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BEFORE THE ARIZONA CORPORATION COMMISSION

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JIM IRVIN  
Commissioner  
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Commissioner

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IN THE MATTER OF THE GENERIC  
INVESTIGATION OF THE DEVELOPMENT  
OF A RENEWABLE PORTFOLIO STANDARD  
AS A POTENTIAL PART OF THE RETAIL  
ELECTRIC COMPETITION RULES

DOCKET NO. E-00000A-99-0205

NOTICE OF FILING

Staff of the Arizona Corporation Commission hereby files the rebuttal testimony of Ray T. Williamson, Acting Director, Utilities Division, and Bruce Hernandez, Behavior Research Center in the above-captioned docket.

RESPECTFULLY SUBMITTED this 30<sup>th</sup> day of August, 1999.

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**REBUTTAL  
TESTIMONY  
OF**

**RAY T. WILLIAMSON**

**AND**

**BRUCE HERNANDEZ  
BEHAVIOR RESEARCH CENTER**

**DOCKET NO. E-00000A-99-0205**

**AUGUST 30, 1999**

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IN THE MATTER OF THE GENERIC )  
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\_\_\_\_\_ )

DOCKET NO. E-00000A-99-0205

REBUTTAL

TESTIMONY

OF

RAY T. WILLIAMSON

ACTING DIRECTOR

UTILITIES DIVISION

AUGUST 30, 1999

1 Q. What is the purpose of Staff's rebuttal testimony?

2 A. There are two parts of Staff's rebuttal testimony. First, I have responded to direct  
3 testimony and comments filed by others in this docket. Included are some of my  
4 comments about the survey just completed for Staff by the Behavior Research Center.  
5 Second, Staff witness Mr. Bruce Hernandez presents the results of the survey conducted  
6 by Behavior Research.

7  
8 Q. Have you reviewed the direct testimony of Mr. Ed Fox of Arizona Public Service  
9 Company and do you have any concerns about his direct testimony?

10 A. Yes. I have a number of concerns about the APS testimony.

11  
12 My first concern is with APS' System Benefits Charge approach. In this approach, only  
13 Utility Distribution Companies (UDCs) would be funded to install and operate portfolio  
14 technologies. This is totally contrary to the original objectives of the portfolio standard:  
15 to encourage all electric service providers to gain experience, at a small scale (less than  
16 1% of electricity), with renewable and clean technologies. This important "learning  
17 curve" experience will be invaluable in the 21st century as these new technologies  
18 become a larger part of our generation mix. To limit this experience to UDCs only will  
19 thwart this goal and could actually offer UDCs a competitive advantage in the future.

20  
21 In addition, to charge all customers to pay for solar generation of only one competitor  
22 (the UDC) is contrary to our attempt to create a "level playing field" among all  
23 competitors.

24  
25 Q. What other concerns do you have about the testimony of Mr. Fox?

26 A. My concern is that APS apparently incorporated into its spreadsheet EZF-5 a cost of solar  
27 installations that seems to reflect the costs of only one type of solar technology.  
28 However, I am aware of offers that have been made to APS for solar electricity costs of

1 less than 10 cents per kWh, which causes significantly less impact on ratepayers than  
2 portrayed by APS in EZF-5. In the APS proposed settlement, customer rates would be  
3 dropping by 1.5 percent per year. This drop is greater than the additional costs of solar  
4 electricity at 10 cents per kWh and at portfolio levels of .4 percent of retail electricity  
5 sales.

6  
7 Q. APS expresses concern about the ability of ESPs and Affected Utilities to install the  
8 amount of solar capacity needed to meet the 2001 portfolio requirement. Is this concern  
9 justified?

10 A. No. Affected Utilities and ESPs have known since December 1996 that the Commission  
11 planned to have a portfolio requirement. APS could have installed part of its required  
12 solar capacity in 1997, 1998 and 1999 and received extra credit multipliers to meet the  
13 2001 requirement. Besides, APS is only counting the potential for "new renewable  
14 energy technologies" when it references the "global solar capacity installed in 1998."  
15 Just because nobody ordered or installed a solar trough system in 1998, does not mean  
16 that the manufacturing capability is not there to meet the demand. But first, utilities, such  
17 as APS, have to make such an order rather than dismissing solar trough systems as  
18 "existing solar technology."

19  
20 Q. Are there contradictions in Mr. Fox's testimony?

21 A. Yes. On the one hand, APS claims that solar technologies are too expensive and that  
22 there is not enough manufacturing capacity to meet the portfolio requirement. But on the  
23 other hand, APS dismisses "existing solar technologies" (such as the solar trough) and  
24 seems to prefer to purchase the newer, developing technologies.

25  
26 The fact is that solar trough technologies account for a major portion the U. S. installed  
27 solar technology: over 350 MW in California alone. Although the troughs do not have  
28 the same potential for future cost reductions as do photovoltaics and Dish Stirling

1 Systems, the troughs are the lowest cost alternative available today. Staff believes that  
2 portfolio participants should consider using both the existing (solar trough) and new (PV  
3 and Dish Stirling) technologies in their portfolios.

4  
5 Q. What about Mr. Fox's claim that the portfolio standard will impact the competitive  
6 market?

7 A. The portfolio standard was designed to ensure that all competitors in the competitive  
8 market will meet the same portfolio requirement. To say that competitors will not enter  
9 the market with a portfolio requirement is shown to be incorrect by the number of ESPs  
10 that have already applied and received Certificates of Convenience and Necessity in  
11 Arizona.

12  
13 Q. Mr. Fox and APS have suggested that geothermal power and municipal solid waste be  
14 included in the portfolio. Do you agree?

15 A. No. First, I have been involved in two studies to evaluate geothermal potential in  
16 Arizona. Arizona just does not have economically viable geothermal resources. To  
17 include geothermal would require that it be imported from outside of Arizona, creating an  
18 increased burden on transmission lines, which will probably be fully scheduled due to  
19 competition.

20  
21 The issue of municipal solid waste (MSW) as a generation source has been discussed, on  
22 and off, over the last 15 or so years. The problem with burning MSW is that the  
23 economics of transporting the waste require a plant near a major metropolitan area, such  
24 as Phoenix and Tucson, but both of these major cities are already in air quality "non-  
25 attainment" areas. Also, MSW projects in other states have had problems with dioxins  
26 and other residues from waste burning.

27 ...

28 ...

1 Q. Are there any other inconsistencies in the APS testimony?

2 A. Yes. Mr. Fox's answer to question 33 does not make sense in the context of what APS  
3 has proposed. APS suggests that the "cost-benefit criteria should be established at the  
4 same time the portfolio standard is adopted." This would be done so that "if the  
5 estimated cost impacts . . . are being exceeded . . . any adverse effects of the portfolio  
6 standard are minimized."

7  
8 So, on the one hand, APS only wants to concentrate its efforts on the very expensive  
9 "new" technologies and wants to take a pass on the already commercialized "existing"  
10 technologies. But on the other hand, by applying the cost benefit criteria too early, APS  
11 will self-abort its own planned R&D plan for the new technologies.

12  
13 Q. In NEV Southwest's comments, biomass was suggested as a technology to include in the  
14 portfolio. Do you agree?

15 A. As far back as the late 1970s, the Arizona Solar Energy Commission (ASEC) conducted  
16 studies of Arizona's biomass potential. The ASEC determination was that, with the  
17 exception of a few isolated locations, there was not a significant economically-viable  
18 biomass potential in Arizona's generally arid climate region.

19  
20 However, land fill gas, if defined as "biomass," would seem to be a reasonable resource  
21 and Staff would recommend its inclusion in the environmental technology portion of the  
22 portfolio.

23  
24 Q. New West Energy suggested fuel cells and microturbines as technologies to be included  
25 in the portfolio. Are they appropriate?

26 A. No. Staff's position has been to include only clean, renewable technologies in the  
27 portfolio. The whole point in developing the portfolio concept was to move away from  
28 polluting conventional fuels and toward the use (at 1 percent or less levels) of non-

1           polluting technologies that do not have to rely on the availability of conventional oil,  
2           natural gas, coal and other non-renewable fuels.

3  
4           Both fuel cells and microturbines will rely on conventional fuel sources. The  
5           microturbines may be less polluting than some of today's technologies, but they will still  
6           rely on natural gas and still produce pollutants. Even the fuel cells, which can be  
7           hydrogen-driven, will rely on either a conventional fuel supply to produce the hydrogen  
8           or on conventionally-produced electricity to create the hydrogen. Staff suggests that both  
9           fuel cells and microturbines fit perfectly into the 99 percent conventional/polluting  
10          portion of an ESP's or UDC's generation mix.

11  
12        Q.     What are your comments concerning the survey conducted by Behavior Research Center?

13        A.     The results are generally what was expected. Arizona's results are consistent with past  
14           surveys conducted in Arizona. Also, the results are consistent with a review of market  
15           research recently published by the National Renewable Energy Laboratory. That report  
16           is attached as Appendix RTW-1 to this testimony.

17  
18        Q.     The Behavior Research Center report shows that 29 percent of Arizonans interviewed are  
19           willing to pay more per month for solar electricity. What are your reactions to this  
20           finding?

21        A.     The fact that close to one-third of customers would be willing to pay more for solar  
22           electricity is very positive. We have assumed, in the past, that the number was much  
23           lower.

24        ...

25        ...

26        ...

27        ...

28        ...

1 Q. What about the concern that 61 percent do not want to pay more for solar electricity? Is  
2 that a problem?

3 A. No, not really. Actually, we probably should have phrased the question differently.  
4 Under the proposed portfolio standard, including the decrease in rates due to competition,  
5 there will be a net reduction in customer rates, even with the small portfolio costs  
6 included.

7  
8 Remember that we are starting by adding only .2 percent of electricity in the portfolio at  
9 the same time that ESPs and UDCs will be lowering their rates. So, characterizing the  
10 question in the context of increasing rates was incorrect.

11  
12 Q. Are there any questions not in the survey that should have been asked?

13 A. Yes. On August 29, 1999, about three weeks after Staff and Behavior Research Center  
14 finalized its list of questions and two weeks after the Arizona survey was conducted,  
15 Staff received a new report from the National Renewable Energy Laboratory (NREL)  
16 entitled *Willingness to Pay for Electricity from Renewable Resources: A Review of*  
17 *Utility Market Research*.

18  
19 Based upon Appendix C of the NREL report, we should have asked if Arizona customers  
20 would be willing to forgo rate decreases in order to incorporate a portfolio requirement.  
21 The results from the NREL report suggest that the vast majority would be willing to pay  
22 the same monthly amount if solar or renewables were included in the generation mix.

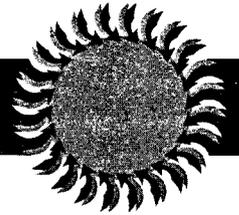
23  
24 Q. Does this conclude your rebuttal testimony?

25 A. Yes, it does.  
26  
27  
28

NREL/TP.550.26148

July 1999

## TOPICAL ISSUES BRIEF



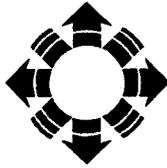
# Willingness to Pay for Electricity from Renewable Resources: A Review of Utility Market Research

Barbara C. Farhar, Ph.D., National Renewable Energy Laboratory



National Renewable Energy Laboratory  
A national laboratory of the U.S. Department of Energy

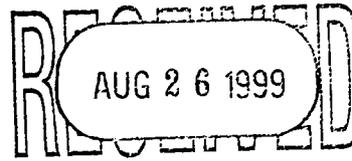
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Director of Utilities

Dear Energy Colleague:

For 20 years, national polls have found that a majority of electricity customers prefer renewable energy to other energy sources. This Topical Issue Brief summarizes recent market research conducted by utility companies on customer interest in and willingness to pay for electricity from renewable sources. Increasingly, market research is documenting in utility service territories the same widespread preference for renewables that has been found in national polls for the past 20 years.

Findings in this paper show that:

- Customers favor renewable electricity sources but know little about them
- Majorities of residential customers say they are willing to pay more on their electric bills for renewable power
- Willingness to pay follows a predictable pattern
- Customers may be even more likely to pay more for renewable energy in a competitive market setting
- Customers may be more willing to purchase electricity from utilities that provide renewable power

The Topical Issue Brief series is funded by the U.S. Department of Energy's Office of Power Technologies and is designed to address topics of current interest that will have an impact on the electric power industry. I hope you find this brief valuable and would appreciate your feedback. A self-addressed and stamped reader response card is provided in the brief for your use.

Sincerely,

H. Lawrence Goldstein  
Power Sector Analysis Program Leader



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## Abstract

As competition in the electric utility industry becomes more widespread, utilities are becoming concerned about actions they can take to help ensure the loyalty of their customers. National polls have, for 20 years, found majority preferences for renewable energy over other energy sources. This issue brief compiles and analyzes recent market research conducted by utility companies on customer interest in, and willingness to pay for, electricity from renewable sources. Increasingly, market research is documenting in utility service territories the same widespread preference for renewables that has been found in national polls for the past 20 years.

Findings in this review show that:

- Customers favor renewable sources of electricity but may know little about them. Percentages favorable toward renewables increase when customers are educated about options. Solar and wind are the most favored sources of electricity generation.
- Majorities of 52% to 95% of residential customers say they are willing to pay at least a modest amount more per month on their electric bills for power from renewable sources. Deliberative polls show that willingness to pay increases when customers are educated about utility energy options.
- Willingness to pay follows a predictable pattern with an average majority of 70% willing to pay at least \$5 per month more for electricity from renewable sources, 38% willing to pay at least \$10 per month more, and 21% willing to pay at least \$15 per month more. It is likely that any utility market survey asking residential customers about willingness to pay more for renewable energy will exhibit a similar pattern of results.
- A limited amount of data suggest that customers may be even more likely to pay more for electricity from renewable sources in a competitive market setting. That is, customers may respond in greater numbers when the choice is between forgoing rate decreases— as would be expected in competitive markets—than when faced with paying more, as is the case with utility green-pricing programs.
- Customers may view with favor and remain loyal to utilities that provide power from renewable sources.

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# Willingness to Pay for Electricity from Renewable Sources: A Review of Utility Market Research

## Approach

This issue brief compiles and analyzes recent market research conducted by utility companies on customer interest in and willingness to pay for electricity from renewable sources. The National Renewable Energy Laboratory (NREL) has obtained the results of market research studies on green pricing from several electric utility companies. To honor the proprietary nature of the data, identities of the utilities conducting the studies have not been provided. The data come from 14 different surveys conducted in 12 utility service territories in five Western/Southwestern states. Most of the data were collected in 1995 through 1997. In addition, the study incorporates results from a 1997 Electric Power Research Institute (EPRI) study (EPRI 1997).

The analysis focuses on the results from quantitative surveys rather than on focus group findings, since quantitative data collection was often built on focus group results and took the focus group findings further to enable generalizations about entire populations. Use of survey data makes the comparison of results among studies more straightforward.

In addition, the analysis was limited only to data from surveys that appeared to meet "best practice." Data were collected for utility companies by professional market research firms. The surveys used scientific procedures to sample utility customers, and results had estimated margins of error of  $\pm 5\%$  or better. In addition, only questions that were, in our opinion, of high quality, relatively objective, and unbiased were included. Because the questions themselves are considered proprietary, they are not included here.

The studies provided far more information than could be reviewed in this short paper; therefore, the analytical focus was limited

to three topics of widespread interest to the utility industry. These were: (1) attitudes toward and knowledge of renewables, (2) customer interest in paying more for electricity from renewable sources (including stated willingness to pay more for electricity from renewable sources and preferences for paying for renewables in the rate base versus on a voluntary basis), and (3) consumer attitudes toward utility companies as suppliers of power from renewable sources. Of these three topics, most of the questions asked were about willingness to pay for electricity from renewable sources. For purposes of this synthesis, findings from questions on like topics, although not worded identically, are grouped together.

This paper presents a summary of key findings; detailed data are presented in the appendixes. The aggregation of utility market research data on willingness to pay is discussed. We also include some related findings from other recently reported market research.

## Key Findings

**Attitudes toward Renewables.** Many surveys have documented, both nationally and locally, the longstanding preference among U.S. adults and electricity customers for renewable energy over other energy sources. Utility market surveys asking about attitudes toward renewables found the same strong preferences for renewable energy to produce electricity when compared with other energy sources, as has been documented in national poll data (Farhar 1993, 1996). Data detailing these findings are reported in Appendix A.

**Knowledge of Renewables.** Although consumers are favorable toward renewables, they may not know very much about renewable energy technologies. Utility findings on consumer favorability toward and knowledge of renewables are sparse. Most of the utility

surveys reviewed did not query customers on their familiarity with renewable energy technologies. Customers, as a whole, are likely to be relatively unfamiliar with green power and are unlikely to know anyone who has participated in a green-power program. The few data that do exist suggest that participants in green-pricing programs tend to be more informed than customers in general, and that solar and wind are the best known renewable energy technologies. Appendix A presents the detailed findings.

**Stated Likelihood of Voluntarily Paying for Electricity from Renewable Sources.** The data reviewed suggest that approximately half or more of respondents surveyed state that they are “somewhat likely” or “very likely” to voluntarily pay more for electricity from renewable sources when price is not mentioned. A sizable minority of samples (~ 45%) tend to indicate that they would be unlikely to voluntarily pay anything more for electricity from renewable sources, when the question is asked in this way.<sup>1</sup> Two samples of commercial customers also expressed likelihood of paying a limited amount more for renewable power. Appendix B presents the data.

**Stated Willingness to Pay More for Renewable Electricity by Residential Customers.** Across the surveys reviewed, majorities of respondents say they are willing to pay at least a modest amount more per month on their electric bills for power from renewable

---

<sup>1</sup>When survey questions take a form similar to: “If paying for renewable electricity were offered on a voluntary basis, how likely would you be to pay more money on a monthly basis to get some or all of your electricity from renewables?”, and no dollar amount is given, sizable minorities tend to respond that they are unlikely to pay more. However, when survey questions take a form similar to: “How much more would you choose to pay on your electric bill each month to ensure that some or all of your electricity comes from renewable sources?”, and dollar amounts are given—usually \$1, \$2, \$3, \$5, and so on—only about 25% of respondents indicate they are unwilling to pay anything more when they see the modest amounts involved.

sources. The sizes of these majorities range from 52% to 95% of total residential customer samples without exposure to special educational programs. Percentages increase when customers receive more information. Appendix B presents the detailed information.

**An Aggregated Residential Customer Willingness-to-Pay Curve.** The similarities in findings on willingness to pay (WTP) for electricity from renewable sources is striking, and a means was sought to describe this observed pattern. A best-fit curve was developed for a scatterplot of the averaged value of incremental amounts per month residential respondents stated that they are willing to pay for various forms of electricity from renewable sources (Figure 1).<sup>2</sup> The curve is based only on responses from residential customers. It includes 95 data points from 12 survey questions.<sup>3</sup>

Figure 1 presents data on the percentages of survey respondents indicating they are willing to pay nothing more and those willing to pay increasing amounts more. As would be expected, the percentage of those willing to pay more drops off as the price increases. An average of 70% are likely to state

---

<sup>2</sup>The curve represents an exponential fit to the data. This “best-fit” curve (in terms of maximizing  $R^2$ ) was obtained using nonlinear regression with the Y-intercept set at 100%. The scatter of response values around the average values depicted in the curve is most likely a function of variation in question wording, question placement, and the dollar values used in response categories.

<sup>3</sup>Data on WTP for grid-tied rooftop photovoltaic (PV) systems were omitted because the amounts involved are much higher than the amounts mentioned in most surveys on green-pricing programs. Bimonthly dollar amounts were halved to make them comparable to the monthly dollar amounts used in most questions. Only “pre” data from deliberative polls were included so that data would be comparable with that from random samples of utility customers. Also, some WTP questions were broad in nature and did not include questions on varying pricing structures.

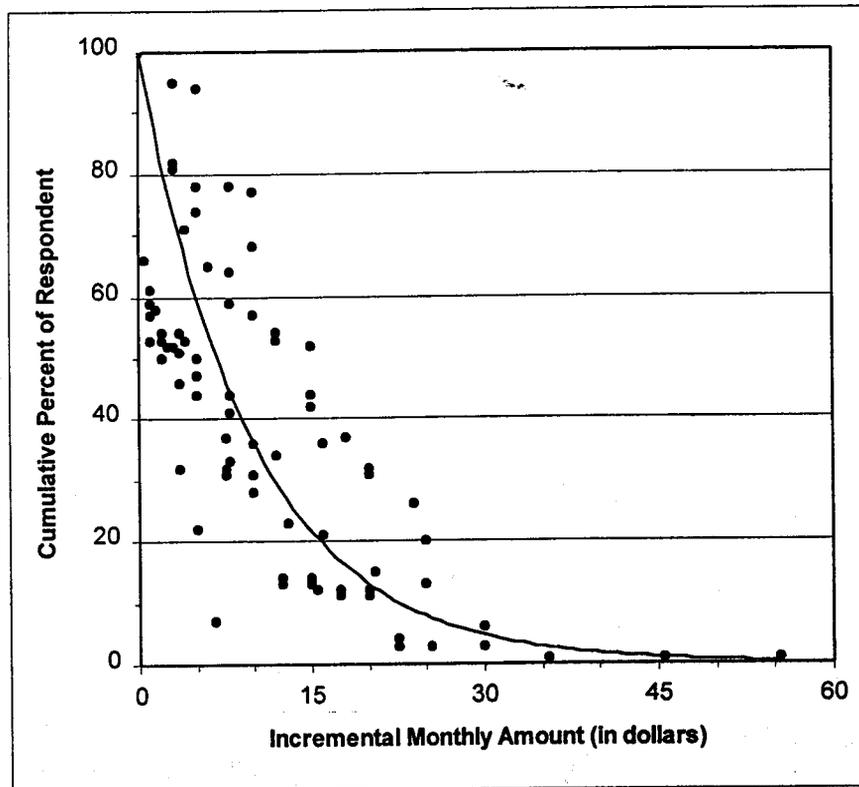
that they will pay at least \$5 per month more. An average of 38% of customers are likely to state they will pay at least \$10 more. An average of 21% are likely to state that they would pay \$15 per month more.

Although these figures represent an important market potential, they should not be construed as the proportion of residential customers who will actually sign up for a green-power product offering at inception. In addition, this curve could change over time as the population gains more experience with green-power programs.

Given the coverage of the research, it is likely that any utility market survey asking

residential customers about WTP for power from renewable sources will obtain results similar to those represented by the curve. Development of a curve on actual participation in green-pricing programs must await the collection of systematic data on participation rates over time.

**Preferences for Rate Basing versus Green Pricing.** Virtually all questions in this review focused exclusively on a utility green-pricing option. The one question addressing customer preference for distributing the costs of new renewables development across the entire customer population showed that customers strongly preferred "rate basing." Detailed information is presented in Appendix B.



The equation for the curve is:

$$Y = 100e^{-.104 \cdot M}$$

where Y = cumulative percentage of respondents, and M = \$ more per month.

$$R^2 = .76$$

**Figure 1. Aggregated Willingness-to-Pay Curve (Residential Customers)**

**Willingness to Pay for Power from Renewables in Competitive Markets.** Two questions asked utility customers about their willingness to forgo price decreases in competitive utility markets to pay for electricity from renewable sources. The few data available show that even higher majorities of customers may be willing to forgo price decreases to pay for environmentally friendly electricity than are willing to voluntarily pay more on their electric bills. Appendix C presents detailed data.

**Attitudes toward Utilities.** Most residential customers in these samples rate their utilities favorably. Majorities of utility customers want their utility companies to develop new renewable sources of electricity. Findings suggest that those most satisfied with their utility company are also most supportive of adding new renewables to the power mix. Also, participants in green-pricing programs are significantly more loyal to their utility company than are other customers. Detailed findings are presented in Appendix D.

### **National Poll Data and Other Recent Market Research Findings**

Findings from the utility market research synthesized here are consistent with other reported research, including national poll data and company-specific market research. Some examples of these findings are briefly provided below.

**Attitudes toward and Knowledge of Renewables.** In a review of market research on renewables and conservation in the Pacific Northwest, Ferguson (1999) found that strong majorities of electricity customers in the Northwest support renewable energy. Ferguson concluded that Northwest consumers view conservation and renewables as being environmentally important.

Consumers continue to select renewables over other energy sources in response to questions asking for their preferences among conventional and renewable energy options. For

example, a 1998 poll of Colorado homeowners found that the electricity sources perceived as least environmentally threatening—solar and wind—are also the most preferred (Farhar and Coburn 1999a). In addition to their environmental benefits, solar and wind are preferred over other electricity sources for other positive attributes, such as safety, economic benefits, self-reliance, and diversity of the U.S. energy supply. Similar findings from a national sample are reported in Farhar and Houston (1996).

A 1997 Portland General Electric study found 41% of residential customers selecting solar over all other energy sources to meet the future electric needs of the region (cited in Ferguson 1999). These findings are consistent with results from national polls (Farhar 1996).

Combined results of surveys of probability samples from four Midwestern states showed that 90% of customers believe their utilities should use solar and 85% believe they should use wind to produce power (Tarnai and Moore 1998). Eighty-nine percent favored more use of renewables.

The 1998 Colorado homeowners survey found that although most respondents were favorable toward grid-tied photovoltaics (PV) (with 59% giving it high favorability ratings), only 10% were familiar with it. Male respondents and those in higher-income households tended to be more familiar with grid-tied PV than others, but they were still not very familiar (Farhar and Coburn 1999b).

**Willingness to Pay More for Electricity from Renewable Sources.** Farhar and Houston (1996) reported that 57% to 80% of national poll samples said they were willing to pay more for electricity produced in a cleaner way or from sources less harmful to the environment. The 1998 survey of Colorado homeowners found that, when asked specific amounts, 76% of respondents indicated a willingness to pay at least \$1 per month more for electricity from renewable sources (Farhar and Coburn 1999a).

Combined data from the poll of adults in four Midwestern states (Tarnai and Moore 1998) showed that 72% indicated they are "very willing" or "somewhat willing" to pay more for renewables. The modal amounts respondents were willing to pay were \$5 per month (30%) and \$10 per month (28%).

#### **Rate Basing versus Green Pricing.**

The Colorado homeowners survey shows broad-based support for renewables development even if it costs more (Farhar and Coburn 1999a). Homeowners prefer to see the costs of developing renewables shared broadly, either through federal subsidies for electricity generation using renewables or through modest increases in electric rates.

Ferguson (1999) reported that Seattle City Light customers preferred that the cost of renewables should be put in everyone's rates, rather than through green-pricing programs in which customers can choose to participate, a result also obtained by other Northwest utility market research.

The surveys of four midwestern states (Tarnai and Moore 1998) found that 30% preferred that everyone's electric rates should be increased to pay for renewables, 29% preferred voluntary choice, and 19% preferred that the federal government pay additional costs. Twenty percent proposed some other way.

**Attitudes toward Utility Companies as Suppliers of Electricity from Renewable Sources.** Ferguson (1999) found that consumers consistently report they are more likely to identify with utilities that support environmentally sound management practices.

The Colorado survey of homeowners found that widespread support exists for utilities to develop renewables as part of their electricity-generating mix (Farhar and Coburn 1999a). Colorado utilities seem to have a relatively good reputation with their customers. Most homeowners want their utilities to do more to invest in the development of renewable sources of electricity.

## **Conclusions**

- Customers favor renewable energy sources but tend to know very little about them.
- Utility market research studies show customer preference for renewable sources of electricity along with majority willingness to pay an incremental amount more for it. Across the studies examined, majorities of 52% to 95% said they were willing to pay at least a modest amount more per month on their electric bills for power from renewable sources. Deliberative polls show that customer WTP increases when customers are educated about utility energy options.
- Across all studies, customer WTP follows a predictable pattern. An average of 70% stated WTP at least \$5 per month for electricity from renewable sources. The percentages decline as the amount per month increases. An average of 38% of customers say they are willing to pay at least \$10 per month more, and 21% say they are willing to pay at least \$15 per month more for power from renewable sources. It is likely that any utility market survey asking residential electricity customers about WTP for renewables will exhibit a similar pattern of results.
- Proprietary utility market research findings track closely with findings from similar questions from national polls and market research in the public domain.
- A limited amount of data show that customers are just as likely to pay more for renewable energy in a competitive market setting. In fact, customers may respond in greater numbers when the choice is between forgoing rate decreases in order to receive renewable energy in competitive markets than when faced with paying more for this option, as is the case in utility green-pricing programs.

- Although most studies focused on residential customers, there is limited evidence that some business customers will pay more for green power. These data, coupled with actual market experience with businesses voluntarily choosing green power options—such as Toyota, Patagonia, and the New Belgium Brewing Company—suggest that business customers could be an important market segment for renewables. Business customers might be interested in knowing about the extent of interest in electricity from renewable sources among residential customers, because this interest could translate into consumer approval for businesses that purchase electricity from renewable sources.
- Although almost all of the surveys focused exclusively on a utility green-pricing type of option, the fact that large majorities of respondents are willing to pay at least a small, incremental amount for renewable energy suggests a potential willingness to accept slightly higher rates in order to capture the public benefits of greater renewable energy use.
- Customer attitudes are more favorable toward utilities that include renewables in their electricity generation mix. However, the evidence is insufficient to determine whether customers who trust their utilities more are more willing than others to sign up for green-power programs.

## References

*Note:* Utility studies are not identified because of the proprietary nature of the questions and findings.

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## Appendix A: Data on Attitudes toward and Knowledge of Renewables

### Attitudes toward Renewables

Utility market surveys asking about attitudes toward renewables found the same strong preferences for renewable energy to produce electricity when compared with other energy sources, as has been documented in national poll data (Farhar 1993, 1996).

Table A-1 shows the results from a question asking customers about their favorability or opposition toward various energy resources, assuming that they had a choice as to the source of their electrical energy.

Another question resulted in a similar pattern of preferences when it asked whether residential and commercial customers want their utility to use a variety of energy sources. Customers strongly support their utility's use of new renewables, defined as electricity generated by solar, wind, geothermal, and landfill gas sources. Of residential customers, 88% say their utility should include new renewables as one of their sources of electricity. Support for hydropower is similarly high. A majority supports the use of natural gas to generate electricity, while fewer support nuclear power and coal. Table A-2 shows the results.

**Table A-2. Preferences among Fuel Sources for Use by Utility as One Source of Electricity**

	Residential	Commercial
New renewables	88	89
Hydropower	85	91
Natural gas	55	64
Nuclear	39	52
Coal	14	22

More evidence for this pattern of preferring renewable sources came from a question asking customers about their preferences for purchasing electricity from coal, nuclear, natural gas, or wind and solar. Findings show that 41% say they would choose electricity from wind and solar, 35% from natural gas, 9% from nuclear energy, and 5% from coal; 10% don't know.

**Table A-1. Preferences among Energy Resources**

Energy Resource	Somewhat or strongly favor %	Somewhat or strongly oppose %	Don't know %	Total
Solar	93	5	2	100
Wind	91	9	--	100
Natural gas	83	11	6	100
Geothermal	71	13	16	100
Landfill gas	64	18	18	100
Forest waste	59	29	12	100
Nuclear	31	63	6	100
Coal	24	69	7	100

Another question asked respondents about favorability toward specific renewable energy sources and also about their top three choices for their utility company to develop. Overwhelming majorities choose wind, PV on homes, geothermal, and PV on schools, and a majority also choose biomass energy. Among the top three choices for development, wind is preferred by two-thirds, followed by PV on homes (64%), and geothermal (63%). PV on public buildings is preferred by a 58% majority. Biomass is selected as a top three choice by 26%. Table A-3 shows the findings.

**Table A-3. Favorability toward Various Renewables Options**

Renewable resource	Percent "very favorable"	Percent choosing in top 3 preferred renewable energy choices
PV on public building	69	58
Geothermal	64	63
Wind	61	69
PV on homes	60	64
Biomass	32	26

Results from another question show favorability toward the idea of utility investment in renewable energy among the customer groups surveyed. On a 1-10 scale, where 1 is low and 10 is high favorability, the mean score for participants in a green-power program is 9.1 and, for all other customers, 6.3.

Findings show that, among customer groups surveyed, most agree that their utility company should provide power from sources that minimize negative environmental impacts (mean scores ranging from 7.7 to 9.2 on a 1-10 scale). Similarly, most agree that the utility should protect the environment as much as possible while producing and distributing power (mean scores ranging from 8.2 to 8.6 on a 1-10 scale).

## Knowledge of Renewables

Only a few of the utility surveys reviewed included questions on awareness and knowledge of renewables. One question showed that commercial customers are slightly more aware of electricity from renewable energy sources than residential customers. The most well-known new renewable energy sources are solar and wind power, of which most customers are aware. Landfill gas and geothermal sources have the lowest awareness levels (between half and three-quarters aware). Not surprisingly, almost all commercial and residential customers have heard of hydropower. Another question produced results showing that, although 84% have heard of using solar panels to produce electricity, lack of knowledge is commonly cited as a reason for not installing them.

Another question was asked of a sample of subscribers to a green-power program, interested nonsubscribers (those who had inquired about the program, but did not subscribe), and other utility customers. Three-quarters of subscribers, 53% of interested nonsubscribers, and 37% of other customers say they are familiar with the term "green energy." Despite the program having been in existence for 1½ years, 21% of subscribers, 45% of interested nonsubscribers, and 61% of other customers are not familiar with the term "green energy." This particular survey found that knowledge about wind power and green energy is significantly greater among program subscribers than among the other two groups.

## Appendix B: Data on Customer Interest in Paying More for Electricity from Renewable Sources

### Stated Likelihood of Paying More for Renewables

Many residential and commercial customers respond that they are likely to pay more for renewables. In one study, 54% of residential customers say they are “very likely” or “somewhat likely” to pay more on their monthly electric bill for electricity from renewable sources; 45% say they are unlikely to do so (Table B-1).

**Table B-1. Likelihood of Paying More in Monthly Bill to Support Energy Generated from Renewable Resources**

Response	%
Very likely	13
Somewhat likely	41
Not likely	45
Unsure	1
Total	100

Another question asked about purchasing a residential, grid-tied PV system. When asked directly how likely they would be to purchase a PV system if the cost of the loan payment plus their new, reduced electric bill combined would remain the same, 21% of customers say they are “very likely” to purchase a PV system, 42% say they are “somewhat likely,” 33% say they are “not likely” to do so, and 4% don’t know.

In response to a different question, 38% say they would be likely to purchase a PV system if their monthly bill were higher than it currently is. Table B-2 shows the responses.

Results from another question asked of both residential and commercial customers indicate that the likelihood of voluntarily paying

**Table B-2. Likelihood of PV System Purchase with Higher or the Same Monthly Electric Bill**

Response	
Yes	38
No, but would if bill remained the same	32
No, but would purchase at lower price	12
Would not purchase at all	6
Unsure	12
Total	100

more for electricity from renewable sources is relatively high. Two-thirds of residential customers and 61% of commercial customers say they are at least somewhat likely to pay more for electricity from renewable energy sources on a voluntary basis. Table B-3 shows the stated likelihood among both residential and commercial customers.

In response to another question, both residential and commercial customers (62% and 65%, respectively) agree that using new renewable energy is “the responsible thing to do for the future, even if it costs more now.” Far fewer residential and commercial customers

**Table B-3. Likelihood of Voluntarily Paying More for Electricity from Renewable Sources**

Response	Residential	Commercial
Very likely	16	21
Somewhat likely	51	40
Not very likely	17	21
Not at all likely	14	14
Don't know	3	3
Total	101 <sup>a</sup>	99 <sup>a</sup>

<sup>a</sup>Percentages do not add to 100 due to rounding.

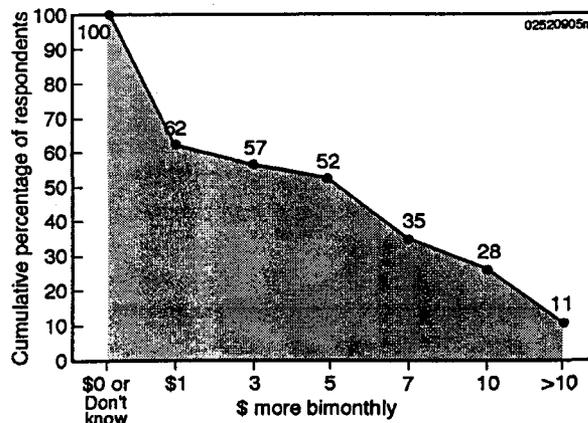
(29% and 27%, respectively) think that maintaining current rates as long as possible is important, even if it means using fossil fuels.

Although commercial and industrial customers were rarely included in the utility market research reviewed, available data provide modest evidence that at least some of these customers might be interested in power from renewable sources. In one study, a majority (53%) of industrial respondents say they are unwilling to pay a higher price for “greener” electricity resources.<sup>1</sup> However, 41% say they are willing to pay 5% or more for greener electricity resources, and 6% say they are willing to pay more than 10% more.

A question from another study showed that 62% of commercial customers are willing to pay at least \$1 more every other month for electricity from renewable sources; 57% are willing to pay at least \$3 more; and 52% are willing to pay at least \$5 more every other month. However, only 11% are willing to pay more than \$10 more every other month. Thirty-eight percent of respondents to this question are unwilling to pay anything more (Figure B-1).

Although not numerous, these results—along with anecdotal evidence about large businesses such as Toyota, Patagonia, and New Belgium Brewing Company selecting a green-power option in a competitive market—suggest that commercial, and possibly industrial, customers are worth further investigation as a potential green-power market segment. In addition, these customers would probably be interested in information on the extent of interest in electricity from renewable sources among residential customers. This interest could

<sup>1</sup>The survey included respondents from 13 different SIC codes, including printing and publishing, electronic and other equipment, and other manufacturing. However, only 17 respondents answered this question on renewable sources of electricity.



**Figure B-1. Incremental Bimonthly Amounts Commercial Customers Are Voluntarily Willing to Pay for Electricity from Renewable Sources<sup>2,3</sup>**

translate into a higher public approval of companies purchasing power from renewable energy sources.

<sup>2</sup>There was insufficient information to determine the percentage responding \$0 and the percentage responding “Don’t know.”

<sup>3</sup>Where data on WTP for electricity from renewable sources are presented, the percentages of respondents willing to pay higher amounts is added to the percentage willing to pay lower amounts to show a cumulative percentage of respondents willing to pay at least a stated amount. This is based on the assumption that those willing to pay a higher amount—say, \$25 a month more—would be willing to pay lower amounts—say, \$10 a month more—for power from renewable energy sources.

Figure B-1 and many of the charts that follow display WTP responses as cumulative percentages. For example, in Figure B-1, 62% of respondents indicate that they would be willing to pay *at least* \$1 bimonthly for electricity from renewable sources. The cumulative curve is drawn to 100% at 0% to indicate that, in this case, some additional number of respondents that answered “zero” may have, if asked, been willing pay some amount between zero and \$1.

## Stated Willingness to Pay More for Electricity from Renewable Sources by Residential Customers

No matter how the question was phrased, a large percentage of residential customers—in all surveys a majority—stated that they are willing to pay at least something more on their electricity bills for electricity from renewable sources. Among most of the surveys analyzed here, majorities of respondents are willing to pay at least \$5 a month more for power from renewable energy sources.

In response to one question, 57% say they are willing to pay 5% or more for environmentally sound electricity, and 15% say they are willing to pay 10% or more. Stated WTP varied by income but did not vary by electricity consumption. If a rebate were offered, 70% say they would be willing to pay for more environmentally friendly electricity sources.

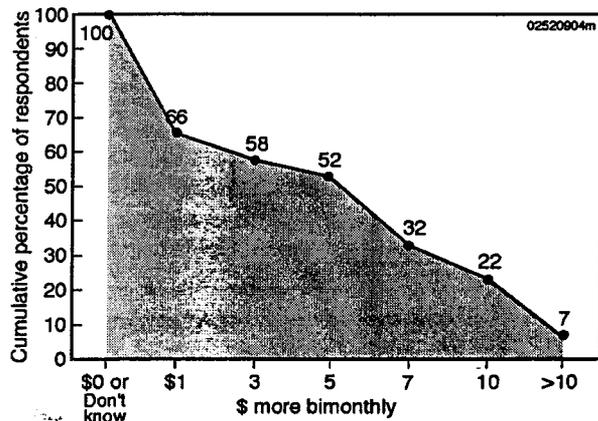
Another result shows that respondents tend to support the option of paying “green rates.” On the whole, respondents say they would “somewhat favor” paying a premium of 5% for electricity generated from renewable resources. On a four-point scale, where 1 represents “strongly favor” and 4 “strongly oppose,” the mean value is 1.83. The average favorability toward paying a 20% premium is in the ambivalent range (mean = 2.36).

Response to another question shows that two-thirds of residential customers state that they are willing to pay at least \$1 more every other month for electricity from renewable sources; 58% are willing to pay \$3 every other month; and 52% are willing to pay at least \$5 every other month. Seven percent said they are willing to pay more than \$10 more every two months for electricity from renewable energy sources (Figure B-2).

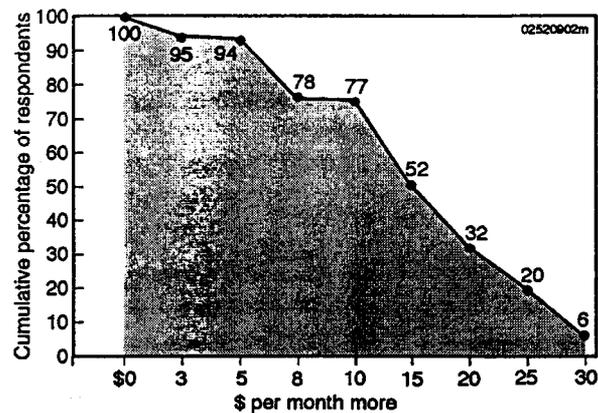
Another question asked respondents whether they favor increasing their electric bill by \$1 a month so that solar and wind power would be produced in their area. Three-quarters of

respondents say they favor such an increase; 21% oppose it; 2% are mixed; and 2% don't know.

Response to a different question shows that 95% of individuals in the sample say they are willing to pay at least \$3 more per month on their electric bills for electricity from renewable sources (Figure B-3).



**Figure B-2. Incremental Bimonthly Amounts Respondents Are Voluntarily Willing to Pay to Support New Renewable Energy<sup>4</sup>**

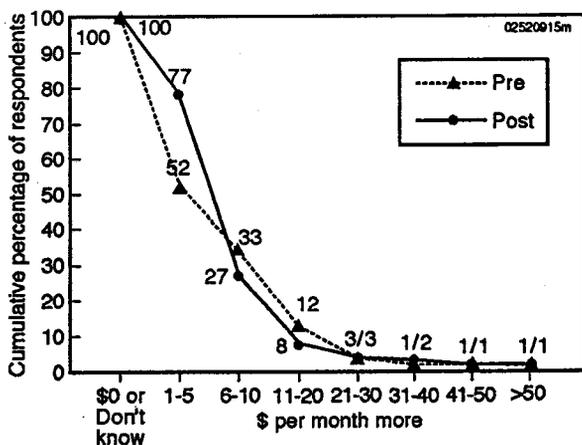


**Figure B-3. Incremental Monthly Amounts Respondents Are Voluntarily Willing to Pay for Electricity from Renewable Sources**

<sup>4</sup>There was insufficient information to determine the percentage responding \$0 and the percentage responding “Don't know.”

Three surveys looked at customer WTP through an innovative polling technique called “deliberative polling.” Using this technique, a sample of electricity customers comes together and completes a questionnaire prior to spending a weekend discussing electricity issues. The customers receive relatively unbiased presentations by energy experts and participate in facilitated discussions, termed a “deliberation.” The sample then completes an identical questionnaire at the end of the weekend.

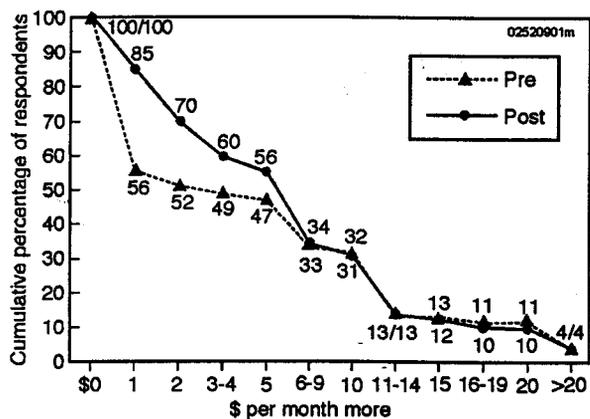
A question in one such deliberative poll questionnaire asked about WTP for electricity generation using wind and solar power. Prior to participating in deliberation, 52% of respondents said they would be willing to pay \$1-\$5 more per month for solar and wind power. After the deliberation, 77% said they would be willing to pay that amount. The percentage unwilling to pay anything dropped from 38% prior to deliberation to 18% afterwards. The percentage of respondents willing to pay more than \$20 a month more did not appear to change as a result of the deliberation. Clearly, exposure to more information about electricity issues increased participants’ WTP modest amounts for power from renewable energy sources (Figure B-4).



Pre: \$0 = 38% Don't know = 10%  
 Post: \$0 = 17% Don't know = 6%

**Figure B-4. Incremental Monthly Amounts Respondents Are Voluntarily Willing to Pay for Solar and Wind Power before and after Deliberation on Electricity Issues**

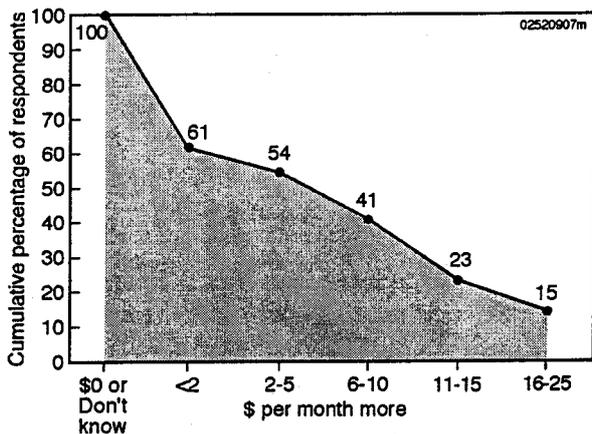
Similar questions were asked in other deliberative polls, each of which used the same data collection instrument. On average, prior to deliberation, 56% of the combined customer samples say that they would pay at least \$1 a month more for electricity generation using technologies such as wind and solar, and approximately one-third say that they would pay at least \$10 a month more. After deliberation, the percentage willing to pay at least \$1 a month more increased to 85%, while the percentage willing to pay at least \$10 a month more remained at almost one-third. (Figure B-5 shows the averaged percentages for the three surveys.)



**Figure B-5. Incremental Monthly Amounts Respondents Are Voluntarily Willing to Pay for Electricity Generation from Renewables (Averaged Data from Three Surveys before and after Deliberation)**

### Specific Renewable Sources

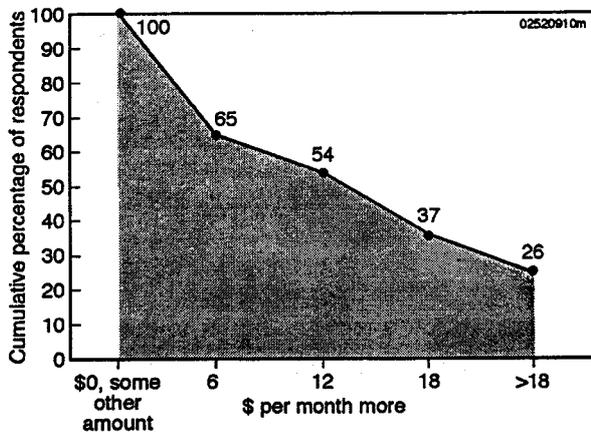
For specific renewable resources, responses follow a pattern similar to that generated from electricity from renewable energy sources in general. In response to one question, 61% of respondents say they are willing to pay up to \$2 per month more for solar, wind, and geothermal development; 54% say they would pay from \$2 to \$5 per month more; and 15% say they would pay from \$15 to \$25 per month more. Twenty-eight percent say they are unwilling to pay more (Figure B-6). These results represent the general trend pertaining to all renewables.



\$0 = 28%; Don't know = 11%

**Figure B-6. Incremental Monthly Amounts Respondents Are Voluntarily Willing to Pay for Solar, Wind, and Geothermal Development**

**Wind Power.** Another question asked specifically about wind power. Sixty-five percent say they are willing to pay at least \$6 per month more, and 26% say they would pay more than \$18 a month more on their electricity bills for wind power (Figure B-7).

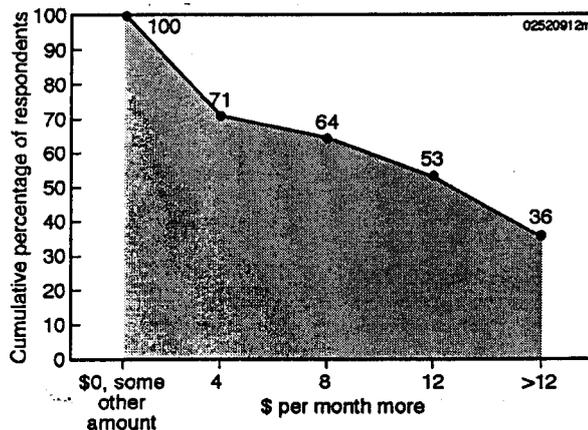


\$0 = 31%; Some other amount = 4%

**Figure B-7. Incremental Monthly Amounts Respondents Are Voluntarily Willing to Pay for Wind Power**

**Geothermal Electricity.** Another question examined WTP for geothermal electricity.

Although 27% are unwilling to pay anything more, 71% say they are willing to pay at least \$4 a month more for geothermal electricity. Thirty-six percent are willing to pay more than \$12 a month more (Figure B-8).

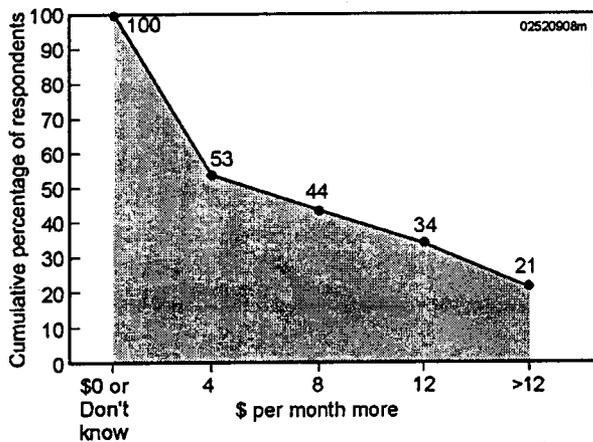


\$0 = 27%; Some other amount = 2%

**Figure B-8. Incremental Monthly Amounts Respondents Are Voluntarily Willing to Pay for Geothermal Electricity**

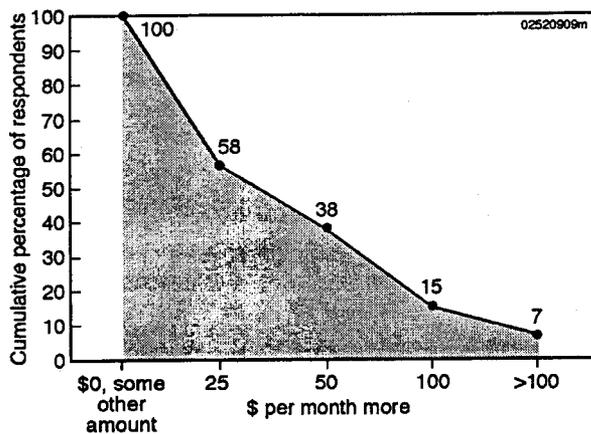
**Biomass Electricity.** Another question examined WTP for biomass electricity. A majority of 53% are willing to pay at least \$4 per month for electricity from biomass; 21% say they would pay more than \$12 a month more. However, 45% say they are unwilling to pay anything more for biomass electricity, the highest percentage unwilling to pay among the surveys in this body of findings (Figure B-9).

**Rooftop PV Systems.** One question asked customers about WTP for a PV system at their home that they would own and that would reduce the amount of purchased power. Nearly 60% of respondents say they would be willing to pay at least \$25 per month for such a PV system; 38% say they would be willing to pay at least \$50 more; and 15% say they would be willing to pay at least \$100 a month more for a PV system at their homes (Figure B-10).



\$0 = 45%; Don't know = 2%

**Figure B-9. Incremental Monthly Amounts Respondents Are Voluntarily Willing to Pay for Electricity from Biomass**



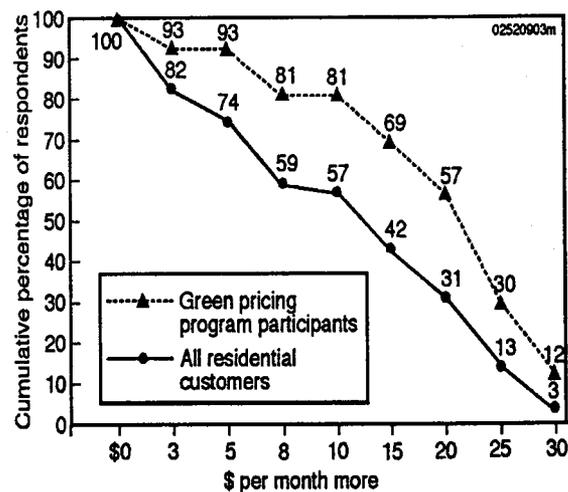
\$0 = 35%; Some other amount = 7%

**Figure B-10. Incremental Monthly Amounts Respondents Are Voluntarily Willing to Pay for Home-Based Rooftop PV System**

In response to another question, respondents indicate a preference for rooftop PV systems that supply all of their electricity needs. Of those answering a question about whether they prefer a system supplying 50% or 100% of their electricity needs, 53% say they prefer the larger system and 26% say they prefer the smaller one; 21% don't know.

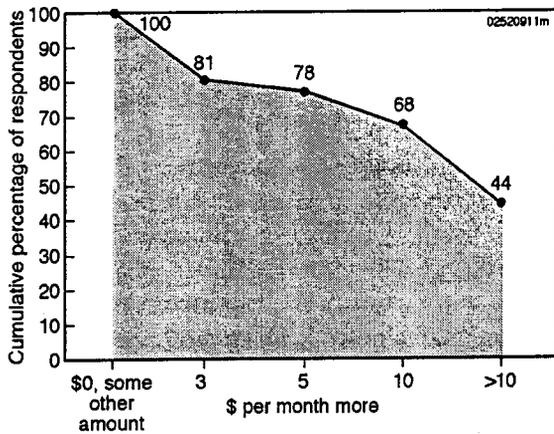
Regarding financing for the PV system, 46% say they prefer a long-term loan, 36% a short-term loan, and 18% are unsure.

Survey data were also collected from a general residential customer sample, and using the same instrument, from existing contributors to a green-pricing program, asking how much respondents would be willing to pay in a combined electric bill for a PV system installed on their roof that they would own. Most respondents in the general sample (82%) are willing to pay *as much as* \$3 per month more for such a system, although it was not possible to discern how many people said "nothing more" because the data were not shown separately for that response. Eighty-two percent say they are willing to pay *at least* \$3 a month more for a PV system. Nearly one-third say they would be willing to pay \$20 per month more, and 13% say they are willing to pay \$25 per month more. Participants in a green-pricing program are likely to indicate even higher amounts, with 93% stating they are willing to pay at least \$3 more on their electric bill for a rooftop PV system they would own (Figure B-11).



**Figure B-11. Incremental Monthly Amounts Respondents Are Voluntarily Willing to Pay on Electric Bills for a Rooftop PV System**

**Solar-for-Schools Program.** A survey question measured WTP for a PV power system at a local school. A sizable majority (81%) of utility customers in the sample say they are willing to pay at least \$3 per month more for a PV-for-schools program; 78% say they are willing to pay at least \$5 per month more; 68% say they would pay at least \$10 per month more; and 44% say they would pay even more (Figure B-12).



\$0 = 17%; some other amount = 2%

**Figure B-12. Incremental Monthly Amounts Respondents Are Voluntarily Willing to Pay for a Solar-for-Schools Program**

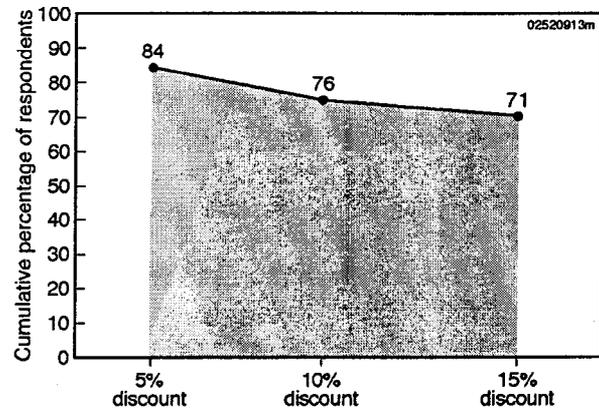
### Preferences for Rate Basing versus Green Pricing

Only one question addressed the rate-basing versus green-pricing issue. The results showed strong support for spreading the costs of new renewables across the entire customer base. When given a choice, respondents asked this question agreed, by nearly four to one, that all households and businesses that can afford it should help pay for renewable power, as opposed to only voluntary purchasers. Seventy-four percent of the respondents in the residential sample and 80% of the commercial customer sample favored spreading the cost over the rate base. All the other questions included in this review focused exclusively on a utility green-pricing option.

## Appendix C: Data on Willingness to Pay for Power from Renewable Sources in a Competitive Market

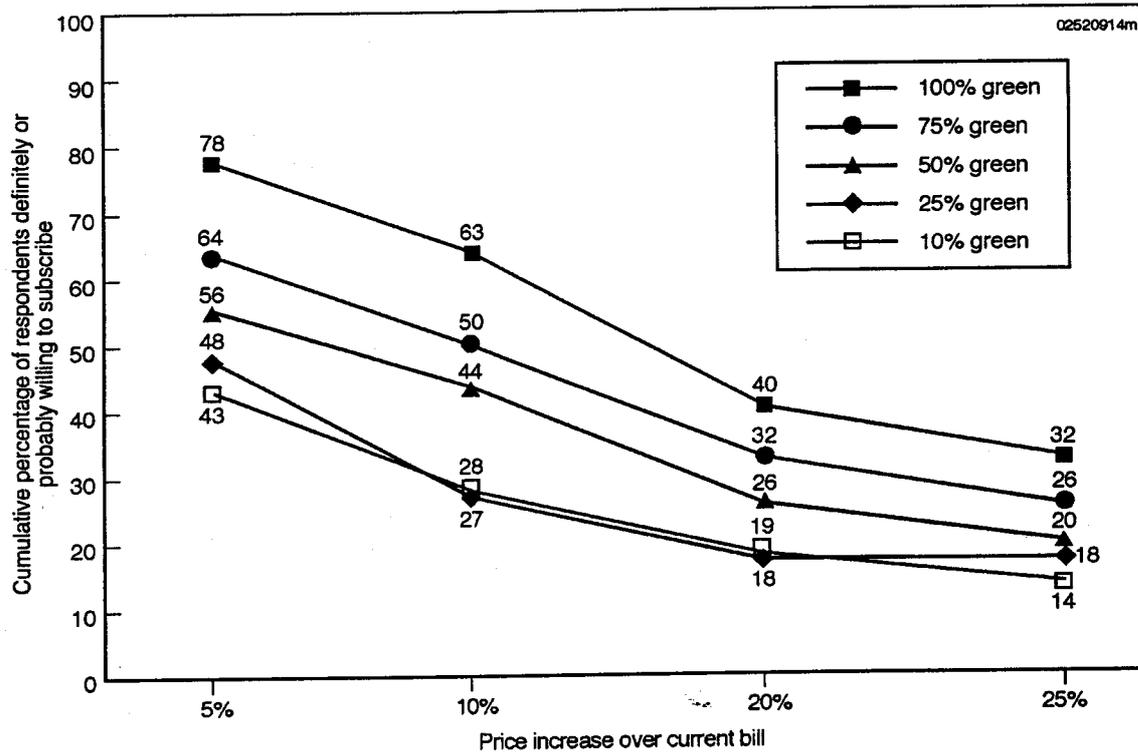
Strong majorities of respondents nationwide also say that they are willing to choose electricity from renewable sources if their electric bills remain the same (EPRI 1997). Another way of measuring WTP is to ask customers to choose between two offers for electric service, one comparable to what customers are receiving already except that it is 5%, 10%, and 15% lower in price, and one that ensures a supply of power from renewable sources at the price they are currently paying (EPRI 1997). In these scenarios, customers would be forgoing rate decreases to choose electricity from renewable energy sources.

Eighty-four percent of respondents nationwide say they would be willing to forgo a 5% discount in electricity prices to select power from renewable sources. Three-quarters (76%) say they would be willing to forgo a 10% discount in order to select electricity from renewable sources, and 71% say they would be willing to forgo a 15% discount to purchase electricity from renewable sources (Figure C-1). These figures are higher than the usual range of WTP for power from renewable sources. This method may represent a less “painful” way of choosing power from renewable sources by allowing customers to opt for a slightly lower bill than they otherwise would have. This pattern of response may be more representative of a competitive market situation.



**Figure C-1. Willingness to Pay for Electricity from Renewable Sources by Forgoing Different Price Discounts**

Customers were asked about their interest in subscribing to different mixes (from 10% to 100%) of “environmentally friendly” electricity. Interest was assessed for different levels of power from renewable sources at price increases ranging from 5% to 25%. More than three-quarters of respondents say they are willing to pay at least a 5% premium to obtain all of their electricity from green sources, while one-third say they would pay a 25% increment. The pattern of responses, illustrated in Figure C-2, bears a similarity to the WTP curves discussed in the previous section.



**Figure C-2. Willingness to Subscribe to Product with Different Levels of Environmentally Friendly Electricity at Various Price Increases**

## Appendix D: Data on Consumer Attitudes toward Utilities

A few of the surveys explored customers' attitudes toward utilities relative to the use of renewables to generate electricity. Although they do not constitute a strong pattern, the findings suggest that customers will look more favorably upon, and would be willing to purchase electricity from, a utility providing power from renewable sources.

Responses to one survey question showed that almost everyone wants the utility to develop new renewables to avoid resource depletion (93%) and because it would be good for the environment (91%). Most (84%) disagree with the statement that it makes no difference how their utility gets its electricity, and 83% trust the utility to make good decisions on the selection and development of new power sources.

Results from another survey question showed that a majority of these respondents give a generally favorable rating to their utility (64%). A moderate relationship was found between satisfaction with the utility and support for adding new renewables. Those giving highest approval to their utility most strongly supported the idea of the utility adding new renewables. Both commercial and residential customers follow this pattern.

Also, residential customers who give the highest rating to the utility company's overall performance are more likely to say they are "very willing" to voluntarily pay more for renewables than all other respondents. They also are more likely to trust their utility to make decisions and to care about how their utility gets electricity. This suggests that, among very willing respondents, there is a higher level of trust in the utility company than among others. Residential customers less willing to pay more for renewables are twice as likely to say something negative about the utility company than those who say they would probably or definitely spend

an additional \$5. Negative comments about the utility included high rates and frequent outages.

A different question showed that green-pricing program participants are significantly more likely than customers at large to assign very high importance to having a utility that gets some of its electricity from green sources (mean scores of 9.1 and 7.3, respectively, on a 1-10 scale).

Results from still another question found that green-pricing program participants are significantly more loyal to the utility company than are customers as a whole. Only 3% of green-pricing participants say they *would* switch utility companies, and 17% say they *might* switch, compared with 40% of customers as a whole who say they would (16%) or might (24%) switch. In comparison, 34% of all respondents had switched long-distance telephone companies in the last year.

Three other survey questions explored respondent selection criteria for power providers if there were competition. One of these showed that 9 in 10 customers would choose as their electric company the one who has taken steps to provide more renewable energy resources. A second one showed that 87% of respondents say a "very important" or "somewhat important" factor in choosing their electric provider is a higher percentage of power from renewable sources than from conventional sources. Ninety percent of respondents to the question say that providing 100% renewables is most important while 85% say the same for clean-burning natural gas. When asked which company they would choose (when price is not mentioned), 63% of the respondents say they would choose the company that generates 80% of its power from renewables, 22% say it wouldn't matter, and 7% don't know.

Responses to the third question showed that criteria for selecting a green-power provider centers around price, environmental benefits, and credentials of the provider (including general reputation and specific experience with clean, renewable energy). Responses are summarized in Table D-1.

**Table D-1. Importance of Green-Power Provider Attributes**

Attributes	%
Is trustworthy/reliable	74
Has experience with clean/renewable energy	64
Experienced/been around a long time	62
Is located in your state	48
Is a company you are familiar with	48
Is a leader in the industry	47
Is your current provider	42



**National Renewable Energy Laboratory**

1617 Cole Boulevard  
Golden, Colorado 80401-3393

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Operated by Midwest Research Institute • Battelle • Bechtel

Contract No. DE-AC36-98-10337

**BEFORE THE ARIZONA CORPORATION COMMISSION**

**CARL J. KUNASEK**

Chairman

**JIM IRVIN**

Commissioner

**WILLIAM A. MUNDELL**

Commissioner

IN THE MATTER OF THE GENERIC )  
INVESTIGATION OF THE DEVELOPMENT OF )  
A RENEWABLE PORTFOLIO STANDARD AS )  
A POTENTIAL PART OF THE RETAIL )  
ELECTRIC COMPETITION RULES )  
\_\_\_\_\_ )

DOCKET NO. E-00000A-99-0205

REBUTTAL

TESTIMONY

OF

BRUCE HERNANDEZ

BEHAVIOR RESEARCH CENTER  
PHOENIX, ARIZONA

AUGUST 30, 1999

1 Q. Please state your name and business address for the record.

2 A. My name is Bruce R. Hernandez and my business address is Behavior Research Center,  
3 1101 North First Street, Phoenix, Arizona 85004.

4  
5 Q. What is your position at Behavior Research Center?

6 A. Senior Vice President and Senior Project Director.

7  
8 Q. Please summarize your experience in conducting surveys.

9 A. Since 1971, I have been a professional staff member of Behavior Research Center where I  
10 have specialized in the design, administration and analysis of opinion research programs  
11 including attitude, behavior, use and need studies. My areas of special interest include  
12 research in public policy, education, transportation, recreation, drug abuse treatment and  
13 development. I have worked on hundreds of public opinion and marketing research studies  
14 throughout the United States for both public and private sector clients. An abbreviated copy  
15 of my resume is presented in Appendix BRH-1

16  
17 Q. Please summarize the experience of Behavior Research Center in conducting surveys.

18 A. The Behavior Research Center, Inc., is an independent Phoenix-based firm providing  
19 marketing and management research and counsel to both public and private sector clients  
20 since 1965. The company specializes in research in public opinion, public policy, and  
21 consumer behavior, and designs and conducts projects on a local, regional and national and  
22 international scale.

23  
24 The Center has comprehensive facilities and a full range of design, data collection and  
25 analysis techniques (drawn from social science and marketing) to meet each client's  
26 informational needs. Behavior Research Center enjoys a reputation for excellence in  
27 innovative problem-solving designs, and accurately monitoring and predicting consumer  
28 behavior.

1 Despite the public visibility of the Behavior Research Center's opinion polls, the company is  
2 mainly involved in developing policy and consumer research to identify and solve  
3 marketing problems of diversified clients.

4  
5 Behavior Research Center provides its clients with a full array of comprehensive, quality  
6 services including the following:

- 7
- 8 • Personal in-home interviewing
  - 8 • Personal intercept interviewing
  - 9 • Telephone interviewing
  - 9 • Focus groups/Concept tests
  - Executive interviewing
  - Mail surveys
  - Interactive electronic group data collection
- 10

11 Q. What is the purpose of your testimony?

12 A. To describe the findings of a public opinion survey the Behavior Research Center conducted  
13 for the Arizona Corporation Commission on Arizona residents' attitudes about solar energy  
14 generation. A copy of the study final report is presented in Appendix BRH-2.

15  
16 Q. Please briefly summarize your survey process and the techniques you utilized.

17 A. The survey consisted of 500 in-depth telephone interviews conducted with a representative  
18 cross section of Arizona residents. During the course of this study only the male or female  
19 head of household were interviewed because prior experience has revealed they are the  
20 household members who could best address the issues under study.

21  
22 All of the interviewing on this project was conducted between August 10 and 15, 1999. All  
23 of the interviewers who work on this project were professional interviewers of the Center.  
24 Each will have had prior experience with BRC and receive a thorough briefing on the  
25 particulars of this study. During the briefing, the interviewers were trained on (a) the  
26 purpose of the study, (b) sampling procedures, (c) administration of the questionnaire, and  
27 (d) other project-related factors. In addition, each interviewer completed a set of practice  
28 interviews to ensure that all procedures were understood and followed.

1 Household selection on this project was accomplished via a computer-generated pure  
2 unweighted (EPSEM) random digit dial (RDD) telephone sample which selects households  
3 on the basis of telephone prefix. This method was used because it ensures a randomly  
4 selected sample of area households proportionately allocated throughout the sample  
5 universe. This method also ensures that all unlisted and newly listed telephone households  
6 are included in the sample. A pre-identification screening process was also utilized on this  
7 project. This computer procedure screens the sample to remove known business and  
8 commercial telephone prefixes in addition to disconnects, faxes and computers. This  
9 process greatly enhances contacts to residential telephones.

10  
11 This survey employed a multi-stage sampling process. The first step in this process was to  
12 stratify the subarea samples according to the current population residing in each area.  
13 Telephone households were then selected within those areas using the RDD methodology.  
14 A probability sample developed in this manner samples proportionately relative to an area's  
15 distribution of the population. This strengthens the ability of the sample to be compared  
16 with Census data and other demographic information.

17  
18 Interviewing on this study was conducted during an approximately equal cross section of  
19 late afternoon, evening and weekend hours. This procedure was followed to further ensure  
20 that all residents were equally represented, regardless of work schedules. Further, during  
21 the interviewing segment of this study, up to four separate attempts -- on different days and  
22 during different times of day -- were made to contact each selected household. Only after  
23 four unsuccessful attempts was a selected household substituted in the sample. Using this  
24 methodology, the full sample was completed, and partially completed interviews were not  
25 accepted, nor counted toward fulfillment of the total sample quotas.

26  
27 All surveys are subject to sampling error. Sampling error, stated simply, is the difference  
28 between the results obtained from a sample and those which would be obtained by

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surveying the entire population under consideration. The size of sampling error varies, to some extent, with the number of interviews completed and with the division of opinion on a particular question.

An estimate of the sampling error range for this study is provided in the following table. The sampling error presented in the table has been calculated at the confidence level most frequently used by social scientists, the 95 percent level. The sampling error figures shown in the table are average figures that represent the maximum error for the sample bases shown (i.e., for the survey findings where the division of opinion is approximately 50%/50%). Survey findings that show a more one-sided distribution of opinion, such as 70%/30% or 90%/10%, are usually subject to slightly lower sampling tolerances than those shown in the table.

As may be seen in the table, the overall sampling error for this study is approximately +/- 4.5 percent when the sample is studied in total (i.e., all 500 cases). However, when subsets of the total sample are studied, the amount of sampling error increases based on the sample size within the subset.

Sample Size	Approximate Sampling Error At A 95% Confidence Level (Plus/Minus Percentage Of Sampling Tolerance)
500	4.5
400	5.0
300	5.8
200	7.1
100	10.0

1 Q. Are Arizona residents supportive of a one percent solar energy portfolio requirement for  
2 Arizona's electric utilities and their competitors?

3 A. Yes, nearly three out of four Arizona residents (74%) indicate they either strongly support  
4 (26%) or support (48%) requiring utilities and other electric suppliers in the state to use  
5 solar energy to produce at least one percent of the electricity they sell. Support for the  
6 requirement does not drop below 60 percent within any demographic subgroup.

7  
8 Q. Do Arizona residents support requiring utilities to develop solar water heater programs?

9 A. Yes, three out of four Arizona residents (75%) indicate they either strongly support (25%)  
10 or support (50%) requiring utilities and other electric suppliers in the state to develop  
11 programs to encourage the use of solar water heating. Support for this requirement does not  
12 drop below 70 percent within any demographic subgroup.

13  
14 Q. What do Arizona residents believe about the use of alternative clean energy sources?

15 A. Over three out of four Arizona residents (77%) indicate they either strongly support (26%)  
16 or support (51%) requiring utilities and other electric suppliers in the state to explore the use  
17 of other clean energy sources such as geothermal energy and wind-generated energy for the  
18 generation of electric power. Only 16 percent of residents oppose such exploration while  
19 seven percent are undecided. Support for this requirement does not drop below 69 percent  
20 within any demographic subgroup

21  
22 Q. Are Arizona residents willing to pay more for solar-generated electricity?

23 A. While residents reveal strong support for solar and alternative clean energy development,  
24 they do not reveal a willingness to pay higher monthly electric bills to receive solar-  
25 generated electricity. Thus, we find that by a two-to-one margin residents reject paying  
26 higher bills for solar-generated electricity - 29 percent willing vs. 61 percent not willing.  
27 This attitude is consistent across demographic subgroups.

28 ...

1 In a related question, when residents are asked to indicate who they feel should pay for the  
2 additional cost of generating solar electricity if utilities and other electric suppliers are  
3 required to produce more, we find that a majority of residents (51%) believe that those  
4 people who choose to receive solar-generated electricity should be the ones to pay any  
5 additional costs. In comparison, only about one in three residents (35%) believe the cost  
6 should be spread among all rate payers.

7  
8 Q. There seems to be a contradiction in the survey responses. On the one hand, respondents  
9 want utilities to produce at least one percent of electricity from solar energy, but on the  
10 other hand, they do not seem to want to pay any extra for this requirement. Does that  
11 response seem to make sense?

12 A. Yes. It is not uncommon for individuals to believe that something may be beneficial or  
13 desirable but not want to pay for it. In the case of solar energy, residents believe it is  
14 beneficial but feel that those people who want to receive it should be the ones to pay for it.

15  
16 Q. Could you please summarize what you believe the survey demonstrates?

17 A. It reveals that Arizona residents have positive attitudes about solar energy primarily  
18 because: 1) they feel it is an environmentally sensitive source of power generation; 2) they  
19 view it as a renewable resource which available in a unlimited supply and; 3) they feel it is a  
20 less expensive method of producing energy than traditional methods such as coal, gas,  
21 nuclear and hydroelectric. Because of these underlying beliefs they support:

- 22
- 23 • requiring utilities and other electric suppliers to use solar energy to produce at least  
24 one percent of the electricity they sell, and;
  - 25 • requiring utilities and other electric suppliers to develop programs to encourage the  
26 use of solar water heating.

27 Additionally, residents support requiring utilities and other electric suppliers in the state to  
28 explore the use of other clean energy sources such as geothermal energy and wind-generated  
energy for the generation of electric power.

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On the other hand, while residents may reveal strong support for solar development, they do not appear willing to reach into their own pockets to pay higher fees for solar-generated electricity.

Q. Does this conclude your rebuttal testimony?

A. Yes, it does.

# APPENDIX BRH-1

**BEHAVIOR RESEARCH CENTER, INC.**

**Bruce R. Hernandez**

Senior Vice President  
Senior Project Director

**GENERAL**

Mr. Hernandez is a recognized authority in the areas of study and sample design, questionnaire design, data input formatting and data retrieval, quality control and data interpretation. Since 1971, he has been a key professional staff member of Behavior Research Center where he has had responsibilities for research design and implementation, data assembly and computer program design, quality and cost control and data analysis.

Mr. Hernandez has worked on hundreds of public opinion and marketing research studies throughout the United States for diversified clients. He is a principal in the Behavior Research Center and holds the position of Senior Vice President.

Mr. Hernandez is a specialist in the design, administration and analysis of opinion research programs including attitude, behavior, use and need studies. His areas of special interest include research in transportation, public policy, recreation, publications and development.

**RESPONSIBILITIES**

Senior Project Director

**EDUCATION**

BA, Marketing, Arizona State University, Tempe, AZ  
Advanced Studies in Social and Economic Statistics

**ACTIVITIES AND AFFILIATIONS**

Bureau of the Census Subcommittee on Population Characteristics  
Valley Forward Urban Concepts Committee  
Vice Chairman of the Board, Community Advisory Board, PBS Station KAET-  
Channel 8  
Board of Directors, Arizona State University, Alumni Association  
Advisor to Arizona Supreme Court Committee on Judicial Performance Review  
American Statistical Society  
American Marketing Association

# ARIZONA SOLAR ENERGY STUDY

Utility Contract No. 220

August 1999

Prepared for

Utilities Division  
Arizona Corporation Commission  
1200 W. Washington  
Phoenix, Arizona

Prepared by

Behavior Research Center  
1101 North First Street  
Phoenix, Arizona 85004  
602 258-4554



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RESEARCH in PUBLIC OPINION, PUBLIC POLICY and CONSUMER BEHAVIOR

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## INTRODUCTION

This study was commissioned by the Utilities Division of the Arizona Corporation Commission. The primary purpose of this effort was to measure residents' attitudes about solar energy power generation. More specifically, this study addressed the following issues:

- Knowledge of solar energy technology and its uses;
- Primary advantages/disadvantages of using solar energy;
- Attitudes about requiring utilities to use solar energy to produce electricity;
- Attitudes about requiring utilities to encourage solar water heater use;
- Attitudes about requiring utilities to explore the use of alternative clean energy sources
- Willingness to pay more to receive solar-generated electricity;

The information contained in this report is based on 500 in-depth interviews conducted with a representative cross-section of Arizona residents. All of the interviewing on this project was conducted via telephone by professional interviewers of the Behavior Research Center between August 10 and 15, 1999. For a detailed explanation of the procedures followed during this project, please refer to the Methodology section of this report.

The information generated from this study is presented in three sections in this report. The first section, EXECUTIVE SUMMARY, presents the primary findings of the survey in a brief summary format. The second section, SUMMARY OF THE FINDINGS, reviews each study question in detail. The final section, APPENDIX, details the study methodology and contains a copy of the survey questionnaire.

The Behavior Research Center has presented all of the data germane to the basic research objectives of this project. However, if Utility Division management requires additional data retrieval or interpretation, we stand ready to provide such input.

BEHAVIOR RESEARCH CENTER, INC.

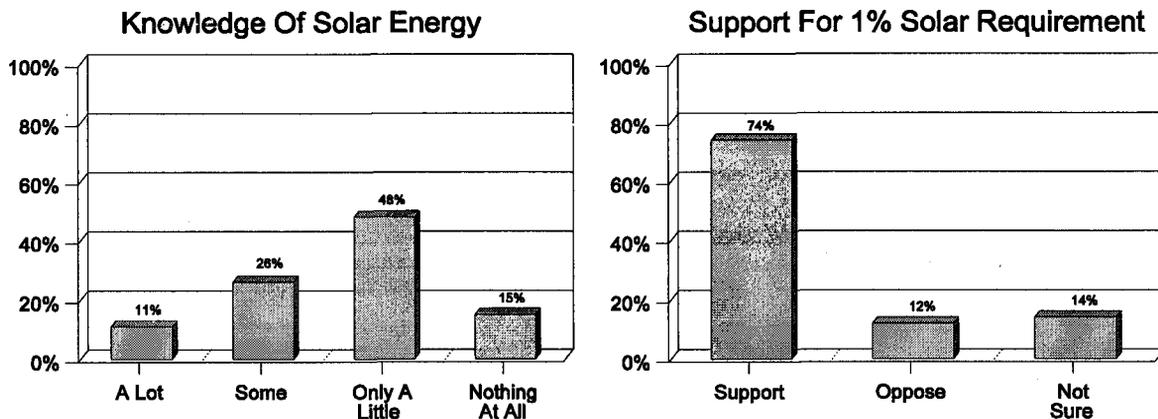
# EXECUTIVE SUMMARY

## KNOWLEDGE OF SOLAR ENERGY TECHNOLOGY AND ITS USES

- Eighty-five percent of Arizona residents indicate they have at least some knowledge of solar energy technology and its uses with 11 percent indicating they know “a lot,” 26 percent “some,” and 48 percent “only a little.” Fifteen percent of residents indicate they know “nothing at all” about solar energy technology.
- The primary advantages residents see of using solar energy to produce electricity rather than other traditional methods are that it is better for the environment (39%), less expensive (34%) and a renewable resource which is available in unlimited supply (32%). On the flip side of the issue, the primary disadvantages residents see of using solar energy are that it is more expensive (25%) and not as reliable as traditional methods (24%).

## ATTITUDES ABOUT REQUIRING UTILITIES TO USE SOLAR ENERGY TO PRODUCE ELECTRICITY

- Nearly three out of four Arizona residents (74%) indicate they either strongly support (26%) or support (48%) requiring utilities and other electric suppliers in the state to use solar energy to produce at least one percent of the electricity they sell. Only 12 percent of residents oppose the requirement while 14 percent are undecided.
- Two out of three residents who support the one percent requirement believe the requirement should be set at a level higher than one percent.

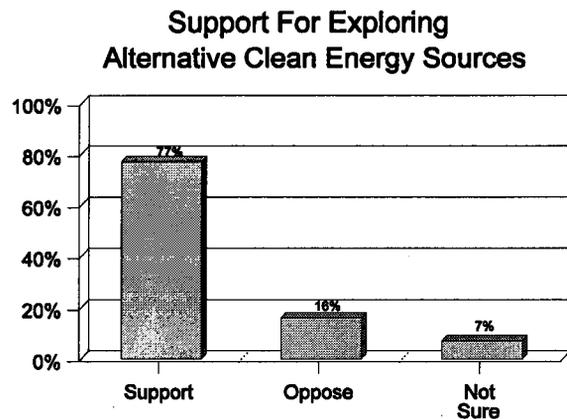
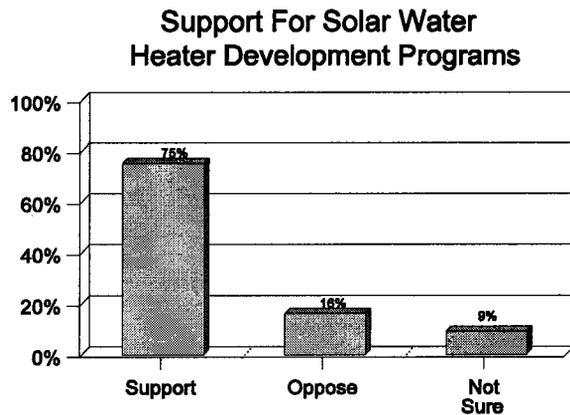


## ATTITUDES ABOUT REQUIRING UTILITIES TO ENCOURAGE SOLAR WATER HEATER USE

- Two out of three Arizona residents (75%) indicate they either strongly support (25%) or support (50%) requiring utilities and other electric supplier in the state to develop programs to encourage the use of solar water heaters. Only 16 percent of residents oppose the programs while nine percent are undecided.

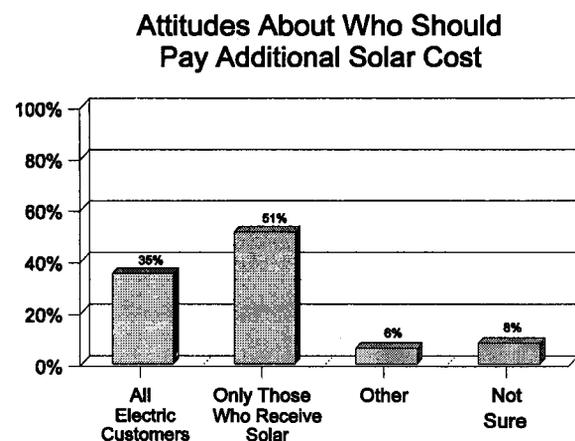
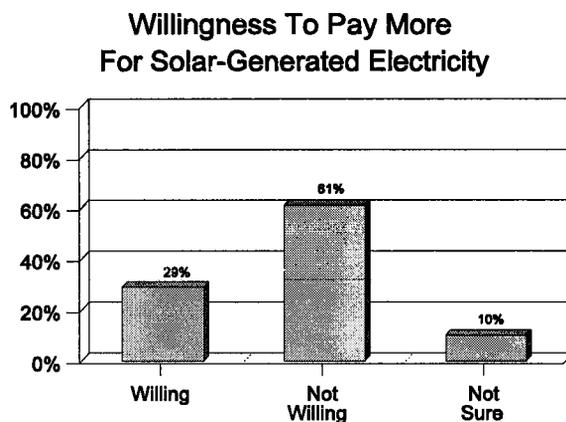
## ATTITUDES ABOUT REQUIRING UTILITIES TO EXPLORE THE USE OF ALTERNATIVE CLEAN ENERGY SOURCES

- Over three out of four Arizona residents (77%) indicate they either strongly support (26%) or support (51%) requiring utilities and other electric suppliers in the state to explore the use of other clean energy sources such as geothermal energy and wind-generated energy for the generation of electric power. Only 16 percent of residents oppose such exploration while seven percent are undecided.



## WILLINGNESS TO PAY MORE TO RECEIVE SOLAR-GENERATED ELECTRICITY

- While residents reveal strong support for solar and alternative clean energy development, they do not reveal the same willingness to pay higher monthly electric bills to receive solar-generated electricity. Thus, by a two-to-one margin residents reject paying higher bills for solar-generated electricity – 29 percent willing vs. 61 percent not willing.
- In a related question, when residents are asked to indicate who they feel should pay for the additional cost of generating solar electricity if utilities and other electric suppliers are required to produce more, a majority of residents (51%) believe that those people who choose to receive solar-generated electricity should be the ones to pay any additional costs. In comparison, only about one in three residents (35%) believe the cost should be spread among all rate payers.



## SUMMARY OF THE FINDINGS

### KNOWLEDGE OF SOLAR ENERGY TECHNOLOGY AND ITS USES

Eighty-five percent of Arizona residents indicate they have at least some knowledge of solar energy technology while 18 percent indicate they know "nothing at all" about it. More specifically, 11 percent of residents indicate they know "a lot," 26 percent "some" and 48 percent "only a little" about solar energy. While knowledge levels are generally consistent across demographic sub-groups, males, residents over 35, Pima County residents, and upper income residents tend to reveal somewhat higher knowledge levels (a lot/some) than their counterparts.

TABLE 1: KNOWLEDGE OF SOLAR ENERGY

"To begin, what I'd like to talk to you about is solar energy. In general, would you say you know a lot, some, only a little or nothing at all about solar energy technology and its uses?"

	A Lot	Some	Only A Little	Nothing At All
<u>TOTAL</u>	11%	26%	48%	15%
<u>GENDER</u>				
Male	15	31	43	11
Female	8	23	51	18
<u>AGE</u>				
Under 35	11	18	55	16
35 to 54	11	30	45	14
55 or over	12	28	45	15
<u>AREA</u>				
Maricopa	12	26	48	14
Pima	14	27	45	14
Rural	8	25	49	18
<u>INCOME</u>				
Under \$25,000	7	19	52	22
\$25,000 to \$39,999	13	23	48	16
\$40,000 to \$54,999	11	26	48	15
\$55,000 or over	14	28	51	7

~~~~~

**PRIMARY ADVANTAGES/DISADVANTAGES OF USING SOLAR ENERGY**

Residents believe there are three primary advantages of using solar energy to generate electricity instead of traditional methods such as coal, gas, nuclear and hydroelectric. First, they feel it is better for the environment (39%). Second, they believe it is less expensive to operate (34%). And third, they view it as a renewable resource of which we have an unlimited supply (32%).

**TABLE 2: MAJOR ADVANTAGES OF SOLAR ENERGY**

“Solar energy can be used to generate electric power and is an alternative to more traditional electric power generating methods such as coal, gas, nuclear or hydro power from dams. What do you feel is the major advantage, if any, of using solar energy to generate electricity instead of the other traditional methods?”

|                                                                        | GENDER |      |        |
|------------------------------------------------------------------------|--------|------|--------|
|                                                                        | TOTAL  | Male | Female |
| Cleaner, better for the environment                                    | 39%    | 41%  | 36%    |
| Less expensive, cheaper to operate                                     | 34     | 26   | 43     |
| Renewable resource, unlimited supply, doesn't use up natural resources | 32     | 34   | 30     |
| Can be used at home to make self sufficient                            | 2      | 3    | 1      |
| Safer than nuclear                                                     | 2      | 1    | 2      |
| Will become less depended on foreign producers                         | 1      | 1    | 1      |
| Miscellaneous other                                                    | 2      | 3    | 1      |
| General positive - just good idea                                      | 2      | 2    | 1      |
| No advantages                                                          | 4      | 5    | 3      |
| Not sure                                                               | 13     | 11   | 15     |

Totals exceed 100% due to multiple responses

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On the flip side of the issue, residents believe there are two primary disadvantages of using solar energy. First, they view it as more expensive than traditional sources (25%) and second they perceived it as unreliable (24%).

**TABLE 3: MAJOR DISADVANTAGES OF SOLAR ENERGY**

“And what do you feel is the major disadvantage, if any, of using solar energy to generate electricity instead of the other traditional methods?”

|                                                             | <u>GENDER</u> |             |               |
|-------------------------------------------------------------|---------------|-------------|---------------|
|                                                             | <u>TOTAL</u>  | <u>Male</u> | <u>Female</u> |
| More expensive                                              | 25%           | 31%         | 19%           |
| Not reliable - no sun, no power                             | 24            | 24          | 25            |
| Technology not perfected yet -<br>no means of storing power | 11            | 14          | 9             |
| Not appropriate for all areas -<br>must live in sunny area  | 3             | 3           | 4             |
| Unattractive generating plants,<br>housing units            | 2             | 2           | 1             |
| People will lose jobs if<br>traditional methods reduced     | 1             | 2           | *             |
| Miscellaneous other                                         | 2             | 3           | 2             |
| None                                                        | 20            | 17          | 23            |
| Not sure                                                    | 17            | 15          | 20            |

Totals exceed 100% due to multiple responses

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## ATTITUDES ABOUT REQUIRING UTILITIES TO USE SOLAR ENERGY TO PRODUCE ELECTRICITY

Nearly three out of four Arizona residents (74%) indicate they either strongly support (26%) or support (48%) requiring utilities and other electric suppliers in the state to use solar energy to produce at least one percent of the electricity they sell. Support for the requirement does not drop below 60 percent within any demographic subgroup and reaches its highest levels among females, residents under 55 and residents with incomes over \$40,000 a year.

**TABLE 4: SUPPORT FOR SOLAR ENERGY  
ELECTRICITY PRODUCTION REQUIREMENT**

“Next, do you strongly support, support, oppose or strongly oppose requiring utilities and other electric suppliers in Arizona to use solar energy to produce at least one percent of the electricity they sell?”

	Strongly Support	Support	Oppose	Strongly Oppose	Not Sure	TOTAL SUPPORT
<u>TOTAL</u>	26%	48%	8%	4%	14%	74%
<u>GENDER</u>						
Male	25	45	12	4	14	70
Female	27	51	5	3	14	78
<u>AGE</u>						
Under 35	26	53	8	2	11	79
35 to 54	28	49	8	5	10	77
55 or over	22	41	11	4	22	63
<u>AREA</u>						
Maricopa	25	51	7	3	14	76
Pima	25	39	17	3	16	64
Rural	29	45	7	6	13	74
<u>INCOME</u>						
Under \$25,000	28	47	4	5	16	75
\$25,000 to \$39,999	25	51	6	6	12	76
\$40,000 to \$54,999	29	55	5	2	9	84
\$55,000 or over	28	50	8	2	12	78

Continuing with this line of questioning, residents who indicate support of the one percent requirement were next asked if they felt the requirement should or should not be higher than the proposed one percent. Here we find that two-thirds of these residents (64%) believe it should be higher, while 20 percent believe it should not and 16 percent are not sure. Among those residents who believe the requirement should be over one percent, 20 percent believe it should be between two and nine percent, 24 percent between ten and 19 percent, 18 percent between 20 and 29 percent and 27 percent 30 percent or more. The median percent these residents believe the requirement should be is 20.5 percent.

**TABLE 5: ATTITUDES ABOUT INCREASING ONE PERCENT  
SOLAR ENERGY PRODUCTION REQUIREMENT**

(AMONG THOSE WHO SUPPORT REQUIREMENT)

“Do you feel the requirement should or should not be higher than one percent?”

	<u>GENDER</u>		
	<u>TOTAL</u>	<u>Male</u>	<u>Female</u>
Should be higher	64%	68%	61%
Should not be higher	20	20	21
Not sure	<u>16</u>	<u>12</u>	<u>18</u>
	100%	100%	100%
 (BASE)	 (369)	 (173)	 (196)

(AMONG THOSE WHO FEEL IT SHOULD BE HIGHER)

“What percent do you feel it should be?”

2 to 5	4%	3%	5%
5 to 9	16	15	18
10 to 19	24	29	19
20 to 29	18	16	19
30 to 49	7	8	7
50 to 74	13	11	15
75 or more	7	8	6
Not sure	<u>11</u>	<u>10</u>	<u>11</u>
	100%	100%	100%
 MEDIAN %	 20.5	 19.6	 21.5
 (BASE)	 (237)	 (117)	 (120)

SUMMARY – TOTAL SAMPLE

Oppose 1% require- ment or are not sure	26%	30%	22%
Oppose requirement higher than 1% or are not sure	26	23	30
Favor requirement higher than 1%	<u>48</u>	<u>47</u>	<u>48</u>
	100%	100%	100%
 (BASE)	 (500)	 (247)	 (253)

**ATTITUDES ABOUT REQUIRING UTILITIES TO ENCOURAGE SOLAR WATER HEATER USE**

Three out of four Arizona residents (75%) indicate they either strongly support (25%) or support (50%) requiring utilities and other electric suppliers in the state to develop programs to encourage the use of solar water heating. Support for this requirement does not drop below 70 percent within any demographic subgroup.

**TABLE 6: SUPPORT FOR PROGRAMS TO ENCOURAGE USE OF SOLAR WATER HEATING**

“In addition to being used to making electricity, solar energy can also be used to directly heat water in homes and businesses. Do you strongly support, support, oppose or strongly oppose requiring utilities and other electric suppliers in Arizona to develop programs to encourage the use of solar water heating in order to reduce the use of traditional power generating methods?”

	Strongly Support	Support	Oppose	Strongly Oppose	Not Sure	TOTAL SUPPORT
<u>TOTAL</u>	25%	50%	12%	4%	9%	75%
<u>GENDER</u>						
Male	26	49	13	5	7	75
Female	24	51	11	3	11	75
<u>AGE</u>						
Under 35	24	52	12	2	10	76
35 to 54	28	49	12	4	7	77
55 or over	21	51	11	5	12	72
<u>AREA</u>						
Maricopa	25	49	14	3	9	74
Pima	26	45	13	5	11	71
Rural	23	58	6	5	8	81
<u>INCOME</u>						
Under \$25,000	25	43	12	7	13	68
\$25,000 to \$39,999	26	54	9	5	6	80
\$40,000 to \$54,999	26	54	13	1	6	80
\$55,000 or over	33	49	9	3	6	82

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**ATTITUDES ABOUT REQUIRING UTILITIES TO EXPLORE THE USE OF ALTERNATIVE CLEAN ENERGY SOURCES**

Resident support for requiring utilities and other electric suppliers in the state to explore the use of other clean energy sources such as geothermal energy and wind-generated energy for the generation of electric power is strong. Thus, we find overall support for the requirement at 77 percent with 26 percent revealing strong support and 51 percent support. Support for this requirement does not drop below 69 percent within any demographic subgroup.

**TABLE 7: SUPPORT FOR EXPLORING ALTERNATIVE CLEAN ENERGY GENERATION SOURCES**

“Next, in addition to solar energy, there are also a variety of other clean energy sources which can be used to generate electric power. Among these are geothermal energy which uses the earth’s natural heat, and wind-generated energy which uses the power of the winds. Do you strongly support, support, oppose or strongly oppose requiring utilities and other electric suppliers in Arizona to explore the use of these other clean energy sources for the generation of electric power in order to reduce the use of traditional power generating methods?”

|                      | Strongly Support | Support | Oppose | Strongly Oppose | Not Sure | TOTAL SUPPORT |
|----------------------|------------------|---------|--------|-----------------|----------|---------------|
| <u>TOTAL</u>         | 26%              | 51%     | 12%    | 4%              | 7%       | 77%           |
| <u>GENDER</u>        |                  |         |        |                 |          |               |
| Male                 | 29               | 47      | 13     | 5               | 6        | 76            |
| Female               | 23               | 54      | 10     | 4               | 9        | 77            |
| <u>AGE</u>           |                  |         |        |                 |          |               |
| Under 35             | 26               | 56      | 9      | 1               | 8        | 82            |
| 35 to 54             | 29               | 51      | 11     | 5               | 4        | 80            |
| 55 or over           | 23               | 46      | 14     | 4               | 13       | 69            |
| <u>AREA</u>          |                  |         |        |                 |          |               |
| Maricopa             | 23               | 53      | 13     | 4               | 7        | 76            |
| Pima                 | 32               | 47      | 5      | 6               | 10       | 79            |
| Rural                | 29               | 47      | 14     | 2               | 8        | 76            |
| <u>INCOME</u>        |                  |         |        |                 |          |               |
| Under \$25,000       | 28               | 46      | 11     | 3               | 12       | 74            |
| \$25,000 to \$39,999 | 28               | 55      | 8      | 4               | 5        | 83            |
| \$40,000 to \$54,999 | 29               | 50      | 15     | 4               | 2        | 79            |
| \$55,000 or over     | 32               | 54      | 8      | 4               | 2        | 86            |

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**WILLINGNESS TO PAY MORE TO RECEIVE SOLAR-GENERATED ELECTRICITY**

While residents reveal strong support for solar and alternative clean energy development, they do not reveal a willingness to pay higher monthly electric bills to receive solar-generated electricity. Thus, as may be seen in Table 8, by a two-to-one margin residents reject paying higher bills for solar-generated electricity – 29 percent willing vs. 61 percent not willing. This attitude is consistent across demographic subgroups.

**TABLE 8: WILLINGNESS TO PAY MORE FOR SOLAR-GENERATED ELECTRICITY**

“Electricity which is produced from solar energy costs more to produce than electricity which is produced from traditional power generating methods. Would you be willing or not willing to pay more per month on your electric bill to receive electricity that was generated from solar energy?”

	<u>Willing</u>	<u>Not Willing</u>	<u>Not Sure</u>
<u>TOTAL</u>	29%	61%	10%
<u>GENDER</u>			
Male	27	62	11
Female	31	59	10
<u>AGE</u>			
Under 35	26	60	14
35 to 54	30	61	9
55 or over	30	60	10
<u>AREA</u>			
Maricopa	28	63	9
Pima	30	53	17
Rural	30	61	9
<u>INCOME</u>			
Under \$25,000	21	67	12
\$25,000 to \$39,999	33	59	8
\$40,000 to \$54,999	34	55	11
\$55,000 or over	35	61	4
<u>UTILITY BILL PAYER</u>			
Self	29	61	10
Landlord	38	50	12

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When residents who indicate they are willing to pay more for solar-generated electricity are asked to reveal how much more they are willing to pay per month, the median figure is approximately \$18.

**TABLE 9: ADDITIONAL AMOUNT WILLING TO PAY  
FOR SOLAR-GENERATED ELECTRICITY**

(AMONG THOSE WILLING TO PAY MORE)

“How many dollars more per month would you be willing to pay?”

|              | <u>GENDER</u> |             |               |
|--------------|---------------|-------------|---------------|
|              | <u>TOTAL</u>  | <u>Male</u> | <u>Female</u> |
| Under \$5    | 5%            | 6%          | 4%            |
| \$5 to \$9   | 12            | 12          | 13            |
| \$10 to \$19 | 29            | 30          | 28            |
| \$20 to \$29 | 22            | 25          | 19            |
| \$30 or more | 11            | 8           | 14            |
| Not sure     | <u>21</u>     | <u>19</u>   | <u>22</u>     |
|              | 100%          | 100%        | 100%          |
| <br>MEDIAN   | <br>\$17.74   | <br>\$17.50 | <br>\$17.95   |
| (BASE)       | (145)         | (67)        | (78)          |

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In a related question, all residents were asked to indicate who they felt should pay for the additional cost of generating solar electricity if utilities and other electric suppliers were required to produce more. Here we find that a majority of residents (51%) believe that those people who choose to receive solar-generated electricity should be the ones to pay any additional costs. In comparison, only about one in three residents (35%) believe the cost should be spread among all rate payers.

**TABLE 10: ATTITUDE ABOUT WHO SHOULD PAY INCREASED  
COST FOR SOLAR-GENERATED ELECTRICITY**

“Next, if the state of Arizona required utilities and other electric suppliers in Arizona to increase the amount of electricity they sold which was produced from solar energy, the price of electricity would go up slightly. Who do you think should pay for this increased cost? Do you feel the cost should be distributed among all electric consumers who would pay a small amount more each month, or do you feel the cost should be paid only by those people who choose to receive solar energy produced electricity?”

	<u>GENDER</u>		
	<u>TOTAL</u>	<u>Male</u>	<u>Female</u>
Only those who choose to receive it	51%	45%	57%
All electric consumers	35	38	32
Equipment makers	2	3	1
The government should pay	2	2	1
Nobody should pay	1	2	*
Utilities should pay	1	1	*
Both should pay	1	0	1
Not sure	<u>8</u>	<u>9</u>	<u>7</u>
	100%	100%	100%

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**APPENDIX**

METHODOLOGY

SURVEY QUESTIONNAIRE

## METHODOLOGY

The information contained in this report is based on 500 in-depth telephone interviews conducted with a representative cross section of Arizona residents. During the course of this study only the male or female head of household were interviewed because prior experience has revealed they are the household members who can best address the issues under study.

The questionnaire to be used in this study was designed by the Behavior Research Center in cooperation with the Utilities Division (see appended questionnaire). On August 7 and 8, the draft questionnaire was pre-tested with a randomly selected cross-section of 10 Arizona residents. The pre-test focused on the value and understandability of the questions, adequacy of response categories, questions for which probes were necessary, and the like. No changes were recommended to the questionnaire following the pre-test.

All of the interviewing on this project was conducted between August 10 and 15, 1999. All of the interviewers who work on this project were professional interviewers of the Center. Each will have had prior experience with BRC and receive a thorough briefing on the particulars of this study. During the briefing, the interviewers were trained on (a) the purpose of the study, (b) sampling procedures, (c) administration of the questionnaire, and (d) other project-related factors. In addition, each interviewer completed a set of practice interviews to ensure that all procedures were understood and followed.

Household selection on this project was accomplished via a computer-generated pure unweighted (EPSEM) random digit dial (RDD) telephone sample which selects households on the basis of telephone prefix. This method was used because it ensures a randomly selected sample of area households proportionately allocated throughout the sample universe. This method also ensures that all unlisted and newly listed telephone households are included in the sample. A pre-identification screening process was also utilized on this project. This computer procedure screens the sample to remove known business and commercial telephone prefixes in addition to disconnects, faxes and computers. This process greatly enhances contacts to residential telephones.

This survey employed a multi-stage sampling process. The first step in this process was to stratify the subarea samples according to the current population residing in each area. Telephone households were then selected within those areas using the RDD methodology. A probability sample developed in this manner samples proportionately relative to an area's distribution of the population. This strengthens the ability of the sample to be compared with Census data and other demographic information.

Interviewing on this study was conducted during an approximately equal cross section of late afternoon, evening and weekend hours. This procedure was followed to further ensure that all residents were equally represented, regardless of work schedules. Further, during the interviewing segment of this study, up to four separate attempts -- on different days and during different times of day -- were made to contact each selected household. Only after four unsuccessful attempts was a selected household substituted in the sample. Using this methodology, the full sample was completed, and partially completed interviews were not accepted, nor counted toward fulfillment of the total sample quotas.

All of the interviewing on this project was conducted at BRC's central location telephone facility located in Phoenix by means of Computer Assisted Telephone Interviewing (CATI). The Behavior Research Center uses the ACS-QUERY CATI system. The CATI system is a computer controlled interview that uses a tightly-integrated branching pattern to control cuing and display of contingent questions. This system allows for a more relaxed interview environment, while reducing the risks of coding error typically found with hard copy survey instruments. The system also performs internal consistency checks on survey variables and prompts interviewer staff to ask probe questions or clarify answers.

Using RDD on the CATI system, when a residential contact was established, the interviewer introduced her/himself and the study, elect the appropriate household member, and attempt to complete the interview with the designated respondent. If the respondent was not at home or if the call was at an inconvenient time, the interview was rescheduled.

All surveys are subject to sampling error. Sampling error, stated simply, is the difference between the results obtained from a sample and those which would be obtained by surveying the entire population under consideration. The size of sampling error varies, to some extent, with the number of interviews completed and with the division of opinion on a particular question.

An estimate of the sampling error range for this study is provided in the following table. The sampling error presented in the table has been calculated at the confidence level most frequently used by social scientists, the 95 percent level. The sampling error figures shown in the table are average figures that represent the maximum error for the sample bases shown (i.e., for the survey findings where the division of opinion is approximately 50%/50%). Survey findings that show a more one-sided distribution of opinion, such as 70%/30% or 90%/10%, are usually subject to slightly lower sampling tolerances than those shown in the table.

As may be seen in the table, the overall sampling error for this study is approximately +/- 4.5 percent when the sample is studied in total (i.e., all 500 cases). However, when subsets of the total sample are studied, the amount of sampling error increases based on the sample size within the subset.

| <u>Sample<br/>Size</u> | <u>Approximate Sampling<br/>Error At A 95% Confidence<br/>Level (Plus/Minus Percentage<br/>Of Sampling Tolerance)</u> |
|------------------------|-----------------------------------------------------------------------------------------------------------------------|
| 500                    | 4.5                                                                                                                   |
| 400                    | 5.0                                                                                                                   |
| 300                    | 5.8                                                                                                                   |
| 200                    | 7.1                                                                                                                   |
| 100                    | 10.0                                                                                                                  |

Hello, my name is \_\_\_\_\_ and I'm with the Behavior Research Center of Arizona. We're conducting a brief survey among Arizona residents on issues of the day and I'd like to speak with you for a few minutes. Are you the (Male/Female) head of your household?

IF YES: CONTINUE

IF NO: ASK TO SPEAK TO MALE/FEMALE  
HEAD, REINTRODUCE YOURSELF  
AND CONTINUE. IF NONE AVAIL-  
ABLE, ARRANGE CALLBACK.

Male...1  
Female...2

CALLBACK INFO: \_\_\_\_\_

1. To begin, what I'd like to talk to you about is solar energy. In general, would you say you know a lot, some, only a little or nothing at all about solar energy technology and its uses?  
A lot...1  
Some...2  
Only a little...3  
Nothing at all...4

2. Solar energy can be used to generate electric power and is an alternative to more traditional electric power generating methods such as coal, gas, nuclear or hydro power from dams. What do you feel is the major advantage, if any, of using solar energy to generate electricity instead of the other traditional methods? (PROBE)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. And what do you feel is the major disadvantage, if any, of using solar energy to generate electricity instead of the other traditional methods? (PROBE)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. Next, do you strongly support, support, oppose or strongly oppose requiring utilities and other electric suppliers in Arizona to use solar energy to produce at least one percent of the electricity they sell?  
(GO TO Q4a) Strongly oppose...1  
Support...2  
(GO TO Q5) Oppose...3  
Strongly oppose...4  
Not sure...5

4a. Do you feel the requirement should or should not be higher than one percent?  
(GO TO Q4b) Should be higher...1  
(GO TO Q5) Should not be higher...2  
Not sure...3

4b. What percent do you feel it should be? PERCENT: / / / /

5. Electricity which is produced from solar energy costs more to produce than electricity which is produced from traditional power generating methods. Would you be willing or not willing to pay more per month on your electric bill to receive electricity that was generated from solar energy?
- (GO TO Q5a) Willing...1  
(GO TO Q6) Not willing...2  
Not sure...3
- 5a. How many dollars more per month would you be willing to pay? AMOUNT: / / / /
6. Next, if the state of Arizona required utilities and other electric suppliers in Arizona to increase the amount of electricity they sold which was produced from solar energy, the price of electricity would go up slightly. Who do you think should pay for this increased cost? Do you feel the cost should be distributed among all electric consumers who would pay a small amount more each month, or do you feel the cost should be paid only by those people who choose to receive solar energy produced electricity?
- All electric consumers...1  
Those who choose to receive it...2  
\_\_\_\_\_ Other (SPECIFY)  
Not sure...9
7. In addition to being used to making electricity, solar energy can also be used to directly heat water in homes and businesses. Do you strongly support, support, oppose or strongly oppose requiring utilities and other electric suppliers in Arizona to develop programs to encourage the use of solar water heating in order to reduce the use of traditional power generating methods?
- Strongly support...1  
Support...2  
Oppose...3  
Strongly oppose...4  
Not sure...5
8. Next, in addition to solar energy, there are also a variety of other clean energy sources which can be used to generate electric power. Among these are geothermal energy which uses the earth's natural heat, and wind generated energy which uses the power of the winds. Do you strongly support, support, oppose or strongly oppose requiring utilities and other electric suppliers in Arizona to explore the use of these other clean energy sources for the generation of electric power in order to reduce the use of traditional power generating methods?
- Strongly support...1  
Support...2  
Oppose...3  
Strongly oppose...4  
Not sure...5
9. Now before we finish, I'd like to ask you a couple of questions for classification purposes. First, which one of the following categories best describes your age?
- Under 35...1  
35 to 54...2  
55 or over...3  
\_\_\_\_\_  
(DO NOT READ) Refused...4
10. Do you own or rent your home?
- (GO TO Q11) Own (buying)...1  
\_\_\_\_\_  
(GO TO Q10a) Rent...2  
\_\_\_\_\_  
(GO TO Q11) Refused...3
- 10a. Does a landlord pay your utility bills or do you pay them directly?
- Landlord...1  
Pay directly...2  
Refused...3

11. And finally, was your total family income for last year, I mean before taxes and including everyone in your household, under or over \$40,000?

UNDER \$40,000

Was it under \$25,000...1

or \$25,000 or over...2

(DO NOT READ) Refused...3

OVER \$40,000

Was it under \$55,000...4

\$55,000 to under \$70,000...5

or \$70,000 or over...6

(DO NOT READ) Refused...7

REFUSED OVERALL.....8

Thank you very much, that completes this interview. My supervisor may want to call you to verify that I conducted this interview so may I have your first name in order that he/she may do so? (VERIFY PHONE NUMBER)

NAME: \_\_\_\_\_ PHONE #: \_\_\_\_\_

ADMINISTRATIVE DATA:

INTERVIEWER NAME: \_\_\_\_\_ #: \_\_\_\_\_

FROM SAMPLE: \_\_\_\_\_ COUNTY \_\_\_\_\_