Using Contingent Valuation to Explore Willingness to Pay for Renewable Energy: A Comparison of Collective and Voluntary Payment Vehicles

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Abstract

This study uses a split-sample, dichotomous choice contingent valuation survey of 1,574 U.S. residents to explore willingness to pay (WTP) for renewable energy under collective and voluntary payment vehicles, and under government and private provision of the good. We also evaluate the impact of "participation expectations" on stated WTP. We find some evidence that, when confronted with a collective payment mechanism, respondents state a somewhat higher WTP than when voluntary payment mechanisms are used. Similarly, private provision of the good elicits a somewhat higher WTP than does government provision. We also find that contingent valuation responses are strongly correlated with expectations for the WTP of others. Our results shed light on strategic response behavior and the incentive compatibility of different CV designs, and offer practical insight into U.S. household preferences for how to support renewable energy.

Keywords: Contingent valuation; Renewable energy; Willingness to pay; Payment vehicles

1. Introduction

Some of the most basic questions about the organization and functioning of society involve issues raised by the existence of public goods. With respect to environmental public goods, how should funds used to support environmental improvement be collected and used? In particular, are collective, mandatory payments superior to voluntary, charitable payments due to the possibility of free riding? And to what degree should the government be involved in spending these funds: should

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the government directly fund environmental improvement projects or should the private sector be used to collect funds and determine funding priorities?

This article explores these questions from the perspective of renewable energy: wind, geothermal, biomass, and solar. Renewable energy can be supported through a mandatory "tax" on electric bills or through voluntary payments via green power marketing; the government may or may not be heavily involved in the collection and expenditure of such funds.

More specifically, this study analyzes the payment preferences of U.S. households through the implementation of a large-scale contingent valuation (CV) survey of willingness to pay (WTP) for renewable energy. The sensitivity of stated WTP for renewable energy under four specific payment and provision contexts (using three different payment levels, or bid points) is evaluated:

1. A **mandatory** increase in the electricity bills of all customers, the funds from which are collected and spent by the **government** on renewable energy projects.
2. A **voluntary** increase in the electricity bills of those customers who choose to pay, the funds from which are collected and spent by the **government** on renewable energy projects.
3. A **voluntary** increase in the electricity bills of those customers who choose to pay, the funds from which are collected and spent by **electricity suppliers** on renewable energy projects.
4. A **mandatory** increase in the electricity bills of all customers, the funds from which are collected and spent by **electricity suppliers** on renewable energy projects.

These payment and provision scenarios are consistent with contemporary forms of support for renewable energy. The first scenario – mandatory payments and government provision – is consistent with a system-benefits charge policy under which a small surcharge on electricity rates is levied, with funds so collected used to support renewable energy under what is often government administration; this is a policy that has been adopted in 15 U.S. states and in several countries. The third scenario – voluntary payments to an electricity supplier – is consistent with competitive green power marketing under which customers are given an opportunity to voluntary support renewable energy through payments on their electric bills. The fourth scenario – mandatory payments through electricity suppliers – is consistent with a renewables portfolio standard, a policy adopted in at least six countries and twenty-one U.S. states as of mid-2005 in which electricity suppliers are obligated to purchase a certain amount of renewable energy. The second scenario – voluntary payments and government provision – has few practical correlates.

In addition to having contemporary policy relevance (and therefore providing practical insight on the preferences of the U.S. populace towards various approaches to encouraging

renewable energy supply), these four contingent valuation scenarios allow one to distinguish differences in stated WTP based on: (1) the payment method – is WTP affected by whether payments are to be made collectively or voluntarily? and (2) the provision arrangement – does the manner in which a good is provided, in this case through the government or the private sector, affect stated WTP? As described in more detail in the next section, results presented here therefore have implications for the methodology and practice of contingent valuation. In particular, the results shed light on strategic response behavior and the incentive compatibility of different CV designs.

Three secondary objectives also influenced research design. First, this study tentatively evaluates the importance of "participation expectations" in CV surveys: specifically, are individuals who state a WTP for renewable energy more likely to think that others will also contribute? Such relationships are commonly discussed in the sociology, social psychology, marketing, and collective action literatures, but have yet to be tested thoroughly in a contingent valuation context. Second, this report assesses the effects of socioeconomic, demographic, and attitudinal variables on willingness to pay for renewable energy. This analysis helps test the construct validity of the contingent valuation method, and informs our understanding of who is and is not willing to pay for renewable energy under different payment and provision contexts. Finally, through the implementation of a concurrent opinion survey with 202 respondents, this study compares the results of the CV surveys to a more direct approach of eliciting individuals' payment preferences.

2. Previous Research

CV has become one of the most popular methods used by environmental and resource economists to value environmental goods (Mitchell and Carson 1989, Bjornstad and Kahn 1996, Bateman and Willis 1999). Despite growing acceptance by some of the usefulness and meaningfulness of CV responses, the technique remains controversial (e.g., Hausman 1993, Cummings and Harrison 1994). That the approach taken to collecting and spending funds for environmental projects may influence the willingness of individuals to provide those funds will come as little surprise to CV practitioners. Nonetheless, to help fill important gaps in the CV literature, Bjornstad and Kahn (1996) identify several research areas that require attention, including the role of CV context in the formation of preferences, and the impact of payment methods on elicited WTP. These are the primary topics of this article, and below we survey relevant

literature on provision and payment effects in CV research, and the more general literature on the influence of "participation expectations" on survey response.

2.1 Provision and Payment Variations

In the present study we consider two ways in which the good – renewable energy – could be provided. One approach is for the government to collect and distribute funds for renewable energy; the other is for a private electricity supplier to collect and spend the funds. A priori, economic theory can do little to predict how or if WTP will differ based on this variation in the CV scenario. One might expect, however, that any difference in WTP across the two provision arrangements will be driven by the relative trust respondents place in the government and the private sector in effectively delivering renewable energy programs.

We also evaluate two possible payment methods. The first is a collective payment approach in which all households and businesses are required to pay for the provision of the good; in the case of renewable energy, this takes the form of a required surcharge on electricity bills. The second payment method is a voluntary one in which each household has the option, but not the obligation, to support the provision of the good; in the case of renewable energy, this is envisioned as a voluntary supplemental charge on electricity bills.

There have been relatively few efforts within the CV literature to systematically test the sensitivity of WTP to whether payments are to be made collectively or voluntarily. A review of the CV, collective action, experimental economics and related literatures leads to two conflicting theories of behavioral response when individuals are faced with these payment options.

Free Riding and Truth Telling: One behavioral theory relies on the traditional economic concept of "free riding." As is well known, when payment is voluntary, economic theory predicts that few individuals will be willing to pay to help provide public goods. The free riding concept has been used to explain the large discrepancy between the stated environmental attitudes of the general populace and the weak actions of that same group in voluntarily engaging in environmental behaviors (Foster et al. 1997). The theory has also been tested in experimental economic research – while complete free riding is not generally found, the evidence for a significant degree of such behavior is clear (Ledyard 1995). Within the CV literature, free-riding has been used to explain why actual contributions to public causes are often well below what CV studies would seem to predict (Hanemann 1996, Carson 1997, Taylor 1998), including empirical differences between hypothetical and actual voluntary contributions to renewable energy (Champ and Bishop 2001). In the present

setting, if survey respondents are assumed to answer CV questions "truthfully" (i.e., as if they are being faced with a true economic choice to voluntarily contribute), free riding might also be used to predict that stated WTP under voluntary payment will be *lower* than elicited WTP when payments are to be made collectively (Champ et al. 2002).

Strategic Behavior and Incentive Compatibility: While few would doubt the incentive to free ride when real economic commitments are involved, CV studies rely on hypothetical survey questions, not real commitments. The hypothetical nature of CV research leads to another possible behavioral response: strategic behavior and overbidding. Concerns over strategic bias in public goods valuation are often attributed to Samuelson (1954), with perhaps the first test of these effects in a CV context by Bohm (1972). Even now, however, the concept of strategic behavior and the related concept of "incentive compatibility" have only begun to be fully integrated into CV design.

Incentive compatibility refers to whether respondents to a CV survey have an incentive to reveal their true valuation for the good. Perhaps the most significant recent contribution to the incentive compatibility literature as it relates to CV studies and different payment methods comes from Carson (1997) and Carson et al. (1999). These studies conclude that for a survey to elicit true preferences, it needs to be consequential; that is, the survey results must be viewed by the respondent as possibly influencing actual outcomes that the respondent cares about. Following Hoehn and Randall (1987) and Randall (1996), these authors also make a persuasive case that for a survey to elicit true preferences, a single, binary dichotomous choice survey question (i.e., a yes/no valuation question) with a *collective* payment rule must be used. The incentive compatibility of this approach is one of the primary reasons for the NOAA panel recommendation to use dichotomous choice elicitation methods (Arrow et al. 1993).

In the case of *voluntary* contributions to the provision of public goods, however, Carson (1997) and Carson et al. (1999) identify an important possible cause of strategic behavior. These authors argue that respondents may overstate their WTP when presented with a hypothetical, voluntary payment mechanism. As long as the good is *potentially* desirable, it is always optimal to say "yes" to a survey valuation question that poses a voluntary payment. This is because the only influence of a "yes" response to a hypothetical CV question is to encourage the actual fund-raising effort, and many respondents may want the good to be provided by others or may want the option of actually volunteering to pay for the good at a later time. Consequently, in a hypothetical survey context, a conniving respondent may overstate their WTP in a voluntary payment setting.

Related CV Research: These two theories of behavioral response suggest opposite effects. Many early CV studies used voluntary payment methods to elicit WTP. Recognizing that such an approach fails the test of incentive compatibility, however, most contemporary CV research uses collective payment vehicles. Surprisingly, however, only a limited amount of empirical work has been undertaken to explore the differences between voluntary and collective WTP, and much of the work that does exist suffers from serious methodological shortcomings.

A number of studies have found no difference in collective and voluntary WTP. Milon (1989), using an approach somewhat similar to the one used in this article, evaluates collective and voluntary WTP for an artificial reef using a dichotomous choice elicitation format. No significant differences in WTP are found. Ajzen et al. (1996) also evaluate WTP for a public (movie theater) and private (noise filter) good under voluntary and compulsory payment vehicles. Using a within-sample approach and open-ended response format, they also find that the payment method has little impact. An earlier study by Babb and Sherr (1975) similarly found little evidence of strategic behavior when respondents are faced with a voluntary payment mechanism.

Other studies do find some evidence for different response effects when individuals are confronted with collective and voluntary payment vehicles. Some of these studies attribute these differences to possible incentive effects, while others emphasize possible credibility differences among the payment vehicles. Champ et al. (2002) use an approach that is nearly identical to our own, and find that a voluntary payment mechanism for preserving open space results in a somewhat lower stated WTP than a mandatory tax. Green et al. (1994), using an open-ended elicitation format, find limited evidence for higher WTP estimates under a taxation arrangement than under voluntary contributions. In a pilot study with an open-ended elicitation format, Bateman et al. (1995) found that a voluntary payment vehicle suffered disproportionately from zero WTP bids compared to a taxation vehicle, and also generated lower mean WTP estimates. Jakobsson and Dragun (1996) find that, under both discrete and continuous response formats, mean WTP for possum protection under a donation mechanisms was 35% lower than under a tax mechanism. Stevens et al. (1991), meanwhile, find that, when confronted with a voluntary payment method for protecting wildlife, 40% of respondents who indicated they were not willing to pay stated that wildlife should be preserved through taxes or license fees. Similarly, Harris and Brown (1992) present survey respondents with a choice of four payment methods for a reduction in wildlife impacts; the majority of respondents preferred collective payment methods.

2.2 Participation Expectations

By evaluating the relationship between stated WTP and the participation expectations of others (i.e., are individuals who state a WTP for renewable energy more likely to think that others will also contribute), this study also seeks to contribute, albeit more modestly, to the collective action and related literatures on what is variously called interpersonal influence, reciprocity, trust in others, and bandwagon effects. While a variety of academic literatures have noted the prevalence of the "participation expectations" effect and of interpersonal influence in decision-making more broadly, these effects have not been thoroughly tested in CV research.[2]

Even within CV, however, a debate has arisen over whether survey participants should be informed of the valuation responses of others. Economists often argue that providing survey respondents information on the (claimed or actual) responses on other subjects could induce strategic behavior or reliance on the "informed" bids of others in formulating one's own answers, thereby invalidating the valuation questions (Arrow 1986, Freeman 1986). Kahnemann (1986), meanwhile, sees such information as an integral part of the valuation process – any one individual's WTP is inextricably linked to what others are paying.

Two of the more relevant papers in other disciplines include Orbell and Dawes (1991) and Dawes, McTavish and Shaklee (1977), both of which conclude that, in experimental settings, contributors to public goods expect significantly more cooperation than do defectors. A related study by Pieters et al. (1998) shows that the expected pro-environmental behavior of other households is positively correlated with individuals' own environmental behaviors.

Others have gone even farther by claiming a causal relationship: people are not only sensitive to what others are doing, but may not participate in an activity unless they are confident that others are participating as well. For example, in sociology the prevalence of "bandwagon" or "critical mass" effects is often noted in studies of how innovations diffuse through society and in studies of how collective action problems can be solved when interpersonal networks and social norms become activated (Rogers 1962, Marwell et al. 1988, Macy 1991, Elster 1989, Oliver 1993). In evaluations of environmental attitudes and behaviors, studies often find that individuals who rank higher in "trust" or "faith in others" also contribute more to environmental causes, and that social

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[2] Some exceptions do exist. Fischhoff and Furby (1988), Harris et al. (1989), and Blamey (1998), for example, note the importance of social context and the possible influence of others in CV transactions in a qualitative fashion, while Vadnjal and O'Conner (1994), Schkade and Payne (1994), and Shechter et al. (1998) note this influence after interviewing or surveying CV respondents. Others have explicitly explored the impact of "reminders" of others' contributions on WTP (e.g., Green et al. 1994 and Bohara et al. 1998).

influences affect behavior (Manzo and Weinstein 1987, Bearden et al. 1989, LaTour and Manrai 1989, Lutzenhiser 1993, Osterhus 1997). Marketers, meanwhile, describe the difficultly of "crossing the chasm" to reach critical mass in product sales (Moore 1991), while economists and political scientists sometimes find evidence for bandwagon effects in voting behavior (Hong and Konrad 1998). Finally, in the collective action literature, Sugden (1984), Chong (1991), Lichbach (1996) and others highlight the importance of reciprocity in providing incentives to contribute; contributions are often matched with contributions, while defection is matched with defection. Formally, game theorists and others note that if individuals can contribute to public goods contingent upon other participants, they can sometimes "solve" the free rider dilemma (Axelrod 1984, Cornes and Sandler 1986, Mitchell and Carson 1989).

3. Methods and Data

This study explores WTP for renewable energy under collective and voluntary payment mechanisms and under private and government provision, as well as the impacts of participation expectations on WTP. Several studies have been conducted over the last several years that have used opinion surveys or deliberative polling to explore individual preferences for supporting renewable power generation. These studies find evidence that U.S. residents prefer collective, mandatory payments for renewable energy to voluntary ones (Decision Research 1992, ECAP 1998, Sloan and Taddune 1999, Ferguson 1999, Farhar and Coburn 1999, Farhar 1999, Guild et al. 2003). None of these opinion surveys, however, have relied on the CV method.

Our study builds off of these results by using CV, but also makes advances relative to much of the previous CV research by: (1) undertaking a complete CV study rather than a pilot study, (2) carefully designing the valuation questions to distinguish between voluntary and collective willingness to pay, (3) implementing the survey through standard CV procedures, including dichotomous choice elicitation and a split sample design, (4) including other questions in the CV survey to better understand responses received, and (5) undertaking an opinion survey with which to compare CV response.

Our analysis is based on data from a single-bounded, dichotomous choice CV survey of 1,574 U.S. households, and on data from a more limited opinion survey with 202 respondents. The CV study crossed payment method (collective or voluntary) and provision arrangement (government or private), yielding a four-cell experimental design (see Table 1). A split-sample

design was employed: each survey respondent received a different CV question corresponding to one of the four CV payment and provision scenarios. Within each of these four independent samples, three different bid points were used (50¢, $3 and $8/month, for a duration of three years), with each survey respondent receiving just one of these three payment levels. A final sample received an opinion survey intended to cover many of the same topics as the CV survey, but to more directly query respondents on their payment preferences. The three-year payment window was established to make clear that this was not to be an indefinite funding obligation.

We note that this is not a standard contingent valuation study in which a single environmental good is being valued. In particular, in this survey higher bid levels correspond to more renewable energy being supplied and increased environmental improvements. As a result, "valuation" of the good is not possible in the traditional sense. The approach taken here is, however, consistent with that used in several other CV studies (see, e.g., Champ et al. 1997, Berrens et al. 1998), and is also more consistent with the actual renewable energy policy choices facing consumers and policymakers. To make the survey consequential, the survey text noted: "The federal government is considering whether and how to support renewable energy in the future. The University of California is conducting this independent survey to help the country make these important choices."

The survey was conducted as a mail questionnaire. The population of interest for this research consisted of U.S. residents who pay their own electric bills. The sample was purchased from Survey Sampling Inc., and residents were selected and sampled randomly in proportion to their occurrence in the 50 states. A total of 4,056 CV surveys and 544 opinion surveys were mailed; 1574 completed CV surveys and 202 completed opinion surveys were returned. After considering undeliverable surveys and ineligible participants, the aggregate response rate to the CV surveys (and the opinion survey) was over 45%, and there were no statistically significant variations in response rate by CV scenario or by bid amount (chi(2) test, $p = 0.985$). There also appear to be no systematic differences in the respondents by survey type or version.

Both the CV and opinion surveys were formatted and administered in a fashion largely consistent with that recommended by Dillman (2000) in order to maximize response rates at reasonable cost. Survey administration included an advance letter, a mailing of the survey packet, a thank you/reminder postcard, a follow-up mail packet, and a follow-up telephone call. The CV surveys were 12 pages in length, and included "warm-up" questions, the valuation exercise, attitudinal questions, and demographic and socioeconomic questions. The opinion survey, at 16

pages in length, was structured similarly but replaced the valuation exercise with more general questions on renewable energy payment preferences. An informal focus group and a mailed pre-test of the survey instrument preceded survey implementation.

To make clean comparisons across CV scenarios, we sought to design each scenario in a comparable fashion, varying only the payment method (collective or voluntary) and provision arrangement (government or private sector). Unfortunately, especially under the private sector provision scenarios, such comparability is not perfect. To make the scenarios credible and give them added policy relevance, Scenario 3 involves the respondent switching to a new electricity provider to pay the specified premium, while Scenario 4 imposes a renewable energy requirement on electricity suppliers, the cost of which would flow through to all customers. Neither Scenario 1 nor Scenario 2 includes switching electricity suppliers or the imposition of a renewable energy requirement. While this makes it more difficult to derive definitive conclusions on the impact of payment and provision arrangements, it also makes the scenarios consistent with current renewable energy support programs, offering a degree of practical relevancy that would not otherwise have been possible. Also note that we treated renewable energy as a homogenous good, and did not identify the specific amounts of different *types* of renewable energy that would be supported by customer payments; this approach is also consistent with present policy efforts in the U.S. Copies of the full surveys can be found in Wiser (2003); the specific valuation questions for the four scenarios are provided in Appendix A.

4. Payment and Provision Preferences: Basic CV Results

The most direct way to test for payment and provision effects in the data is to compare the empirical distribution of WTP responses across the four CV scenarios. Figure 1 shows the important pair wise comparisons among the scenarios, illustrating the separable effects of payment method (voluntary vs. collective) and provision arrangement (government vs. private).

Some systematic differences among response to the CV scenarios appear to exist depending on the payment method and provision arrangement. The top two graphs embedded in Figure 1 show pair wise comparisons where the provision approach is fixed and the payment method varies. Under both provision modes (government and private), the collective payment method elicits a higher WTP at all bid points than does voluntary payment. Similarly, the bottom two graphs in the figure show pair wise comparisons where the payment method is fixed and the provision arrangement

varies. Under both payment methods (collective and voluntary), the private provision arrangement elicits a higher WTP at all bid points than does government provision. These results suggest that collective payment methods elicit a higher WTP than voluntary ones, and that private provision arrangements elicit a higher WTP than governmental ones.

Nonetheless, these differences are not always sizable. The statistical test used here is a likelihood ratio test for the equality of two binomial variables. We apply this test to each of the four pair wise comparisons shown in Figure 1, as opposed to each data point, allowing one to evaluate whether the different treatments (payment method and provision arrangement) yield statistically distinct responses on "average" across all bid points.[3] Results are presented in Figure 1 under each of the four pair wise comparison graphs. "LR" represents the test statistic of the likelihood ratio test. When compared to critical values on the chi-squared distribution, "p" represents the statistical significance of the results.

Based on this test, statistically significant differences can be claimed for just two of the four pair wise comparisons:

- Under the private provision cases, collective payments elicit a higher WTP than voluntary payments at a significance level of p = 0.009 (significance of over 99%).
- Under the collective payment cases, private provision elicits a higher WTP than government provision at a significance level of p = 0.015 (significance of 98.5%).

The other two pair wise comparisons show data that are supportive of these conclusions – collective payment and private provision elicit a slightly higher WTP than voluntary payment and government provision – but statistical significance cannot be claimed (p= 0.78 and 0.41).

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[3] For a single bid point, consider two different samples: A and B. To test whether the binomial parameter θ in samples A and B is the same ($\theta_A = \theta_B = \theta$) or different ($\theta_A \neq \theta_B$) a simple likelihood ratio test may be used. Pooling the two samples, the restricted log-likelihood function will equal:

$$\sum_{i=1}^{n}\left(y_i \ln\theta + (1-y_i)\ln(1-\theta)\right) \quad (1)$$

The unrestricted log-likelihood function will be:

$$\sum_{i=1}^{n_A}\left(y_i \ln\theta_A + (1-y_i)\ln(1-\theta_A)\right) + \sum_{i=1}^{n_B}\left(y_i \ln\theta_B + (1-y_i)\ln(1-\theta_B)\right) \quad (2)$$

This is simply the sum of the log-likelihood functions for each sub-sample. The test is then a simple likelihood ratio test, and can be compared to a chi-squared random variable with 1 degree of freedom. Because our respondents are randomly assigned each to a single bid point, this approach easily generalizes to multiple bid points. We assume that each bid point has its own binomial parameter θ_{Bid} . The log-likelihood for multiple bid points is therefore the sum of the log-likelihoods for each bid point. With three bid points this can be compared to a chi-square random variable with 3 degrees of freedom.

5. Participation Expectation Effects: Basic CV Results

The CV survey also explored the expectations of the survey respondents about the willingness to pay of other U.S. residents. That is, do respondents who state a WTP for renewable energy themselves predict that more people will join them in being willing to pay than do those respondents who say they are unwilling to pay the premium?

In the present study, we test for these effects in a hypothetical contingent valuation setting. Specifically, each CV survey asked what percent of U.S. residents the respondent believes would support and be willing to pay the specified premium for renewable energy. Not only do answers to this question allow one to evaluate the relationship between stated willingness to pay and expectations for the willingness to pay of others, but they also allow one to assess how survey respondents believe others would respond to different payment or provision contexts.

Table 2 shows the mean results for this question by bid, scenario, and response to the valuation question. Several important tentative conclusions emerge from these data:

- **Payment Method Affects WTP Expectations.** As with the direct valuation question reported earlier, a greater willingness to pay is expected under collective payment methods than under voluntary payment. This is true under both the government and private provision arrangements. The differences also appear more substantial across all bid levels than the differences reported earlier for the direct valuation question. On average, collective WTP is expected to be approximately 25% higher than voluntary WTP. Survey respondents seemingly understand the nature of the free-riding effect: respondents expect more residents to support a collective payment approach for renewable energy than a voluntary one.
- **Individuals Who Are Willing to Pay Often Expect Others to Reciprocate.** The WTP expectations for others is far lower among those who are not willing to pay for renewable energy themselves than it is for those who are willing to pay. The differences are striking. Those who indicate a willingness to pay for renewable energy often expect twice as many people to do likewise than do those who indicate they are not willing to pay. Apparently, regardless of the payment and provision method, those who indicate a willingness to pay for renewable energy also believe that many others will reciprocate and be willing to pay. This finding is consistent with those of previous academic work, as described earlier.

- **Respondents Perceive Themselves to be More Willing to Pay than Others.** How do these responses compare to actual stated WTP as expressed in the earlier valuation question? Using overall responses from Table 2 and comparing them to Figure 1, it is clear that respondents' perception of the WTP of others is lower than their own stated willingness to pay. Apparently, respondents to this survey in general feel that they are more likely to be willing to pay for renewable energy than are others. This is consistent with other research findings that show that individuals attribute higher levels of pro-environmental behavior to themselves than to others (Pieters et al. 1998).

6. Multivariate Regression Results

Here we present logit analysis, performed in a fashion that is typical in contingent valuation studies (see, e.g., Hanemann and Kanninen 1999). Perhaps the simplest method of testing for the impact of payment method and provision arrangement on responses to the valuation question is to consider pair wise comparisons between the different valuation scenarios, much as was done earlier with summary statistics. Using this approach, the dependent variable in the logit equation is whether or not the respondent said "yes" to the valuation question (1=yes; 0=no). Including a dummy "treatment" variable that indicates whether payment was voluntary or collective, or whether provision was through the government or the private sector, allows one to test whether the treatment has a significant positive or negative effect on the probability of being willing to pay for renewable energy. Other socioeconomic and demographic variables are also included as independent explanatory variables. Table 3 shows the independent variables used in the simple logit analysis that follows and the more comprehensive model presented later.

Table 4 shows the results of the four pair wise regression analyses. Each of the four pair wise regression equations equates to one of the graphs shown earlier in Figure 1: the first column in the table analyzes responses to Scenarios 1 & 2, the second column Scenarios 3 & 4, the third column Scenarios 2 & 3, and the fourth column Scenarios 1 & 4.

The regression results are consistent with the findings presented earlier. The negative coefficient on "voluntary payment" in the first two columns in Table 4 shows that collective payments elicit a higher WTP than voluntary ones under both the private (column 2) and government (column 1) provision scenarios, though only the coefficient in the private provision case is statistically significant. Similarly, the positive coefficient on the "private provision" variable

in the latter two columns in Table 4 shows that private provision elicits a higher WTP than government provision, though only the coefficient in the collective provision case is highly significant.

As for the demographic and socioeconomic variables, some consistent impacts are found. Households with higher incomes and respondents who are more liberal are found be to be more likely to say "yes" to the valuation question. Being female also appears to increase the probability of being willing to pay for renewable energy, but this effect is only apparent and statistically significant in two of the four regressions. Respondents with children appear less willing to pay for renewable energy, though again this effect is only significant in two of the four pair wise comparisons. Finally, though statistical significance is limited, increased age appears to reduce WTP and education appears to increase WTP; home ownership has no consistent effect.

7. A More Complex Regression Model

A more complex regression model, incorporating both the attitudinal and "participation expectation" variables listed in Table 3, is described in this section. Rather than proceeding with pair wise comparisons, here four distinct logit models are estimated, one for each of the four payment and provision scenarios. The goal is to evaluate the impacts of various socioeconomic, demographic, and attitudinal factors – including "participation expectation" – on the probability of a "yes" response to the valuation question, and to do this across different CV scenarios. Table 5 shows the results of the logit analysis in the same format as provided earlier. Visual inspection of the results leads to the following conclusions:

- **Model Accuracy Improves:** Including attitudinal variables in addition to standard socioeconomic and demographic variables increases the predictive capabilities of the regression models substantially.[4] At the same time, once attitudinal variables are included in the model, the statistical significance of the socioeconomic and demographic variables decreases. The importance of attitudinal variables in this analysis is consistent with the

[4] Data presented earlier for the more restricted model runs that only included socioeconomic and demographic variables showed that those logit models accurately predicted respondents' "yes/no" valuation responses 59-67% of the time. The more complex models presented here predict valuation responses accurately 77-85% of the time. This comparison is not perfect, however, because the more restricted model was run using pair wise comparisons, while the more complete model was run on each valuation scenario separately. We therefore also ran the logit model on each valuation scenario separately, with attitudinal variables excluded. The results show a prediction accuracy for these four runs that ranges from 59.8% to 70.7%.

results of other CV studies, which have also found that attitudinal variables often do a better job of predicting WTP response than do socioeconomic and demographic factors (Luzar and Cosse 1998, Kotchen and Reiling 2000).

- **"Participation Expectations" Effects are Substantial.** Data reported here confirm previous analysis that showed the importance of "participation expectations." Respondents who indicate they are willing to pay for renewable energy are far more likely to believe that large numbers of others will also contribute. This is true across all payment and provision scenarios, and can be seen by the statistical significance of the "participation expectation" variable in all four of the regressions presented in Table 5.
- **Several Attitudinal Variables Have Significant Effects.** Those who believe that their family and friends would also support renewable energy ("family support") are more likely to be willing to pay themselves. This result is supportive of the "participation expectations" finding discussed earlier, and suggests that the influence of near peers is separate from the more general "participation expectations" result. Similarly, those who more strongly agreed with the statement "I am more likely to buy environmentally friendly products if I know that other people are doing the same" ("affected by others") were also more likely to be willing to pay for renewable energy. A belief that government should require everyone to pay for environmental improvements ("all should pay") is positively related to willingness to pay for renewable energy, including those with collective *and* voluntary payments. Apparently, those who are willing to pay for renewable energy, regardless of the payment method, are also inclined to believe that everyone should be required to pay for environmental improvements. On the other hand, distrust of the government to effectively collect and spend funds ("government distrust") is negatively related to WTP in all four CV scenarios. Survey participants who strongly agreed with the statement "I will only pay more for environmentally friendly products if I receive a direct benefit from doing so" ("direct benefits") were less willing to pay for renewables than those who disagreed with this statement. Finally, those respondents who indicated that their household undertakes a large number of environmental actions on a regular basis (e.g., recycling, purchasing organic foods, etc.) also appear more willing to pay for renewable energy, especially in the collective payment scenarios.

8. Opinion Survey Results

As an adjunct to the CV surveys, an opinion survey was fielded to a more limited sample of U.S. residents. An important goal of this survey was to provide a measuring stick for the CV results. As shown in more detail in Wiser (2003), results of the opinion survey are found to be consistent with the CV results presented above.

In particular, the opinion survey directly asked whether survey respondents would prefer that collective or voluntary payment methods be used to support renewable energy.

> *If renewable energy is to be supported, the extra money needed to increase the supply of renewable energy could be collected in a number of ways. Of the two possible approached listed below, which one would you most prefer?*
>
> 1. *Option 1: The extra money could be raised through a required surcharge on the electricity bills of all homes and businesses in the United States.*
> 2. *Option 2: The extra money could be raised through a voluntary surcharge on the electricity bills of only those homes and businesses in the United States that volunteer to support renewable energy.*

A very narrow majority of U.S. households (53% to 47%) indicate a preference for collective payment vehicles (Table 6). As expected, those U.S. residents who show a strong affinity for renewable energy generally prefer collective payment methods, while those U.S. residents who do not believe renewable energy is a priority prefer voluntary payment.

Similarly, consistent with the CV results, a small majority of opinion survey respondents prefer private provision mechanisms to government provision (Table 7), when responding to the question below.

> *Funds used to support renewable energy could be managed in many ways. Of the two possible approaches listed below, which one would you most prefer?*
>
> 1. *Option 1: Funds from an electricity bill surcharge could be collected by the government and used to help fund the construction of more renewable energy projects*
> 2. *Option 2: Funds from an electricity bill surcharge could be collected by each customers' electricity supplier and used by private companies that sell renewable energy to build more renewable energy projects*

The opinion survey also directly asked a question related to "participation expectations":

Which one of the following statements do you most agree with:

1 *My household would be more interested in purchasing renewable energy if we knew that lots of other households were also purchasing renewable energy*

2 *My household would not be affected by the behavior of other households when deciding whether to purchase renewable energy*

3 *My household would be less interested in purchasing renewable energy if we knew that lots of other households were also purchasing renewable energy*

Opinion survey results show that 46% of respondents say they would be more interested in purchasing renewable energy if they knew that others were doing so, while just 5% say they would be less interested. Another 49% say they would be unaffected by the behavior of others. This finding suggests that people are sensitive to what others are (or are perceived to be) doing and may not contribute towards renewable energy if they are not confident that others are also contributing.

9. Conclusions

The main objective of this research has been to test the hypothesis that individuals' stated WTP for renewable energy will differ based on the way in which the good is provided and funded. We find that contingent valuation responses are somewhat sensitive to payment and provision context. Using both bivariate and multivariate analysis, we find a statistically significant difference in WTP responses in two of four pair wise comparisons. We find some evidence that elicited WTP for renewable energy is higher under a collective payment method than under a voluntary one. Similarly, we find some evidence that stated WTP under a private provision arrangement exceeds WTP under government provision. These CV findings are also consistent with a contemporaneously fielded opinion survey.

Earlier, we presented information on two plausible behavioral responses to voluntary payment vehicles in CV: free-riding or strategic response/overbidding. Consistent with Champ et al. (2002), results from this study suggest that the first effect may exert a slightly more powerful

influence on survey responses than the second, at least in the setting presented in this article. Despite theoretical concerns raised by Randall (1996), Carson et al. (1999), and others, this study finds limited evidence for the magnitude of overbidding behavior that is posited by those who are concerned that strategic behavior may be rampant in CV surveys that lack incentive compatibility. The results presented in this article show that valuation responses to CV surveys based on voluntary payments will not necessarily be overstated *relative* to the incentive-compatible collective payment approach (though, it deserves note, that they may be overstated relative to *actual* payments – see Champ and Bishop 2001). Differences between collective and voluntary stated WTP are found to be modest and, if anything, it appears as if some CV respondents may recognize the incentive to free ride and respond to non-incentive compatible CV surveys as if they involved real economic commitments. As a result, this study suggests that selection of an incentive-compatible collective payment approach or a non-incentive compatible voluntary approach *may not* be a decisive factor in CV surveys. As such, CV surveys that rely on a voluntary payment vehicle should be used with caution, but should not simply be dismissed out of hand due to theoretical concerns.

Interestingly, we also find that contingent valuation responses are strongly correlated with expectations for the willingness to pay of others. Those survey respondents who indicate a willingness to pay for renewable energy are systematically more likely to also believe that many other U.S. residents would also pay the specified premium for renewable energy. By illustrating the apparent importance of such social influences in a contingent valuation setting, this study extends a large body of other work that has explored these concepts in more detail. Nonetheless, while this correlation is strong, it does not yet prove causality: is it because others are expected to contribute that survey respondents also indicate a willingness to pay, or do respondents who say they are willing to pay simply "defend" their choice by saying that they believe others would make a similar one? The results presented here are not sufficient to truly understand the nature and magnitude of these influences. At a minimum, however, these results suggest that there is a need to include social factors in understanding choice behavior when public goods are involved, and to understand responses to contingent valuation surveys. The results also suggest that individuals may come into a valuation exercise already holding views on the likely contributions of others and that these views may affect valuation responses. Finally, results confirm the findings of Smith and Haugtvedt (1995) and Weiner and Doescher (1991), both of whom argue that concerns that others may not contribute may partially explain the gap between stated environmental attitudes and actual environmental behaviors.

The survey results presented here also provide some practical insight into the preferences of U.S. residents towards different approaches to supporting renewable energy, and the barriers to growing the voluntary green power market. The option that elicits the highest WTP in the CV survey is one in which electricity suppliers are obligated to purchase a certain amount of renewable energy: collective payment, with private provision. This policy approach is consistent with a renewables portfolio standard, a policy that has gained some popularity in recent years. Related, when asked about the participation expectations of others, respondents consistently indicated that they would expect a higher WTP under collective payment than under voluntary payment. It deserves mention, however, that the strength of these preferences (as expressed in the CV and opinion surveys) is perhaps not as high as what one might expect for a good (renewable energy) that provides public benefits. Apparently, at least in this survey setting, U.S. residents do not recognize the need for collective action for renewable energy to the degree that one might expect. Additional research is needed to further explore this finding.

Nor is voluntary support for renewable energy likely to be a panacea. First, even in a survey setting, the incentive to free-ride and not voluntarily pay for renewable energy is apparent. Second, our participation expectations results suggest the anemic 1-3% customer participation rates typical of voluntary green marketing efforts to date may, in part, be a self-fulfilling prophecy. Though the findings are still tentative, CV results show a strong positive correlation between stated WTP and the expectations for the WTP of others. As such, without a "critical mass" of participants, households may become disillusioned and choose not to participate. The findings presented here therefore suggest that the most difficult part of developing the voluntary green power market may be to develop a stable base of contributors on which further contributions can grow.

Appendix A: The Four Contingent Valuation Scenarios

Scenario 1: Collective Payment, Government Provision

The federal government is considering a program where all homes and businesses in the United States would be required to pay a $3 surcharge on their monthly electricity bills for 3 years to increase the supply of renewable energy. This surcharge will be collected by the government and used to help fund the construction of more renewable energy projects. Because the proposed surcharge is mandatory, all homes and businesses will be required to pay.

Data from the U.S. Environmental Protection Agency shows that for each household a surcharge of $3/month for 3 years will provide the same environmental benefits as not driving a car a total of 72,000

miles. Because every home and business would be required to pay this surcharge, renewable energy production in the United States would increase from 2% to 8%.

Remembering that all homes and businesses in the United States will have to pay the same amount if this policy is adopted, would your household support the adoption of this proposed monthly surcharge of $3 for 3 years (equal to $36 per year and $108 over the life of the program)?

Scenario 2: Voluntary Payment, Government Provision

The federal government is considering a program where all homes and businesses in the United States would be given the opportunity to voluntarily pay a $3 surcharge on their monthly electricity bills for 3 years to increase the supply of renewable energy. This surcharge will be collected by the government and used to help fund the construction of more renewable energy projects. Because the proposed surcharge is voluntary, many homes and businesses may decide not to pay.

Data from the U.S. Environmental Protection Agency shows that for each household a surcharge of $3/month for 3 years will provide the same environmental benefits as not driving a car a total of 72,000 miles. If every home and business were to pay this surcharge, renewable energy production in the United States would increase from 2% to 8%.

Remembering that all homes and businesses in the United States will be able to individually decide whether to contribute and that many homes and businesses may decide not to pay, would your household volunteer to pay this proposed monthly surcharge of $3 for 3 years (equal to $36 per year and $108 over the life of the program)?

Scenario 3: Voluntary Payment, Private Provision

The federal government is considering a program where all homes and businesses in the United States would be given the opportunity to voluntarily purchase their electricity from a private company that sells renewable energy. By switching to a private electricity provider and paying a $3 surcharge on their monthly electricity bills for 3 years, homes and businesses will help increase the supply of renewable energy. This surcharge will be collected by the private company and used to build more renewable energy projects. Because switching electricity providers and paying the proposed surcharge is voluntary, many homes and businesses may decide not to switch providers and not to pay.

Data from the U.S. Environmental Protection Agency shows that for each household a surcharge of $3/month for 3 years will provide the same environmental benefits as not driving a car a total of 72,000 miles. If every home and business were to pay this surcharge, renewable energy production in the United States would increase from 2% to 8%.

Remembering that all homes and businesses in the United States will be able to individually decide whether to contribute and that many homes and businesses may decide not to pay, would your household

volunteer to switch to a private electricity provider and pay this proposed monthly surcharge of $3 for 3 years (equal to $36 per year and $108 over the life of the program)?

Scenario 4: Collective Payment, Private Provision

The federal government is considering a program where all electricity suppliers (e.g., utilities) in the United States would be required to purchase some of their electricity from private companies that sell renewable energy. To meet this requirement, and to increase the supply of renewable energy, all homes and businesses in the United States would be required to pay a $3 surcharge on their monthly electricity bills for 3 years. This surcharge will be collected by each customers' electricity supplier and used by private companies that sell renewable energy to build more renewable energy projects. Because the proposed surcharge is mandatory, all homes and businesses will be required to pay.

Data from the U.S. Environmental Protection Agency shows that for each household a surcharge of $3/month for 3 years will provide the same environmental benefits as not driving a car a total of 72,000 miles. Because every home and business would be required to pay this surcharge, renewable energy production in the United States would increase from 2% to 8%.

Remembering that all homes and businesses in the United States will have to pay the same amount if this policy is adopted, would your household support the adoption of this proposed monthly surcharge of $3 for 3 years (equal to $36 per year and $108 over the life of the program)?

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References

Ajzen, I., Brown, T., Rosenthal, L. 1996. "Information Bias in Contingent Valuation: Effects of Personal Relevance, Quality of Information, and Motivational Orientation." *Journal of Environmental Economics and Management*, 30: 43.57.

Arrow, K. 1986. Comments in Cummings, Brookshire and Schulze, *Valuing Environmental Goods: An Assessment of the Contingent Valuation Method*. Totowa, New Jersey: Rowman and Allanheld.

Arrow, K., Solow, R., Portney, P., Leaner, E., Radner, R., Schuman, H. 1993. "Report of the NOAA Panel on Contingent Valuation." *Federal Register*, 58(10): 4602-4614.

Axelrod, R. 1984. *The Evolution of Cooperation*. Basic Books.

Babb, E., Sherr, B. 1975. "Pricing Public Goods: An Experiment with Two Proposed Pricing Systems." *Public Choice*, 23: 25-48.

Bateman, I., Langford, I., Turner, T., Willis, K., Garrod, G. 1995. "Elicitation and Truncation Effects In Contingent Valuation Studies." *Ecological Economics*, 12: 161-179.

Bateman, I., Willis, K. (eds). 1999. *Valuing Environmental Preferences: Theory and Practice of the Contingent Valuation Method in the US, EU, and Developing Countries*. Oxford, United Kingdom: Oxford University Press.

Bearden, W., Netemeyer, R., Teel, J. 1989. "Measurement of Consumer Susceptibility to Interpersonal Influence." *Journal of Consumer Research*, 15: 473-481.

Berrens, R., Bohara, A., Jenkins-Smith, H., Silva, C., Ganderton, P., Brookshire, D. 1998. "A Joint Investigation of Public Support and Public Values: Case of Instream Flows in New Mexico." *Ecological Economics*, 27: 189-203.

Bjornstad, D., Kahn, J. (eds). 1996. *The Contingent Valuation of Environmental Resources: Methodological Issues and Research Needs*. Cheltenham, United Kingdom: Edward Elgar.

Blamey, R. 1998. "Contingent Valuation and the Activation of Environmental Norms." *Ecological Economics*, 24: 47-72.

Bohara, A., Berrens, R., Jenkins-Smith, H., Silva, C., Brookshire, D. 1998. "Effects of Total Cost and Group-Size Information on Willingness to Pay Responses: Open Ended vs. Dichotomous Choice." *Journal of Environmental Economics and Management*, 35: 142-163.

Bohm, P. 1972. "Estimating Demand for Public Goods: An Experiment." *European Economic Review*, 3: 111-130.

Carson, R. 1997. "Contingent Valuation: Theoretical Advances and Empirical Tests Since the NOAA Panel." *American Journal of Agricultural Economics*, 79(5): 1501-1507.

Carson, R., Groves, T., Machina, M. 1999. "Incentives and Informational Properties of Preference Questions." Plenary Address: European Association of Resource and Environmental Economists. Oslo, Norway.

Champ, P., Bishop, R., Brown, T., McCollum, D. 1997. "Using Donation Mechanisms to Value Nonuse Benefits from Public Goods*." Journal of Environmental Economics and Management*, 33: 151-162.

Champ, P., Bishop, R. 2001. "Donation Payment Mechanisms and Contingent Valuation: An Empirical Survey of Hypothetical Bias." Environmental and Resource Economics, 19 (4): 383-402.

Champ, P., Flores, N., Brown, T, Chivers, J. 2002. "Contingent Valuation and Incentives." *Land Economics*, 78 (4): 591-604.

Chong, D. 1991. *Collective Action and the Civil Rights Movement*. Chicago, Ill.: University of Chicago Press.

Cornes, R., Sandler, T. 1986. *The Theory of Externalities, Public Goods, and Club Goods.* Cambridge, United Kingdom: Cambridge University Press.

Cummings, R., Harrison, G. 1994. "Was the Ohio Court Well Informed in its Assessment of the Accuracy of the Contingent Valuation Method?" *Natural Resources Journal*, 34: 1-36.

Dawes, R., McTavish, J., Shaklee, H. 1977. "Behavior, Communication, and Assumptions About Other People's Behavior in a Commons Dilemma Situation." *Journal of Personality and Social Psychology*, 35: 1-11.

Decision Research. 1992. *Summary of Green Power Research Results.* Presentation prepared for New England Power Service.

Dillman, D. 2000. *Mail and Internet Surveys: The Tailored Design Method.* Second Edition. New York, NY: John Wiley & Sons, Inc.

Elster, J. 1989. "Social Norms and Economic Theory." *Journal of Economic Perspectives*, 3 (4): 99-117.

Energy Coordinating Agency of Philadelphia (ECAP). 1998. *The Residential Market Potential for Renewables and Energy Conservation in Pennsylvania.* Philadelphia, Pennsylvania: The Energy Coordinating Agency of Philadelphia.

Farhar, B. 1999. *Willingness to Pay for Electricity from Renewable Resources: A Review of Utility Market Research.* NREL/TP-550-26148. Golden, Colorado: National Renewable Energy Laboratory.

Farhar, B., Coburn, T. 1999. *Colorado Homeowner Preferences on Energy and Environmental Policy.* NREL/TP-550-25285. Golden, Colorado: National Renewable Energy Laboratory.

Ferguson, E. 1999. *Renewable Resources and Conservation: What Consumers Want.* Portland, Oregon: Renewable Northwest Project.

Fischhoff, B., Furby, L. 1988. "Measuring Values: A Conceptual Framework for Interpreting Transactions with Special Reference to Contingent Valuation of Visibility." *Journal of Risk and Uncertainty*, 1: 147-184.

Foster, V., Bateman, I., Harley, D. 1997. "Real and Hypothetical Willingness to Pay for Environmental Preservation: A Non-Experimental Comparison." *Journal of Agricultural Economics*, 48(2): 123-138.

Freeman, A. 1986. Comments in Cummings, Brookshire and Schulze, *Valuing Environmental Goods: An Assessment of the Contingent Valuation Method*. Totowa, New Jersey: Rowman and Allanheld.

Green, D., Kahnemann, D., Kunreuther, H. 1994. "How Scope and Method of Public Funding Affect Willingness to Pay for Public Goods." *Public Opinion Quarterly*, 58(1): 49-67.

Guild, W., Lehr, R., Thomas, D. 2003. *Nebraska Public Power District Customer Meeting on Energy Alternatives: Summary of Results.* Prepared by Public Decision Partnership.

Hanemann, M. 1996. "Theory Versus Data in the Contingent Valuation Debate." Chapter 3 in Bjornstad and Kahn (eds.) *The Contingent Valuation of Environmental Resources: Methodological Issues and Research Needs*. Cheltenham, United Kingdom: Edward Elgar.

Hanemann, M., Kanninen, B. 1999. "The Statistical Analysis of Discrete-Response CV Data." Chapter 11 in Bateman and Willis (eds.) *Valuing Environmental Preferences: Theory and Practice of the Contingent Valuation Method in the US, EU, and Developing Countries*. Oxford, United Kingdom: Oxford University Press.

Harris, C., Brown, G. 1992. "Gain, Loss and Personal Responsibility: The Role of Motivation in Resource Valuation Decision-Making." *Ecological Economics*, 5:73-92.

Harris, C., Driver, B., McLaughlin, W. 1989. "Improving the Contingent Valuation Method: A Psychological Perspective*." Journal of Environmental Economics and Management*, 17: 213-229.

Hausman, J.A (ed.). 1993. *Contingent Valuation: A Critical Assessment*. Amsterdam, Netherlands: North-Holland.

Hoehn, J., Randall, A. 1987. "A Satisfactory Benefit Cost Indicator from Contingent Valuation." *Journal of Environmental Economics and Management*, 14: 226-247.

Hong, C., Konrad, K. 1998. "Bandwagon Effects and Two-Party Majority Voting." *Journal of Risk and Uncertainty*, 16 (2): 165-172.

Jakobsson, K., Dragun, A. 1996. *Contingent Valuation and Endangered Species. Methodological Issues and Applications.* UK: Edward Elgar Publishing Company.

Kahnemann, D. 1986. Comments in Cummings, Brookshire and Schulze, *Valuing Environmental Goods: An Assessment of the Contingent Valuation Method*. Totowa, New Jersey: Rowman and Allanheld.

Kotchen, M., Reiling, S. 2000. "Environmental Attitudes, Motivations, and Contingent Valuation of Nonuse Values: A Case Study Involving Endangered Species. *Ecological Economics*, 32: 93-107.

LaTourm S., Manrai, A. 1989. "Interactive Impact of Informational and Normative Influence on Donations." *Journal of Marketing Research,* 26: 327-335.

Ledyard, J. 1995. "Public Goods: A Survey of Experimental Research." In J. Kagel and A. Roth, eds., *Handbook of Experimental Economics*. Princeton, NJ: Princeton University Press.

Lichbach, M. 1996. *The Cooperator's Dilemma.* Ann Arbor, Michigan: The University of Michigan Press.

Lutzenhiser, L. 1993. "Social and Behavioral Aspects of Energy Use*." Annual Review of Energy and the Environment*, 18: 247-289.

Luzar, E., Cosse, K. 1998. "Willingness to Pay or Intention to Pay: The Attitude-Behavior Relationship in Contingent Valuation." *Journal of Socio-Economics*, 27(3): 527-444.

Macy, M. 1991. "Chains of Cooperation: Threshold Effects in Collective Action." *American Sociological Review*, 56 (6): 730-747.

Manzo, L., Weinstein, N. 1987. "Behavioral Commitment to Environmental Protection: A Study of Active and Nonactive Members of the Sierra Club." *Environment and Behavior*, 19 (6): 673-694.

Marwell, G., Oliver, P., Prahl, R. 1988. "Social Networks and Collective Action: A Theory of Critical Mass. III." *American Journal of Sociology*, 94 (3)" 502-534.

Milon, J. 1989. "Contingent Valuation Experiments for Strategic Behavior." *Journal of Environmental Economics and Management*, 17: 293-308.

Mitchell, R., Carson, R. 1989. *Using Surveys to Value Public Goods: The Contingent Valuation Method.* Washington, D.C.: Resources for the Future.

Moore, G. 1991. *Crossing the Chasm: Marketing and Selling High-Tech Products to Mainstream Customers*. New York, NY: HarperBusiness.

Oliver, P. 1993. "Formal Models of Collective Action." *Annual Review of Sociology*, 19: 271-300.

Orbell, J., Dawes, R. 1991. "A 'Cognitive Miser' Theory of Cooperators' Advantage." *American Political Science Review*, 85 (2): 515-528.

Osterhus, T. 1997. "Pro-Social Consumer Influence Strategies: When and How do They Work?" *Journal of Marketing*, 61: 16-29.

Pieters, R., Bijmolt, T., Raaij, F., Kruijk, M. 1998. "Consumers' Attributions of Proenvironmental Behavior, Motivation, and Ability to Self and Others." *Journal of and Management*, 23: 78-90.

Randall, A. 1996. "Calibration of CV Responses: Discussion." Chapter 11 in Bjornstad and Kahn (eds.) *The Contingent Valuation of Environmental Resources: Methodological Issues and Research Needs*. Cheltenham, United Kingdom: Edward Elgar.

Rogers, E. 1962. *Diffusion of Innovations*. New York, NY: The Free Press.

Samuelson, P. 1954. "The Pure Theory of Public Expenditure." *Review of Economics and Statistics*, 36: 386-389.

Schkade, D., Payne, J. 1994. "How People Respond to Contingent Valuation Questions: A Verbal Protocol Analysis of Willingness to Pay for an Environmental Regulation." *Journal of Environmental Economics and Management*, 26: 88-109.

Shechter, M, Reiser, B., Zaitsev, N. 1998. "Measuring Passive Use Values: Pledges, Donations and CV Responses in Connection with an Important Natural Resource. *Environmental and Resource Economics,* 12: 457-478.

Sloan, M., Taddune, G. 1999. "What Texans Want from Their Electric Utility." *Proceedings: SOLAR 1999.* Portland, Maine: American solar Energy Society.

Smith, S., Haugtvedt, C. 1995. "Implications of Understanding Basic Attitude Change Processes and Attitude Structure for Enhancing Pro-Environmental Behaviors." Chapter 8 in M. Polansky and A. Mintu-Wimsatt eds. *Environmental Marketing: Strategies, Practice, Theory, Research*. New York, New York: The Hawthorn Press.

Stevens, T., Echeverria, J., Glass, R., Hagar, T., More, T. 1991. "Measuring the Existence Value of Wildlife: What Do CVM Estimates Really Show?" *Land Economics*, 67(4): 390-400.

Sugden, R. 1984. "Reciprocity: The Supply of Public Goods Through Voluntary Contributions." *The Economic Journal*, 94 (376): 772-787.

Taylor, L. 1998. "Incentive Compatible Referenda and the Valuation of Environmental Goods." *Agricultural and Resource Economics Review*, October, 132-139.

Vadnjal, D., O'Connor, M. 1994. "What is the Value of Rangitoto Island?" *Environmental Values*, 3: 369-380.

Weiner, J., Doescher, T. 1991. "A Framework for Promoting Cooperation." *Journal of Marketing*, 55: 38-47.

Wiser, R. 2003. *Using Contingent Valuation to Explore Willingness to Pay for Renewable Energy: A Comparison of Collective and Voluntary Payment Vehicles*. LBNL-53239. Berkeley, California: Lawrence Berkeley National Laboratory.

Table 1. Four Contingent Valuation Scenarios

Degree of Gov't Involvement	*Voluntary or Collective Payment*	
	SCENARIO 2 Voluntary Payment, Government Provision	SCENARIO 1 Collective Payment, Government Provision *(consistent with a system benefits charge)*
	SCENARIO 3 Voluntary Payment, Private Provision *(consistent with competitive green power marketing)*	SCENARIO 4 Collective Payment, Private Provision *(consistent with a renewables portfolio standard)*

Table 2. Expectations of the WTP of Others by Scenario and Bid

CV Scenario	Response to Valuation Question	Bid Amount		
		50¢ /month	$3/month	$8/month
Scenario 1: Collective Payment, Government Provision	Yes	62.1%	50.6%	49.5%
	No	37.9%	23.5%	30.7%
	Overall	52.9%	37.4%	38.7%
Scenario 2: Voluntary Payment, Government Provision	Yes	49.3%	42.9%	36.3%
	No	31.7%	23.2%	23.4%
	Overall	41.5%	32.8%	29.2%
Scenario 3: Voluntary Payment, Private Provision	Yes	49.5%	37.1%	39.8%
	No	28.4%	22.2%	25.4%
	Overall	40.7%	31.0%	31.9%
Scenario 4: Collective Payment, Private Provision	Yes	59.1%	50.3%	46.8%
	No	29.6%	28.3%	26.9%
	Overall	52.4%	42.0%	36.6%

Table 3. Model Variables

Variable	Description
Bid	$0.5, $3, or $8 depending on survey version
Payment and Provision Dummy Variables	
Voluntary Payment	1 if voluntary payment; 0 if collective payment
Private Provision	1 if private provision; 0 if government provision
Demographic and Socioeconomic Variables	
Rent	1 if rent; 0 if home ownership
Age	1-7 age scale
Female	1 if female; 0 if male
Children	1 if have children; 0 otherwise
Liberalism	1-5 scale; 1=very conservative, 5=very liberal
Education	1-8 education scale
Income	1-12 household income scale
Attitudinal Questions: 1-5 agreement scales; 1=strongly disagree, 5=strongly agree	
First Mover	"I am often one of the first people I know to try new products"
Little One Can Do	"There is not much that any one individual can do about the environment"
Affected by Others	"I am more likely to buy environmentally friendly products if I know that other people are doing the same"
Company Distrust	"I don't trust the environmental claims of companies offering environmentally friendly products"
Distrust of Others	"I don't trust other people to make personal sacrifices to protect the environment"
No Regulations	"Now that companies are offering environmentally friendly products, we don't need as many environmental regulations"
Government Distrust	"The government can't be trusted to collect funds and spend them on worthwhile causes"
All Should Pay	"The government should require everyone to help pay for environmental improvements"
Direct Benefits	"I will only pay more for environmentally friendly products if I receive a direct benefit from doing so"
Family Support	"I think my family and friends would support renewable energy if they had the option"
Other Questions	
Participation Expectations	1-10 scale on perceived likelihood that others would be willing to pay
Environmental Actions	Number of environmental actions done by household on regular basis from list of 11 possibilities

Table 4. Logit Equations for Pair Wise Comparisons

Variable	Collective vs. Voluntary Payment		Government vs. Private Provision	
	Government Provision *coefficient* *(s.e.)*	Private Provision *coefficient* *(s.e.)*	Voluntary Payment *coefficient* *(s.e.)*	Collective Payment *coefficient* *(s.e.)*
Bid	-0.097***	-0.147***	-0.091***	-0.149***
	(-0.025)	(0.027)	(0.026)	(0.026)
Rent	-0.204	0.261	0.086	-0.098
	(0.223)	(0.249)	(0.230)	(0.236)
Age	-0.081	-0.097	-0.097	-0.093
	(0.063)	(0.063)	(0.061)	(0.064)
Female	0.448***	-0.024	-0.042	0.485***
	(0.177)	(0.178)	(0.171)	(0.186)
Children	0.054	-0.468**	-0.037	-0.389*
	(0.215)	(0.221)	(0.209)	(0.224)
Liberalism	0.316***	0.229***	0.303***	0.233***
	(0.084)	(0.086)	(0.083)	(0.086)
Education	0.000	0.115**	0.059	0.062
	(0.058)	(0.058)	(0.057)	(0.060)
Income	0.117***	0.089***	0.092***	0.108***
	(0.031)	(0.032)	(0.031)	(0.033)
Private Provision	na	na	0.200	0.505***
			(0.159)	(0.167)
Voluntary Payment	-0.139	-0.451***	Na	na
	(0.161)	(0.165)		
Constant	-0.819	0.226	-0.874	-0.296
	(0.575)	(0.561)	(0.553)	(0.583)
# of Observations	*682*	*698*	*694*	*686*
Log Likelihood	*-442.5*	*-429.0*	*-454.3*	*-421.2*
LR Test	*59.46*	*85.95*	*52.10*	*86.06*
p-value	*0.00*	*0.00*	*0.00*	*0.00*
% Correct Predictions	*62.3%*	*65.6%*	*59.2%*	*66.6%*

*, **, *** denote significance at the 10%, 5% and 1% level

Table 5. Logit Equations for Independent Sample Results

Variable	Treatment			
	Scenario 1: Coll/Gov't *coefficient* *(s.e.)*	Scenario 2: Vol/Gov't *coefficient* *(s.e.)*	Scenario 3: Vol/Pvt *coefficient* *(s.e.)*	Scenario 4: Coll/Pvt *coefficient* *(s.e.)*
Bid	-0.17***	-0.03	-0.08*	-0.23***
	(0.06)	(0.05)	(0.05)	(0.06)
Rent	-1.01**	-0.72*	0.31	0.33
	(0.47)	(0.39)	(0.43)	(0.49)
Age	-0.08	-0.18	-0.20*	-0.26*
	(0.13)	(0.12)	(0.12)	(0.14)
Female	0.90**	0.15	-0.20	0.52
	(0.38)	(0.33)	(0.31)	(0.44))
Children	-0.05	0.32	-0.43	-0.43
	(0.46)	(0.37)	(0.38)	(0.50)
Liberalism	-0.03	0.08	0.11	-0.29
	(0.18)	(0.16)	(0.16)	(0.19)
Education	0.03	-0.06	0.26**	-0.04
	(0.13)	(0.11)	(0.11)	(0.13)
Income	0.08	0.12**	0.06	0.10
	(0.07)	(0.06)	(0.06)	(0.08)
First Mover	0.04	0.19	0.35**	-0.14
	(0.18)	(0.15)	(0.15)	(0.17))
Little One Can Do	-0.24*	-0.04	-0.03	0.07
	(0.14)	(0.12)	(0.13)	(0.16)
Affected by Others	0.11	0.27*	0.09	0.31**
	(0.14)	(0.14)	(0.14)	(0.17)
Company Distrust	-0.25	-0.01	-0.18	-0.15
	(0.19)	(0.17)	(0.18)	(0.20)
Distrust of Others	0.22	0.14	-0.09	0.02
	(0.17)	(0.16)	(0.17))	(0.17)
No Regulations	-0.05	-0.15	0.11	-0.22
	(0.16)	(0.14)	(0.16)	(0.17)
Government Distrust	-0.43***	-0.27**	-0.10	-0.34**
	(0.15)	(0.13)	(0.13)	(0.16)
All Should Pay	0.71***	0.25**	0.27**	0.41***
	(0.14)	(0.12)	(0.12)	(0.15)
Direct Benefits	-0.01	-0.42***	-0.35***	-0.31*
	(0.15)	(0.15)	(0.14)	(0.16)
Family Support	0.62***	0.74***	0.59***	0.77***
	(0.19)	(0.19)	(0.21)	(0.22)
Participation Expectations	0.48***	0.41***	0.61***	0.56***
	(0.09)	(0.09)	(0.10)	(0.10))
Environ. Actions	0.21**	0.07	-0.05	0.29***
	(0.11)	(0.09)	(0.09)	(0.11)
Constant	-4.75***	-4.02***	-4.16**	-1.50
	(1.77)	(1.49)	(1.63)	1.89
Number of Observations	318	330	324	336
Log Likelihood	-121.0	-152.3	-152.1	-112.8
LR Test	196.4	152.6	141.77	212.5
p-value	0.00	0.0	0.00	0.00
% Correct Predictions	84.6%	78.5%	77.5%	84.9%

*, **, *** denote significance at the 10%, 5% and 1% level

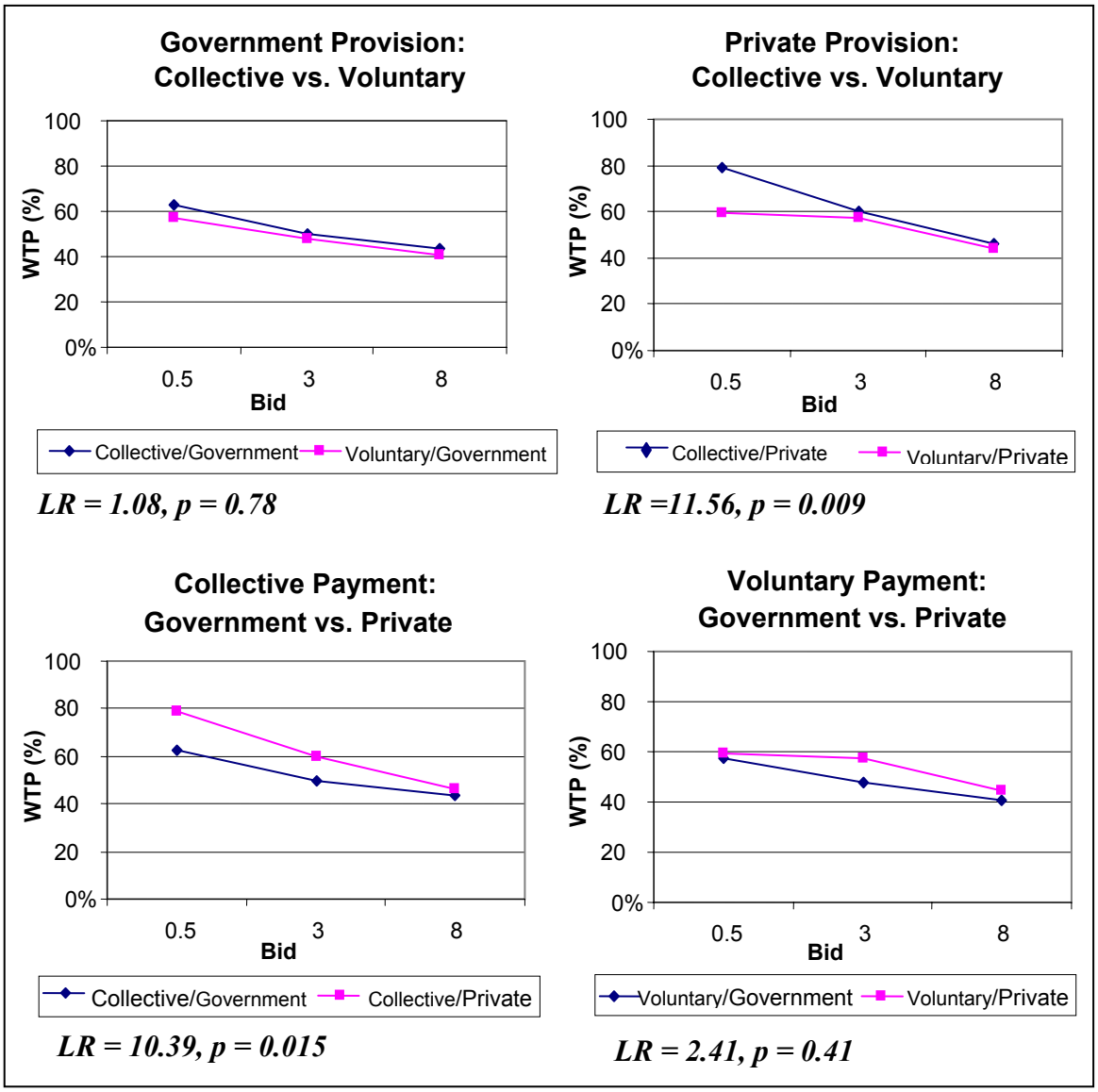
Table 6. Response to Payment Preferences Question

Payment Preference	Overall Response	Response of Those Who Indicated Support for Renewables	Response of Those Who Indicated a Lack of Support for Renewables
Required Surcharge	53%	70%	29%
Voluntary Surcharge	47%	30%	71%
Sample Size	*n=182*	*n = 106*	*n = 75*

Table 7. Response to Provision Preferences Question

Payment Preference	Overall Response	Response of Those Who Indicated Support for Renewables	Response of Those Who Indicated a Lack of Support for Renewables
Government Provision	46%	45%	47%
Private Provision	54%	55%	53%
Sample Size	*n= 179*	*n = 106*	*n = 72*

Figure 1. WTP Responses by Scenario and Bid Level


Government Provision:
Collective vs. Voluntary
100
80
60
40
20
0%
WTP (%)
0.5
3
8
Bid
Collective/Government
Voluntary/Government
LR = 1.08, p = 0.78
Private Provision:
Collective vs. Voluntary
100
80
60
40
20
0%
WTP (%)
0.5
3
8
Bid
Collective/Private
Voluntary/Private
LR =11.56, p = 0.009
Collective Payment:
Government vs. Private
100
80
60
40
20
0%
WTP (%)
0.5
3
8
Bid
Collective/Government
Collective/Private
LR = 10.39, p = 0.015
Voluntary Payment:
Government vs. Private
100
80
60
40
20
0%
WTP (%)
0.5
3
8
Bid
Voluntary/Government
Voluntary/Private
LR = 2.41, p = 0.41