17. Environmental Voluntary Contracts between Individuals and Industry: An Analysis of Consumer Preferences for Green Electricity

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1 INTRODUCTION

Stakeholders in environmental problems increasingly perceive voluntary contracts as a viable form of environmental policy and regulatory reform. These stakeholders include governments, corporations, interest groups, and individuals. Tietenberg identifies many of these voluntary agreements as a disclosure strategy for pollution control.[1] Disclosure strategies are policies that seek to increase the availability of information on pollution as a mechanism to achieve environmental goals. These strategies are based on the premise that increasing the availability of information will mitigate informational market failure, reduce transaction costs, and induce market forces to adjust toward efficient pollution control. Thus, disclosure strategies may serve as substitutes or complements for traditional regulatory approaches (such as emission standards) and incentive-based approaches (such as tradable pollution permits and emission charges).

Several governmental programs in the United States take advantage of disclosure strategies through voluntary contracts. Project XL (or "excellent leadership"), the Common Sense Initiative, and the 33/50 Program provide examples of voluntary contracts between corporations and the Environmental Protection Agency. Habitat Conservation Plans under the Endangered Species Act provide another example of voluntary contracts that may arise between individuals and the federal government.[2] In addition, several

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[1] T. Tietenberg, "Disclosure Strategies for Pollution Control" (1998) 11 *Environmental and Resource Economics* 587–602.

[2] Details on these programs are discussed by other chapters in this volume.

U.S. Department of Agriculture programs (e.g., the Conservation Reserve Program and the Environmental Quality Incentive Program) use voluntary contracts between farm producers and the government to improve environmental quality through changes in production practices. A common feature of these examples is their inclusion of the government as a party to the contract.

Environmental voluntary contracts based on the information disclosure strategy also arise directly between individuals and industry. These contracts may arise implicitly or explicitly. Market transactions between producers and consumers define an implicit contract that is increasingly used to promote "environmentally friendly" or "green" goods and services. Markets for organic produce and certified sustainable forest products are examples. In both cases, producers disclose information about the goods being produced, and consumers are generally willing to pay a price premium for the green production practices.

Individuals and industries may agree to explicit contracts to reduce the supply and demand uncertainty of implicit agreements. Markets for "green" electricity demonstrate the use of explicit contracts. Green electricity is electricity generated from renewable energy sources, including solar, wind, geothermal, and biomass energy. A large part of this market is structured through explicit contracts between electric utility companies agreeing to produce green electricity and customers agreeing to purchase green electricity at a predetermined price premium for a set period of time. The rationale for these contracts is to enable consumers to choose from generation technologies that impose lower social costs of pollution emissions.

This chapter analyzes the explicit contracts between individuals and companies for green electricity. The focus is on the question of why individuals agree to these voluntary contracts. Industry incentives are understood as attempts to market a differentiated product and retain environmentally-minded customers as deregulation of the electric utility industry in the United States opens the door for retail competition.[3] Individual incentives, however, are less well understood despite their importance to voluntary contracts for green electricity. The analysis presented in this chapter combines economic and psychological theories to explain why individuals may decide to engage in voluntary contracts for environmental improvement. These theories are then tested in an empirical study of electricity consumers in southeastern Michigan. The overall objectives are (1) to highlight green electricity as an environmental contract between individuals and industry, (2) to expand the understanding of why individuals are willing to engage in voluntary environmental contracts, and (3) to assess the potential of disclosure strategies through environmental contracts between individuals and industry.

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[3] Other sources discuss industry incentives for green electricity in detail. See, for example, R. Wiser and S. Pickle, *Selling Green Power in California: Product, Industry, and Market Trends*, Environmental Energy Technologies Division, Ernest Orlando Lawrence Berkeley National Laboratory, University of California, Berkeley, LBNL-41807, 1998.

The chapter is organized in the following manner. Section 2 describes the United States market for green electricity based on voluntary contracts. The section also includes information on the empirical setting for this study: Detroit Edison's Solar*Currents*® program. Section 3 develops a conceptual framework to explain individual behavior in environmental voluntary contracts. The framework combines insights from economic theory on the private provision of public goods and psychological theory on pro-environmental behavior. Section 4 describes the survey instrument and data collection for the empirical study of Detroit Edison's Solar*Currents*® program. Section 5 reports results for both participants and nonparticipants in the program. These results are discussed in Section 6, along with more general lessons for disclosure strategies through individual–industry environmental contracts.

2 GREEN ELECTRICITY AS AN ENVIRONMENTAL CONTRACT

Green electricity is being offered to households as a supplement to electricity generated by fossil fuels and nuclear power. Production of green electricity displaces the pollution emissions and resource degradation associated with generation from conventional fuels. Participants in programs offering green electricity agree to pay a price premium to meet part or all of their household's electricity demand with green electricity. The number of utility-sponsored green electricity programs in the United States has grown in response to marketing studies that indicate a resounding consumer preference and willingness to pay for electricity generated from renewable energy.[4] Seventy-five electric utilities have established or designated green electricity programs.[5]

The number of green electricity programs is likely to continue growing as the United States deregulates its electricity industry.[6] Recent rulings at the federal and state level have opened the door for retail competition among electricity producers. As a consequence, utilities that were once guaranteed monopoly status will be forced to compete for customers. With the advent of choice for electricity consumers, public utilities will increasingly look to sponsor green electricity programs to help secure environmentally-minded consumers. These utilities will face competition from new entrants offering green electricity in the market.

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[4] E. Holt, *Green Pricing Resource Guide* (Ed Holt & Associates, The Regulatory Assistance Project, Gardner, Maine, 1997).

[5] U.S. Department of Energy, "Summary of Green Pricing Programs" <http://www.eren.doe.gov/greenpower>, 20 June 2000.

[6] R. Wiser and S. Pickle, *Green Marketing, Renewables, and Free Riders: Increasing Consumer Demand for a Public Good*, Environmental Energy Technologies Division, Ernest Orlando Lawrence Berkeley National Laboratory, University of California, Berkeley, LBNL-40632, 1997.

Many existing green electricity programs operate with contracts between electric utilities and consumers. To participate in these green electricity programs, consumers must agree to purchase green electricity at a predetermined price premium for a set period of time.[7] Table 1 provides an overview of selected green electricity programs in the United States that operate with explicit contracts. These programs are generally organized as capacity-based or energy-based.[8] Capacity-based programs are presently limited to solar energy programs, which generate electricity either on household rooftops or at centralized facilities. Customers in these programs choose to purchase a fixed block of green electric capacity, with amounts chosen typically below customers' total electricity requirements. Monthly price premiums range from $2.50 to $6.59 per month for 100 watts of capacity. Energy-based programs require customers to choose a percentage of their total electricity consumption as green. In several of these programs, customers can choose 100 percent of their electricity as green. Price premiums in this type of program range from 0.5 to 5.0 cents per kilowatt-hour.

The empirical setting for this study is Detroit Edison's Solar*Currents*® program. Detroit Edison supplies electricity to over two million customers in southeastern Michigan. The Solar*Currents*® program commenced operation in August 1996. Solar energy is generated at two centralized facilities in the Detroit metropolitan area with a total capacity of 54.8 kilowatts. Electricity produced at these facilities is fed directly onto the company's regional power grid and displaces an equivalent amount of electricity generated by Detroit Edison's coal, oil, and nuclear power plants. Customers who enroll in the Solar*Currents*® program pay an additional average fee of $6.59 per month to lease each 100-watt block of solar electric service. A 100-watt block produces an equivalent of twelve kilowatt-hours of solar electricity per month. Customers sign a two-year contract to enroll in the program.

3 ECONOMIC AND PSYCHOLOGICAL PERSPECTIVES ON CONSUMER PREFERENCES

This section describes and, to a degree, synthesizes economic and psychological perspectives on why individuals may contract for green electricity. The economic perspective focuses on the private provision of a public good, while the psychology perspective focuses on motives for pro-environmental behavior (PEB).

Pollution reduction is a byproduct of green electricity production. For example, solar energy (ignoring the production process for solar panels)

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[7] Other programs are simply structured as voluntary contributions to help support green electricity. Programs of this type have no designated prices, and consumers make no formal commitments to the program.

[8] See B. Swezey and L. Bird, *Information Brief on Green Power Marketing*, National Renewable Energy Laboratory, NREL/TP-620-26901 (Colorado, 4th edn, 1999).

Table 1 Overview of Contracts in Selected Green Electricity Programs

State	*Utility*	*Program*	*Technology*	*Premium*	*Contract*	*Type*
CA	Sacramento Municipal	Photovoltaic Pioneers	PV	$4/month	10 years	Capacity
CO	Fort Collins Light and Power	Wind Power Pilot Program	Wind	2.5 cents/kWh	3 years	Energy
MI	Detroit Edison	SolarCurrents	PV	$6.59/100 W unit	2 years	Capacity
MI	Traverse City Light and Power	Green Rate	Wind	1.58 cents/kWh	3 years	Energy
MN	Northern States Power	Solar Advantage	PV	$36/month	5 years	Capacity
OR	Portland General Electric	Share the Wind	Wind	1.0 cent/kWh	1 year	Energy
WI	Wisconsin Public Service	SolarWise	PV	$17/month	10 years	Capacity

Notes: PV is photovoltaic. Table adapted from Holt (supra note 4) and Swezey and Bird (supra note 8).

emits no pollutants, while combustion of fossil fuels emits carbon dioxide, sulfur dioxide, nitrogen oxides, and other pollutants. The environmental conditions produced by these emissions—global warming, acid precipitation, and ground-level ozone—satisfy the non-rivalry and non-exclusivity characteristics of pure public goods. Thus, consumption of green electricity supplies an environmental public good through displacement of emissions from conventional electricity. From an economic perspective, voluntary contracts for green electricity are an example of the private provision of a public good.

Beginning with Olsen's *The Logic of Collective Action*, economists have developed theoretical models to examine different conditions for the private provision of public goods.[9] Olsen's analysis employs a rational-choice approach to demonstrate that individual members of a group may have little incentive to contribute to the collective provision of a public good. Rather than contribute, the self-interested individual may choose to free ride: to enjoy the benefits derived from the public good that is provided by others. The irony of the public goods model is that everyone in the group could be made better off if all members contributed.

More recently, this general framework has been extended to predict which individuals in the group will make contributions.[10] This inquiry gives rise to three general predictions. First, voluntary contributions depend on individual "tastes" for the public good, as well as income. Second, individuals sort into two groups: those with relatively high income or a taste for the particular public good, and those with relatively low income or little taste for the public good. The former will choose to contribute, and the latter will choose to free ride. Finally, the fraction of individuals making contributions decreases as group size increases.

While these predictions shape the economic understanding of privately provided public goods, they are rarely demonstrated empirically. Actual contributions to public goods generally exceed contribution levels predicted by rational choice models.[11] This observation underscores the sense that most real-world examples violate strict assumptions of rational egoism. Accordingly, economists are recognizing that a fuller understanding of public goods provision requires consideration of additional motives. For example, studies are now examining the role of various types of altruism in motivating individuals to contribute to public goods.[12] More generally,

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[9] M. Olsen, *The Logic of Collective Action* (Harvard University Press, 1965).

[10] See, e.g., J. Andreoni and M. McGuire, "Identifying the Free Riders: A Simple Algorithm for Determining Who Will Contribute to a Public Good" (1993) 51 *Journal of Public Economics* 447–454; J. Andreoni, "Privately Provided Public Goods in a Large Economy: The Limits of Altruism" (1988) 35 *Journal of Public Economics* 57–73; T. Bergstrom, et al., "On the Private Provision of Public Goods" (1986) 33 *Journal of Public Economics* 25–49.

[11] See J. Piliavin and H. Charng, "Altruism: A Review of Recent Theory and Research" (1990) 16 *Annual Review of Sociology* 27–65.

[12] See J. Andreoni, "Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving" (1990) 100 *The Economic Journal* 464–477; J. Palfrey and J. Prisbrey, "Anomalous Behavior in Public Goods Experiments: How Much and Why?" (1997) 87 *American Economic Review* 829–846.

Rose-Ackerman calls for "a richer conception of individual utility functions and a base in cognitive psychology that incorporates the power of ideas and emotions in motivating behavior."[13]

Rose-Ackerman's recommendation begins to describe the approach psychologists use when studying the incidence of PEB. The majority of psychological research on PEB examines the influence of attitudes, beliefs, and values. A large literature establishes attitudes as predictors of behavior and behavioral intentions.[14] Similarly, a body of research explores relationships between underlying value orientations and PEB, whereby value orientations are hypothesized to precede attitudes. Stern, Dietz, and Kalof conclude that motivations for environmental behavior are derived from a combination of egoistic, social altruistic, and biocentric value orientations.[15] Although all three value orientations are found to predict willingness to take political action, only awareness of consequences for oneself (egoism) reliably predicts intended willingness to pay for environmental protection. In a related study, Thompson and Barton find that ecocentric and anthropocentric value orientations independently contribute to explanations of apathy toward the environment, conservation behaviors, and membership in environmental organizations.[16]

Much like economists, psychologists are also beginning to utilize theory from other disciplines with the purpose of developing a more comprehensive explanation of PEB. For example, Guagnano, Stern, and Dietz test the hypothesis that interactions between psychological and socioeconomic variables affect the incidence of PEB.[17] Their model posits that attitudinal and socioeconomic factors act jointly to influence behavior. In an application to recycling, they find that socioeconomic factors affect the strength of attitude-behavior relationships, whereby attitudes are less likely to induce behavior in the presence of strong negative socioeconomic conditions. Alternatively, strong socioeconomic conditions increase the likelihood of attitudes giving rise to particular behaviors.

The application studied here takes advantage of insights from both the economic literature on private provision of public goods and the psychology literature on PEB. In this context, PEB is equivalent to the provision of an environmental public good. Attitudes toward both altruism and the environment are identified as psychological factors that could affect PEB. Combining these psychological factors with socioeconomic characteristics

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[13] S. Rose-Ackerman, "Altruism, Nonprofits, and Economic Theory" (1996) 24 *Journal of Economic Literature* 701–728.

[14] See, e.g., I. Ajzen, *Attitudes, Personality, and Behavior* (The Dorsey Press, Chicago, 1988); Ajzen and M. Fishbein, *Understanding Attitudes and Predicting Social Behavior* (Prentice Hall, Inc., New York, 1980); T. Heberlein, "Attitudes and Environmental Management" (1989) 45 *Journal of Social Issues* 37–57.

[15] P. Stern, et al., "Value Orientations, Gender and Environmental Concern" (1993) 25 *Environment and Behavior* 322–348.

[16] S. Thompson and M. Barton, "Ecocentric and Anthropocentric Attitudes Toward the Environment" (1994) 14 *Journal of Environmental Psychology* 149–157.

[17] G. Guagnano, et al., "Influences on Attitude-Behavior Relationships: A Natural Experiment with Curbside Recycling" (1995) 27 *Environment and Behavior* 699–718.

enables an economic and psychological investigation of determinants of participation in a green electricity program.

4 SURVEY INSTRUMENT AND DATA COLLECTION

Mail surveys were sent to 281 participants and 619 non-participants in the Solar*Currents*® green electricity program. The 281 participants comprise the complete population of participants in the program. The sample of 619 non-participants was randomly selected from 80,000 Detroit Edison customers who were solicited to join the Solar*Currents*® program.[18] Mailing addresses for participants and non-participants were provided by Detroit Edison. The survey was administered in 1998 using the Dillman Total Design Method.[19] Two participant and 70 non-participant surveys could not be delivered due to incorrect addresses; 263 and 361 surveys were completed and returned for participants and non-participants, respectively. Response rates were 95 percent for participants, 67 percent for non-participants, and 76 percent overall.

Participants and non-participants in the program received different versions of the survey instrument.[20] Versions differed only in one section, where respondents were asked about their personal motivations for enrolling or not enrolling in the program. An additional set of questions for participants focused attention on their environmental reasons for enrollment. Drafts of the surveys were pre-tested in two separate focus groups. The survey instrument was modified to increase clarity based on focus group input.

The final survey instrument consisted of 43 and 37 questions for the participant and non-participant versions, respectively. All respondents completed two scales: a ten-item modified New Ecological Paradigm (NEP) scale[21] and a newly developed, nine-item Altruism scale. A five-point Likert response scale was used for each item in the NEP and Altruism scales. The NEP scale, along with its original predecessor, has been used and examined by social scientists for over two decades.[22] Previous research in the area provides a basis for hypothesis testing and a framework for interpretation.

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[18] Detroit Edison selected the 80,000 solicited customers from a random sample of households meeting minimum credit history qualifications. Solicitations were based on informational inserts in monthly statements.

[19] D. Dillman, *Mail and Telephone Surveys* (Wiley and Sons, New York, 1978).

[20] Copies of the survey instruments are available upon request from the authors.

[21] R. Dunlap, et al., "Measuring Endorsement of an Ecological Worldview: A Revised NEP Scale" (1992). Paper presented at the 1992 Meeting of the Rural Sociological Society, State College, Pennsylvania.

[22] For the original version, see R. Dunlap and K. Van Liere, "The New Environmental Paradigm: A Proposed Measuring Instrument and Preliminary Results" (1978) 9 *Journal of Environmental Education* 10–19. A recent application is found in P. Stern, et al., "The New Ecological Paradigm Scale in Social-Psychological Context" (1995) 27 *Environment and Behavior* 723–743.

In the context of analyzing contracts for green electricity, the NEP scale provides a method for measuring attitudes toward the environment.

The Altruism scale developed for this research applies the Schwartz norm-activation model to measure altruistic beliefs.[23] According to the Schwartz model, altruistic behavior arises from personal norms if two criteria are met: an individual must be aware that particular actions or inactions have negative consequences for the welfare of others (Awareness of Consequences, or AC) and an individual must ascribe responsibility for those actions and their consequences to himself or herself (Ascription of Responsibility, or AR). The presence of AC and AR in a specific situation enables personal norms to motivate behavior. Without the concurrent presence of AC, AR, and a relevant personal norm, altruistic behavior is unlikely to occur. Our research operationalizes the Schwartz model in the form of a general Altruism scale. The scale contains a total of nine items that test for the presence of individual personal norms, AC, and AR.[24]

In addition to the NEP and Altruism scales, survey questions collected data on the respondents' socioeconomic and demographic characteristics. Variables were formed from these data for the statistical analysis.

5 EMPIRICAL RESULTS

The empirical analysis considers: (1) the factors that affect participation in the Solar*Currents*® program and (2) participants' motives for enrolling in the program. Several variables are considered as possible determinants of participation, including psychological factors and socioeconomic and demographic characteristics. For attitudinal variables, *NEP* and *ALT* represent summed responses to the NEP and Altruism scales, respectively. *NEP* responses are bounded between a high of 50 and a low of 10. Higher summated responses indicate stronger pro-environmental attitudes. *ALT* responses are bounded between a high of 45 and a low of 9. Similarly, higher summated responses indicate stronger altruistic attitudes according to the Schwartz norm-activation model. Other variables include *AGE*, *ASTHMA* (whether or not any household members have asthma or other respiratory diseases, no = 0, yes = 1), *GENDER* (female = 0, male = 1), *HOUSEHLD* (number of individuals living in the household), *INCOME* (1997 household income before taxes), and *SATISFAC* (level of general satisfaction with Detroit Edison on a five-point scale, from 1 = *very dissatisfied* to 5 = *very satisfied*).

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[23] S. Schwartz, "Elicitation of Moral Obligation and Self-Sacrificing Behavior" (1970) 15 *Journal of Personal and Social Psychology* 283–293.

[24] Specific items included in the scale and reliability results can be found in C. Clark, et al., "Internal and External Influences on Behavior: An Analysis of Participation in a Green Electricity Program" (1998) Working Paper, School of Natural Resources and Environment, University of Michigan.

Table 2 provides a comparison of means between participants and nonparticipants in the Solar*Currents*® program. Both participants and nonparticipants appear to demonstrate reasonably strong pro-environmental and altruistic attitudes, although summated mean responses for *NEP* and *ALT* are higher for participants. *AGE* and *ASTHMA* appear similar for participants and nonparticipants. The average age of respondents is just above 50 years, and the proportion reporting asthma or other respiratory diseases is above 20 percent. The proportion of respondents that are female is greater for participants, and the number of individuals living in the household is greater for nonparticipants. Finally, participants show greater household income and greater customer satisfaction with Detroit Edison.

Statistical comparisons of means between groups are not presented due to the degree of choice-based sampling. The choice-based sampling occurs at highly disproportionate rates, with all of the participants sampled and only 619 of 80,000 non-participants sampled. Unbiased statistical comparisons of means between participants and nonparticipants require weighting observations based on the degree of disproportionate sampling. The high degree of disproportionate sampling in this case, however, renders all comparisons statistically insignificant. Thus, beyond qualitative comparisons between groups, no further insights follow from statistical comparisons of means.

Table 2 Comparison of Means between Participants and Nonparticipants in the Green Electricity Program

Variable	*Participants*	*Nonparticipants*
NEP	37.84	33.93
	(7.32)	(6.9)
ALT	35.08	31.0
	(4.55)	(5.2)
AGE	52.34	51.3
	(12.93)	(13.53)
ASTHMA (% yes)	0.22	0.24
	(0.42)	(0.43)
GENDER (% male)	0.58	0.70
	(0.49)	(0.46)
HOUSEHLD	2.53	2.94
	(1.29)	(1.48)
INCOME	79,714	66,753
	(46,651)	(42,480)
SATISFAC	4.22	4.01
	(0.89)	(0.91)

Notes: Standard deviations are given in parentheses. The number of observations for each variable ranges from 245 to 264 for participants and from 308 to 351 for nonparticipants. *NEP* = summated scale indexing environmental attitude; *ALT* = summated scale indexing altruisitic attitude; *AGE* = age of respondent; *ASTHMA* = whether any member of household suffers from respiratory ailment (0 = no; 1 = yes); *GENDER* = gender of respondent (0 = female; 1 = male); *HOUSEHLD* = number of people living in household; *INCOME* = household income ($/year); *SATISFAC* = customer satisfaction with the electric utility on a scale ranging from 1 = *very dissatisfied* to 5 = *very satisfied*.

Table 3 Logit Regression Results of Green Electricity Participation Decision

Variable	*Coefficient*	*Standard Error*
Constant[a]	−5.517***	1.168
NEP	0.041**	0.018
ALT	0.152***	0.025
AGE	0.009	0.009
ASTHMA	−0.075	0.244
GENDER	−0.360*	0.220
HOUSEHLD	−0.253***	0.085
INCOME	4.90*E* − 06***	2.325*E* − 06
SATISFAC	0.298***	0.117
N	509	
% correct predictions	71.32	
Log Likelihood	−290.23	
Nagelkerke R^2	0.28	

Notes: *, **, ***, indicate significance at the 0.1, 0.05, and 0.01 levels, respectively. [a]The constant term is corrected for choice-based sampling. The method is discussed on pages 90–91 in Maddala (supra note 25). Variables are defined in the text and the notes to Table 2.

The decision of whether or not to enroll in the Solar*Currents*® program is evaluated with a multivariate, logit regression model. The logit model has the advantage of readily handling choice-based sampling. Maddala shows that the logit model with choice-based sampling still produces consistent coefficients, except for the constant term, which is easily corrected.[25] All attitudinal, socioeconomic, and demographic variables are included in the model (see Table 3). Both attitudinal variables are statistically significant in the expected direction. The positive signs on *NEP* and *ALT* indicate that stronger pro-environmental and altruistic attitudes lead to higher probabilities of participating in the green electricity program. The coefficients for *AGE* and *ASTHMA* are not significantly different from zero, indicating that neither affects the probability of participation. The negative significance of *GENDER* and *HOUSEHLD* indicate that males and larger households are less likely to participate. Finally, respondents with greater *INCOME* are significantly more likely to participate, as are those with greater customer satisfaction (*SATISFAC*). The percentage of correct predictions from the model is approximately 71 percent and the Nagelkerke *R* squared is 0.28.

In general, these results indicate the importance of both economic and psychological perspectives for explaining individuals' participation in a voluntary green electricity program. In particular, the finding that *INCOME*, *NEP*, and *ALT* influence the decision is consistent with predictions from the

[25] G. Maddala, *Limited Dependent and Qualitative Variables in Econometrics* (Cambridge University Press, 1983).

Table 4 General Reasons for Green Electricity Participation

Reason	*Percent "Yes"*	*Standard Deviation*
My support of Solar*Currents*® may help lower the costs of solar energy in the future	76	43
Solar Energy is more environmentally sound than other ways of producing electricity	92	27
I like to encourage development of new technology	65	48
Supporting Solar*Currents*® is personally satisfying independently of the program's impacts	30	46
Solar energy helps reduce our reliance on imported oil	68	47

Notes: Percent "Yes" corresponds to the percent of respondents indicating that the reason was a motivating factor in the participation decision. The number of observations included is 262 participants.

economic model of private provision of a public good and the psychological model of PEB.

Motivations for participation are probed further with questions geared only to participants. Initially, participants were asked to indicate which of five general reasons motivated them to enroll in the green electricity program. Table 4 reports the percentage of "yes" responses for each general reason. Over 90 percent of the participants responded "yes" to the reason that solar energy is an environmentally sound way to generate electricity. Another relevant reason is that participants believe their support of the program will reduce the costs of solar energy in the future, as 76 percent responded "yes" to this reason. Over 65 percent also indicated the importance of encouraging new technology and reducing reliance on imported oil. The idea that participants find the program personally satisfying independent of its impact was less relevant, with only 30 percent responding "yes".

Environmental reasons were then investigated in more depth with a ranking question. Participants were asked to rank five environmental reasons, in order of importance, for their participation in the green electricity program. The reasons are designed to reflect: benefits to Michigan residents (*MICHRES*); specific beliefs about ecosystem health (*ECOHLTH*); warm-glow satisfaction (*WARMGLOW*);[26] personal and family health (*OURHLTH*); and global warming (*GLOBWARM*). More generally, these

[26] Warm-glow is the term economists have given to forms of altruism whereby people gain satisfaction from the actual process of giving rather than from tangible consequences of their giving. See, for example, Andreoni, supra note 12; Palfrey and Prisbrey, supra note 12; D. Kahneman and J. Knetsch, "Valuing Public Goods: The Purchase of Moral Satisfaction" (1992) 22 J Envtl Econ & Mgmt 57–70.

statements are designed to elicit responses that reflect biocentrism, altruism, egoism, altruism/biocentrism, and warm-glow altruism, respectively. Respondents began by completing a 5-point Likert scale for each individual motivation. Then, the relative importance of these items was determined by asking participants to rank these motivations in order of importance.

Table 5 reports mean ranks and percentile distributions of these five specific environmental motivations. Beliefs about ecosystem health have the highest mean rank, followed respectively by beliefs about benefits to southeastern Michigan residents; personal and family health; global warming; and warm-glow altruism.[27] Improving ecosystem health is ranked as the top motivation 39 percent of the time; motivations based on warm-glow

Table 5 Percentage Distributions and Relative Rankings of Environmental Motivations for Green Electricity Participation

Motivation	*Mean Rank**	*Percentage for Each Rank*				
		1	*2*	*3*	*4*	*5*
Reducing air pollution from electricity production will improve the health of natural ecosystems	2.08	39.4	25.9	23.5	9.6	1.6
Reducing air pollution from electricity production will benefit residents of southeastern Michigan	2.49	20.6	32.0	27.7	17.4	2.4
My health, and the health of my family, may improve because the program will improve air quality	2.85	17.9	22.6	22.6	31.0	6.0
Decreasing carbon dioxide emissions from electricity production will slow the rate of global warming	3.04	19.0	16.3	20.2	31.0	13.5
I take satisfaction in participating in this program, regardless of its environmental effects	4.51	4.0	3.2	6.1	10.9	75.7

Notes: Within a row, percentages may not sum to 100 due to rounding. Mean Rank is calculated based on 1 = most important, 2 = second most important, 3 = third most important, 4 = fourth most important, and 5 = least important. *The Friedman test, applied to mean ranks for each motivation, shows that the rankings are statistically different ($p < 0.05$). The summary ranking of reasons from most to least important is therefore a statistically valid rank ordering.

[27] Results related to the warm-glow altruism question should be interpreted with caution. Designing questions to probe this motivation is inherently difficult, as people are not accustomed to thinking in these terms. While the question used here is conceptually correct, respondents may have misinterpreted it to mean the program will actually have no effects. In subsequent research on warm-glow motivations for shade-grown coffee, the question is reworded as "purchase of this coffee gives me moral satisfaction." In that study, the importance of warm glow altruism becomes indistinguishable from egoistic and general altruistic motivations. See M. Kotchen, et al., "Green Products as Impure Public Goods: Shade Grown Coffee and Tropical Forest Conservation" (1999) Working Paper, School of Natural Resources and Environment, University of Michigan.

altruism are ranked as least important 76 percent of the time. The Friedman test, a non-parametric test that compares ranked data for three or more paired groups, is applied to all possible bivariate combinations of the five ranked reasons.[28] Mean rankings for each of the five reasons are shown to be statistically different ($p < 0.05$) for all possible pairings. Thus, the summary ranking of reasons from most to least important is statistically valid.

6 DISCUSSION

This study analyzes the household participation decision in a green electricity program as an example of a voluntary environmental contract between an individual and a corporation. A conceptual framework embedded in economics and psychology is applied to understand the characteristics of households that tend to enroll in such a program. Income, environmental attitudes, and altruistic attitudes exert a positive effect on the probability of participating in the program. These results are consistent with the economic model of private provision of a public good and the psychological model of motives for pro-environmental behavior.

Two results are interesting in the relative rankings of participants' environmental motives for program enrollment. First, altruism toward the environment (biocentricism) is generally more important than either altruism toward regional residents or health-based egoism. This may suggest that the notion in environmental economics of a natural environment's existence value is quantitatively important, at least to a subset of the population.[29] Second, local concerns about benefits for southeastern Michigan residents (ranked second) are more important than global concerns associated with the greenhouse effect (ranked fourth). The greater importance attached to a local environmental issue, as opposed to a global issue, suggests that voluntary environmental contracts may be most successful in addressing market failures associated with local public goods.

As an exchange between two private parties, green electricity is an example of a purely voluntary information disclosure strategy. The supplier of green electricity has a clear incentive to reveal information on production technologies as a means of obtaining a price premium and, in some cases, strategically improving corporate image. A subset of interested consumers demands this information and then makes a program participation decision. As a form of public policy, information disclosure strategies are labeled the "third wave" in pollution control policy, following the first wave of legal regulation and the second wave of market-based instruments.[30]

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[28] See J. Gibbons, *Nonparametric Statistics: An Introduction* (Sage Publications, Newbury Park, 1993).

[29] Existence value is roughly defined as individuals' economic value from simply knowing that a certain natural environment exists, independently of their use of that environment. See J. Krutilla, "Conservation Reconsidered" (1967) 57 *American Economic Review* 777–786.

[30] See Tietenberg, supra note 1.

From the perspective of environmental policy, can private contracts substitute for regulatory policy in the control of pollution emissions? For the case of green electricity, the answer is likely "no" on purely conceptual grounds. The economic benefits from reductions in pollution emissions from fossil-fuel-based electricity production are public goods in most cases. Relying on voluntary actions to privately provide pollution abatement would result in inefficiently low levels of abatement. While individuals do engage in voluntary contracts for green electricity, public goods theory demonstrates that actual participation will be below socially efficient levels. Voluntary environmental contracts should not be expected to function as the exclusive tool of environmental policy.

Nevertheless, voluntary environmental contracts for green electricity can complement existing regulatory policies. They provide an opportunity for individuals to express personal preferences for environmental quality and, thus, are beneficial to consumers. They provide a niche market for both existing electric utilities and new energy supply companies. These niches will be created by the introduction of retail competition on a state-by-state basis. In California, for example, several renewable power suppliers began operating after the electricity market was opened to retail competition in 1998.[31] With retail competition in effect in only a few states, yet seemingly destined to occur in every state, voluntary contracts for green electricity will continue to expand over the next decade.

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[31] The Center for Resource Solutions, a California-based nonprofit organization, established the *Green-e* program as a voluntary certification and verification program to assure that green power suppliers accurately represent their fuel mix. Suppliers that meet certain program guidelines receive the *Green-e* certification. The *Green-e* program is in effect in California and Pennsylvania.