. The market test period turned out to coincide with a long cloudy cold spell just prior to Christmas. Test marketing a solar product in Wisconsin would probably best be done in the summer, when Wisconsin consumers are enjoying sunshine and warmth. Initially, promotion of solar domestic water heaters should be done in this time period, as well.

Finally, don't avoid a market simulation because you cannot successfully simulate true market conditions with a knowledgeable customer base. Despite the problems we encountered, the market simulation provided a better means for estimating market potential than without market simulation materials. It also provided quantitative information that confirmed the results of our qualitative research efforts, and raised issues related to identifying the true market population for solar domestic water heaters.

As a result of the simulation we understand many of the drivers behind interest and eligibility for a SDHW lease-based program in Wisconsin. While we might have concluded a similar low level of interest from the focus groups and trade-ally research, the market simulation in conjunction with the business analysis, provided a level of certainty even the most avid solar enthusiasts had to take seriously.

Postscript

As of the writing of this paper the ad hoc solar committee is submitting a report to the Public Service Commission of Wisconsin. The committee did not recommend full-scale implementation of a solar retrofit program. Instead, they recommended four activities:

- Statewide offering of solar orphan programs to repair existing SDHW systems, along with a targeted education campaign to ensure the program reaches the maximum number of customers.
- Co-funding efforts to develop less expensive freeze-protected systems and reliable three-season systems.
- Pilot testing a new construction program that includes SDHW and other solar technologies.
- Large scale "Solar Works in Wisconsin" education campaign to address attitudinal barriers.