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WP 2001-12
July 2001



Working Paper

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Supporting Public Goods with Voluntary Programs: Non-Residential Demand for Green Power

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SUPPORTING PUBLIC GOODS WITH VOLUNTARY PROGRAMS: NON-RESIDENTIAL
DEMAND FOR GREEN POWER

MEREDITH FOWLIE, RYAN WISER and DUANE CHAPMAN*

Abstract

The sale of “green power” (electricity generated using renewable energy sources such as wind, solar or geothermal power) to non-residential customers at a premium is one of several market-based approaches for supporting renewables. Why would profit-maximizing firms or budget-conscious institutions be willing to increase their own costs so as to provide environmental improvements which benefit everyone? The literature offers several possible motivations, including increasing “green” market share, public image enhancement and pre-emption of more stringent environmental regulation. This article tests the hypotheses that (1) firms and institutions purchasing green power are primarily motivated by the private benefits associated with making such a contribution; and (2) participating firms and institutions favor voluntary programs over more direct policy approaches to supporting renewables, such as taxation. Hypotheses are tested using data from a nationwide mail survey of non-residential green power customers. The results of this empirical analysis do not support either of the research hypotheses.

* Work presented here was funded by the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Power Technologies of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098, as well as by the American Wind Energy Association, the National Wind Coordinating Committee and the Energy Foundation. The authors would like to acknowledge the support and encouragement of Jack Cadogen and Tina Kaarsberg of the U.S. Department of Energy and Randy Swisher of the American Wind Energy Association.

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I. INTRODUCTION

Fossil fueled electricity generators are responsible for 72% of domestic SO₂ emissions, 33% of domestic NO_x emissions, 33% of domestic mercury and 36% of domestic CO₂ emissions in the U.S.(Bernow *et al.*, 1998; Carlin, 1997; USEPA, 1997). Emissions from electricity generation serve to exacerbate the prevalence of asthma and respiratory disease, regional haze and smog, acid-rain related damage and global climate change. If a GWh of electricity is generated using renewable technologies, (such as wind turbines or photovoltaic cells) instead of Eastern coal, it is estimated that 1.7 tons of SO₂, 3 tons of NO_x and 1000 tons of CO₂ emissions can be avoided.¹ Changes in the fuel mix used to generate electricity have historically been among the most significant variables accounting for shifting emission trends (Schipper *et al.*, 1996).

Although the environmental benefits associated with renewable generation technologies are widely recognized, fossil fueled generation has always dominated the fuel mix. The contribution of non-hydro renewable generation (including solar, wind, geothermal and various forms of biomass) accounted for a mere 2.2% of the overall fuel mix in 1999 (EIA, 1999).

Generating electricity using renewable technologies has historically been, and continues to be, more expensive than fossil fuel alternatives. Although the costs per kWh for most renewable technologies have declined dramatically since 1975, costs of conventional

¹ These values are derived from Oak Ridge National Laboratory (1994) *The Impact of Environmental Externality Requirements on Renewable Energy*. Estimates are likely technology and location specific and are best interpreted as indicative of relative damages.

generation have also declined such that renewable technologies continue to be more costly (Burtaw *et al.*, 1999). Higher renewable generation costs and a failure to internalize the external environmental costs associated with fossil fueled generation result in a significant competitive market disadvantage for renewable technologies.

Over the past 25 years, several public policies have been introduced to support the development of renewable energy. The sale of “green power” (electricity generated using renewable technologies) to retail customers at a premium is one of several market-based policy approaches being pursued currently. Traditionally, utilities and green power marketers have targeted residential customers. More recently, however, increased attention has focused on non-residential demand for green power.

There are a number of reasons why a non-residential customer might decide to purchase a premium green energy product. Voluntary participation in environmental programs can (1) enhance the appeal of one’s company or institution to “green” consumers; (2) pre-empt future environmental regulation and (3) relieve an institution of other, more stringent, regulatory obligations (Videras and Alberini, 2000). Here, we include these factors in our analysis. In addition, we consider: (4) improving efficiency (Porter and van der Linde, 1995), (5) public image enhancement (Konar and Cohen, 1997, Cormier and Magnan, 1999, Khanna *et al.*, 1998); (6) employee morale improvement (Smith 1994); and (7) a more philanthropic desire to increase the amount of a public good or service provided to society as a whole.

The principal objective of this research is to evaluate the relative importance of several different motivating factors in influencing institutional participation in a voluntary environmental program. Given the growing popularity of voluntary approaches to environmental regulation in the United States, there has been surprisingly little empirical research done that evaluates what is

behind the successes and failures of specific programs. Several authors have endeavored to determine what characteristics differentiate those who participate from those who do not (Arora and Cason, 1996; Kalweit and Peterson, 1999; Videras and Albernini, 2000; Welch *et al.*, 2000). This study takes a different approach, focusing exclusively on those organizations that have volunteered to purchase green power and asking why. A better understanding of what motivates different types of firms and organizations to participate can shed light on the future potentials and limitations of non-residential green power markets specifically, and voluntary environmental programs in general.

A second objective of this work is to investigate the policy preferences of program participants. This study evaluates the hypothesis that participating firms will favor voluntary programs over more direct policy approaches to support renewables such as taxation, as these approaches offer private benefits.

Hypotheses are tested using data from a nationwide mail survey that explored the motivations, experiences and policy preferences of those businesses' non-profit and public sector customers that have voluntarily opted to pay a premium for green power. Our empirical evidence indicates that (1) public value oriented motivations play a more significant role than private value motivations in driving green power purchasing decisions; and (2) the majority of customers surveyed prefers mandatory approaches to supporting renewables.

II. GREEN POWER MARKETING IN CONTEXT: ELECTRICITY INDUSTRY RESTRUCTURING

Green pricing programs, or programs that offer ratepayers the ability to make voluntary payments in support of renewables, were introduced in 1993 when utilities first detected a willingness to pay for renewables among electricity consumers. Utilities hoped that green pricing programs would allow them to experiment with renewable generation without exposing utility shareholders to the associated risks (Wiser *et al.* 2000). Green pricing started small, but as market restructuring plans appeared on the radar screen in many states, green marketing was increasingly seen as one of the most effective means by which competing suppliers could differentiate an otherwise homogeneous product.

The ongoing restructuring of American electricity markets presents both obstacles and opportunities for the further development of renewables. Electricity sector restructuring was welcomed by many who anticipated lower costs, increased market efficiency and improved customer service. Indeed, it has been issues of consumer choice, market structure and pricing that have dominated the restructuring dialogue, with little attention paid to environmental impacts.

On a positive note, there are at least four ways in which restructured markets could favor alternative technologies. Increased access to the transmission grid, provided that it comes at reasonable cost, could increase access for more remote renewable sources. Restructuring also brings a reallocation of environmental regulatory risk, which could induce producers to invest in renewable technologies so as to hedge the risks associated with future, more stringent

environmental policies. Third, to the extent that consumers are willing to pay a premium for electricity generated using renewable sources, retail choice will provide a means for consumers to support renewables with their own pocketbooks through the purchase of green power products. Finally, higher prices arising from market power in deregulated markets can improve the competitive position of renewables.

On a more negative note, the economics of renewable energy, particularly the high ratio of capital to variable costs, can handicap renewables in competitive wholesale markets. In anticipating the impacts of industry restructuring, renewable energy advocates feared that lower consumer prices would make it increasingly difficult for renewable technologies to compete.² Well-documented evidence from California, however, demonstrates that restructuring does not inevitably lead to falling wholesale prices. For a variety of reasons beyond the scope of this paper,³ electricity sector reform has led to significant price increases.

Although, as noted, one might think that high prices should bode well for renewables, this has not been the case in California.⁴ The increased uncertainty which prevails in restructured markets amounts to shorter investment horizons and higher discount rates, neither of which favor investment in renewable generation. Infrastructural constraints, delays in payment, corporate

² In theory, electricity industry restructuring involves a transition from a regulated monopoly (where prices are set approximately equal to average cost) to a competitive market (where competition among suppliers should theoretically drive consumer prices closer to marginal cost). The expected result is that wholesale prices will fall, which could be problematic for renewable generators trying to compete with cheaper, fossil fueled plants.

³ For a concise, well-written review of the factors contributing to California's energy woes, please see Marcus, William and J. Hamrin, "How We Got into the California Energy Crisis," Center for Resource Solutions, 2001.

⁴ In California, non-hydro renewable generation at utilities fell by 91% from 1999 to 2000 (EIA 2000. Electric Power Monthly, March 2001, Table 13: Electric Utility Net Generation from Other Energy Sources by Census Division and State).

prejudice against small generators, incomplete information, reduced government support for research and development and regulatory uncertainty are all factors which serve to further complicate the plight of the renewable generator in a restructured market.

In a new industrial environment where economic conditions do not favor renewables, the question emerges: what to do about renewable energy? In light of consistent public support of renewables, many argue that regulatory intervention in restructured markets on behalf of renewables is justified (Farhar, 1993; Rader and Norgaard, 1996). Of those 24 states where restructuring legislation had been enacted at the time of writing, many have introduced some form of renewables support.

A variety of policy options exist for supporting renewables in restructured markets. In states such as Arizona, Maine and Texas, a renewable portfolio standard (RPS) has been introduced. This approach mandates that all electricity sellers generate a stipulated and increasing percentage of the electricity they sell using renewables. To meet their requirements, sellers can either operate their own renewable generation facilities or purchase credits from other operators. Delaware, New York and Pennsylvania are among those states that have imposed a public benefit charge on all consumers. Revenues from this charge are used to support, among other things, renewables development. In states such as California and Texas, legislators have turned to “green power” as a means of financing renewables development. Green power programs give consumers the opportunity to support a greater level of investment in renewable energy technologies by volunteering to pay a premium on their electricity bills. Green power has been referred to as “. . . one of the only bright lights that emerged in response to California deregulation law” (CRS, 2001).

Although green power suppliers have traditionally focused on residential customers, sales to non-residential customers are increasingly important. In 2000, it is estimated that non-residential customers represented approximately 50% of demand for green power in California and 15-20% of demand in Pennsylvania (Wiser *et al.*, 2000; Goett *et al.*, 2000). This apparent willingness on the part of non-residential customers to pay a premium for green power is good news for suppliers. Because non-residential accounts tend to be much larger, non-residential green power contracts are often more lucrative for providers, as compared to residential purchases. Furthermore, when a high profile organization or corporation purchases green power, public awareness of the product is heightened.

This voluntary approach to supporting renewables is not entirely new. Over the past decade, non-mandatory pollution prevention programs that rely on the ability of firms to profit from voluntary environmental initiatives have increasingly been endorsed by government and adopted by regulatory agencies. Since 1991, the Environmental Protection Agency has developed more than 12 programs wherein socially desirable outcomes are facilitated through government encouragement of voluntary actions, to be undertaken by participants based on their own self-interest (McCarthy, 1995). Growing enthusiasm for voluntary approaches is associated with a concomitant increase in both theoretical and empirical analysis of these programs.

III. A REVIEW OF THE LITERATURE ON FIRM PARTICIPATION IN VOLUNTARY ENVIRONMENTAL PROGRAMS⁵

When fossil fueled generation is offset by increased use of more costly renewable generation, the environmental benefits accruing from the avoided emissions are enjoyed by everyone, regardless of whether they purchased green power. The “green” attributes associated with green power can thus be thought of as a kind of public good.

The majority of non-residential customers who have elected to purchase green power are paying a premium on their electricity costs. Assuming the decision to purchase green power is a rational one, these organizations must believe that the costs associated with purchasing green power are outweighed by the benefits. The emerging empirical and theoretical literature on what motivates firms to exceed environmental regulations has identified a number of explanations for the phenomenon of voluntary participation. In particular, attention has thus far focused on four (non-exclusive) motivations:

A. Efficiency Gains

Industrial ecology and related literature in corporate environmentalism stress that – in many instances – voluntary pollution reduction can be accompanied by higher resource productivity or improved product quality, particularly in an industrial or manufacturing context. In such circumstances, firms’ voluntary contributions to a healthier environment may be

⁵ This section is based on a literature review which appears in a previous paper: Wiser, W., M. Fowlie and E. Holt. “Public goods and private interests: understanding non-residential demand for green power,” forthcoming in *Energy Policy*.

motivated by cost minimization concerns (e.g. Lober, 1998; Monty, 1991; O'Rourke *et al.*, 1996; Porter and van der Linde, 1995; Romm, 1994 ; Walleye and Whitehead, 1994).

B. Reduced Regulatory Risk

A growing body of literature considers an organization's decision to volunteer as an attempt to pre-empt or affect the design of more stringent environmental regulation (Barrett, 1991; Henriques and Sadosky, 1996; Sergeson and Miceli, 1998; Videras and Alberini, 2000). In theory, firms voluntarily commit to environmental improvement with the underlying objective of either achieving reductions in regulatory scrutiny – possibly in an area unrelated to the voluntary activity – or influencing the scope of the regulations to provide competitive advantage to the firm. Although some researchers separate the pre-emption of future regulation and seeking relief from current regulatory obligations as two distinct motivations (Videras and Alberini, 2000), this study considers the general desire to affect regulation via voluntary action as a single concept.

C. Green Marketing

With high levels of environmental concern among consumers and an ever increasing number of green products entering the market, a third important potential motivation for voluntary environmental commitments is the desire to differentiate products based on their environmental attributes and thereby gain new customers and build the loyalty of existing ones through green marketing (Arora and Gangopadyay, 1995; Kirchhoff, 2000; Ottman and Reilly, 1997).

D. Public Image Enhancement

Closely related to green marketing considerations are more general attempts by organizations to manage the public perception of their environmental performance (Arora and Cason, 1996). While it is difficult to assign a precise monetary value to a good reputation, it is nevertheless perceived by both public and private sector organizations as being important to maintain. Perhaps the most tangible economic gains (and losses) associated with a firm's reputation have been documented by changes in capital market valuations resulting from environmental disclosures (Austin, 1998; Khanna *et al.*, 1998; Konar and Cohen 1997).

Existing literature has focused principally on some of the largest firms in the U.S. economy, and the importance of each of these four motivations is premised on the belief that corporate environmentalism will only be successful if organizations believe that they will directly benefit from the resources they devote to improved environmental performance. Because the sample considered in this study included many small firms (much smaller than those typically considered in the existing literature) two additional motivations – not previously emphasized in the existing literature – could prove significant.

E. Improved Employee Morale

Some organizations may derive value from and therefore be motivated by improving employee morale and enhancing their ability to recruit top-rated college graduates. Though relatively little emphasis has been placed on this motivation in empirical work, improving employee morale through enhanced environmental performance has been identified in case studies and surveys as possibly an important motivator (Fri, 1992; Henriques and Sadorsky, 1996; Smith, 1994).

F. Public Value

Finally, some organizations may simply be motivated by good will, driven by a benevolent desire to maintain their civic responsibility and a strong organizational commitment to the environment rather than solely by economic gain. In studies of the voluntary environmental contributions of individuals and of interest group participation more broadly, altruistic motivations are frequently mentioned as being a key motivator (e.g. Knoke, 1988; Vining *et al.*, 1992). Less attention has been paid, however, to the potential role of good will in the decision making of non-residential customers generally, and businesses in particular (Weaver, 1996). Altruism as a key motivation is dismissed by some observers of corporate environmentalism (Fri, 1992). Traditional models of firm behavior assume a profit-maximizing firm that cares little for purely altruistic investments. Despite a dearth of empirical evidence, an altruistic concern for the environment was included in this study as a potentially significant motivating factor.

Through both direct and indirect questioning, this study seeks to explore the relative importance of these motivations in the purchasing decisions of our respondents.

IV. AN ECONOMIC MODEL OF VOLUNTARY CONTRIBUTIONS TO A PUBLIC GOOD

Andreoni (1990) was one of the first to introduce a generalization of the standard public goods model that accounted for the private benefits associated with contributing to public goods. The model is similar to more conventional public goods models insofar as it is based on individual utility as a function of the consumption of private and public goods. The model differs significantly in its implication that an individual's private donation has utility and properties as a private good that are independent of its public good properties.

Building on Andreoni's work, Cornes and Sandler (1996) take a slightly different approach and cast the mixed public goods problem entirely in terms of characteristics. A consumer's preferences are represented by the continuous utility function: ⁶

$$(1) U_i [X(x_i), Y(\Sigma y), Z(y_i)],$$

where x_i is the quantity of the private good purchased by consumer i , y_i is the quantity of the public good purchased by consumer i and Σy is the total quantity of public good provided by all consumers. Consumption of a unit of the private good (x) generates one unit of characteristic X for the consumer. Consumption of the public good (y) jointly generates Y , a public characteristic, (the total quantity of which is a function of the sum of all contributions, Σy_i), and Z , a private characteristic, (the total quantity of which depends on the individual's contribution, y_i). A purchase of one unit of the public good produces α units of Y and β units of Z . α and β are

exogenously determined coefficients that reflect the simple process by which Y and Z are generated through contributing to the public good in question.

The preceding review of the literature suggests that, in the case of a firm participating in a voluntary program, a disproportionate share of the utility derived from the voluntary contribution made by the firm may be private in nature:

$$(2) \quad U_i (\alpha y_i) < U_i (\beta y_i)$$

where $U_i (\alpha y_i)$ represents the utility derived from the public benefits resulting from one's own contribution and $U_i (\beta y_i)$ represents the utility derived from the private benefits resulting from a voluntary contribution. This study tests this hypothesis using data from a survey of firms purchasing green power.

If non-residential purchasers of green power are more strongly motivated by the private benefits (such as marketing benefits and/or the pre-emption of regulation) than by the environmental benefits accruing to society as a whole, one would expect respondents to indicate a preference for voluntary approaches to supporting renewable energy. After all, these private benefits cannot be as easily captured under mandatory regulation.

In theory, a firm will prefer voluntary regulation if :

$$(3) \quad U_i (\beta y_i) > U_i (Y_{MP} - Y_{VP}),$$

where $U_i (Y_{MP} - Y_{VP})$ represents the utility derived from consumption of the additional public good provided under a mandatory regime that would not have been provided under a voluntary regime. Although this inequality is difficult to evaluate directly, a testable hypothesis

⁶ The Cornes and Sandler model is restated here using different and somewhat simplified terminology.

is simply that firms more motivated by private benefits will be more likely to prefer voluntary programs.

V. METHODOLOGY

This paper presents the results of the first large-sample mail survey of non-residential green power customers in the U.S. The target population was non-residential customers (businesses, public sector institutions and non-profit organizations) paying a premium for green power. The sample population was compiled with the cooperation of regulated utilities and competitive marketers offering green power products. The two largest competitive green marketers agreed to participate in the survey by providing customer contact information, as did five regulated utilities that were known to have the largest number of non-residential customer sign-ups.

Geographically, the sample is diverse, containing customers from the competitive markets of California and Pennsylvania and from regulated markets in Oregon, California, Wisconsin, and Colorado.

The entire sample population consists of 1,800 customers, each of whom received the mail questionnaire in the spring of 2000. A follow-up reminder and additional copy of the questionnaire were sent to non-respondents of the initial mailing. The survey instrument included questions pertaining to motivation, policy preferences, product and supplier selection criteria and market barriers. Due to the limited follow-up procedures and the sample population (business customers), a low response rate was expected. 464 completed surveys were returned.

Given the low response rate to the survey, non-response and selection biases are expected to be especially prevalent. Consequently, the extent to which survey findings can be generalized to the sample population, much less to the overall target population, is limited. The target population is small and is limited by the incipient state of the green power market. Accordingly,

it is difficult to generalize the experiences of these “early adopters” to the larger potential market for green power among non-residential customers. An additional methodological challenge is the common problem of hypothetical bias. To increase the robustness of the findings, issues pertaining to the central objectives of the study were addressed through several lines of questioning, and the consistency of the responses to these related questions was analyzed.

VI. DATA ANALYSIS AND RESULTS

A. Profiling the Respondents

Eighty-two percent of the survey respondents represent businesses. Of those businesses, 82% classified themselves as retail, with the remaining 18% falling into the “wholesale or industrial/manufacturing” category. Fourteen percent of respondents represent non-profit organizations, while the remaining 4% represent public sector organizations. When asked about organization size, 57.5% of respondents classified their institutions as “small,” with less than \$0.5M in annual revenues or budget and 31.6% classified their institution as medium-sized, with revenues or budgets between \$0.5M-\$10M. The remaining 10.9% fell into the “large” category, reporting revenues or annual budgets larger than \$10M.

Eighty percent of respondents reported annual electricity expenditures of less than the national average of \$8,226.⁷ Several respondents have sizable electricity expenditures, however, resulting in a mean annual electricity expenditure among respondents of \$88,000, well above the

⁷ Energy Information Administration Form EIA-861, “Annual Electric Utility Report, 1998.”

national average. Sixty-nine percent of respondents indicate that green power is costing them more than other available options, while 24% report it costs about the same and 6% believe it is costing them less.

Those customers reporting a discount can be divided into two groups:

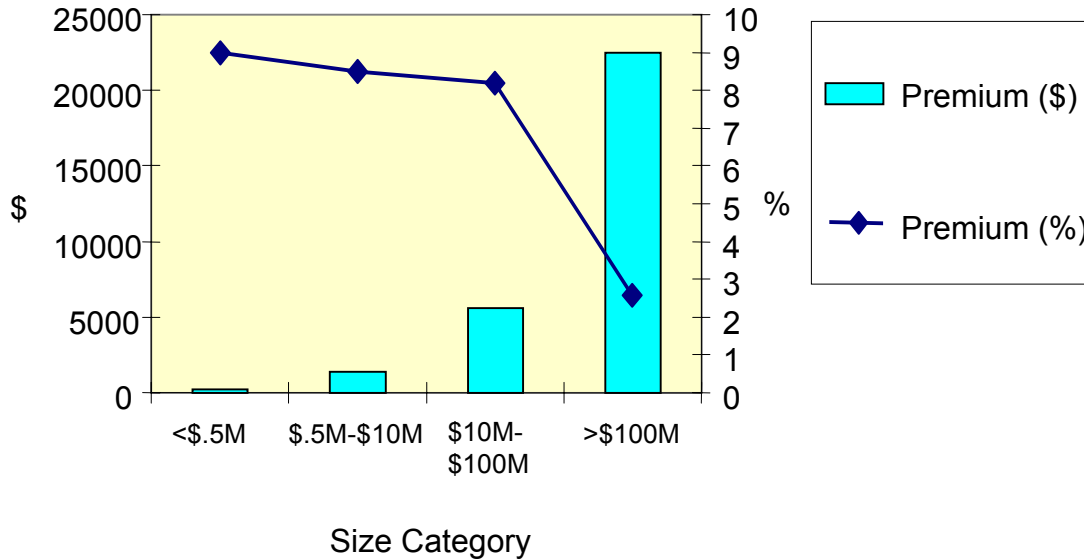
(1) Some respondents, reported receiving a discount when in fact they are paying a premium for their green power product. (Each survey was numbered to indicate the respondent's marketer or utility. In some cases, a respondent reported receiving a discount from a provider that only sold green products at a premium).

(2) Because of subsidy programs in California, some marketers have been able to offer green power products at a discount. Although efforts were made to exclude from our sample those California customers who are able to take advantage of the subsidy, it is possible that some remained in the sample.

The unweighted average reported green premium, including respondents who reported receiving a discount, is 8.4%. The average premium paid per dollar of electricity expenditures in the sample is 1.2%, weighted downward considerably by the presence of a few large firms paying small percentage premiums. Figure 1 illustrates the relationship observed between organization size and premium.

FIGURE 1

Average Annual Premium by Organization Size



B. Motivations

Survey respondents were asked to indicate the importance of several different considerations which influenced their organization’s decision to purchase green power (5-point scale; 1 = not important, 5 = very important). Table 2 presents the wording used to distinguish the possible motivations. Figure 2 presents the results. Neither efficiency gains nor a reduction of regulatory risk are ranked highly by respondents. Despite the emphasis of the literature on these motivations, it is not surprising that they are of limited importance in this context. After all, green power is typically sold as a premium product-- efficiency gains are thus not relevant. Nor

would the purchase of green power have an obvious influence on the fate of future regulatory action, particularly where small firms are concerned.

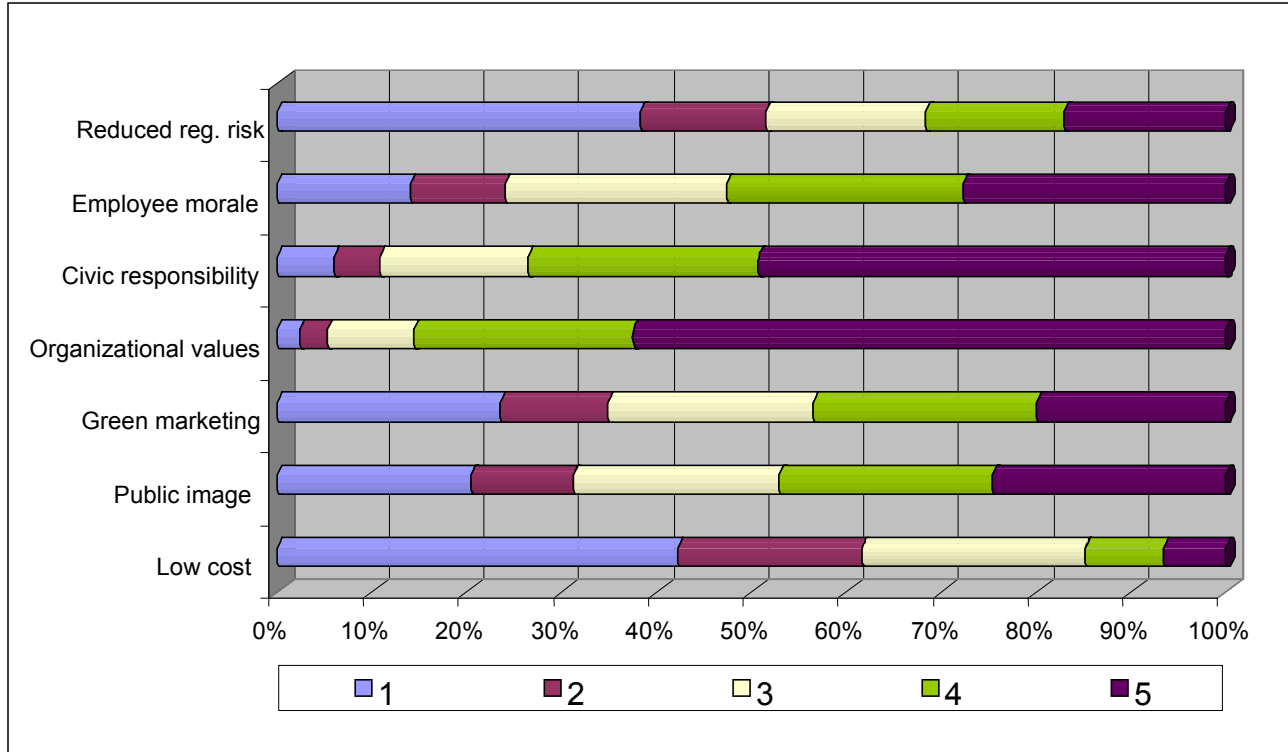
TABLE 1

Summary of Potential Motivations for Purchasing Green Power

Theoretical Motivation	Survey Description of Motivation
Efficiency Gains	<u>Lowest Cost:</u> Green power is our cheapest electricity option
Public Image Enhancement	<u>Public Image of Our Organization:</u> Maintaining a “green” public image is important to us.
Green Marketing	<u>Catering to Environmentally-Conscious Consumers:</u> It is important that we accommodate the needs and concerns of our customers, shareholders or constituents
Public Value	<u>Organizational Values:</u> Our organization feels a strong and pervasive commitment to public health and the environment.
	<u>Civic Responsibility:</u> We feel a responsibility to be community leaders, not just for the environment
Improved Employee Morale	<u>Employee Morale:</u> Employees feel more pride in an organization that is giving back to the environment.
Reduced Regulatory Risk	<u>Reduced Risk of Future Environmental Regulation:</u> Our voluntary actions in support of renewable energy reduce the need for further government intervention and regulation.

Figure 2

Ranking of Motivations for Purchasing Green Power



(1 = not important, 5 = very important)

More interesting are the remaining results which suggest that public value-oriented considerations (organizational values and civic responsibility) rank as the dominant motivations, followed by employee morale. Public image enhancement and green marketing, both viewed as potentially important motivations in the literature, are given secondary importance. These results are consistent with two recent empirical studies. In the first, only 15% of companies surveyed

“strongly agreed” that “going green” would increase customer loyalty; most did not believe that their customers care if they improve environmental performance (Kalweit and Peterson, 1999). In the second study, several large companies indicated that even if they purchased all the green power their utility had to offer, they would be unlikely to gain any public relations benefits as a result (Mayer *et al.*, 1999).

As organizations can be expected to exaggerate the importance of altruistic concerns as compared to profit-maximizing motivations, some effort was made to contrast stated motivation with reported behavior. Respondents were asked if they had engaged in or had plans to engage in any number of activities to “get the word out” about their green power purchase. These activities included (1) educating employees about green power; (2) developing point-of-sale marketing or public education material about their purchases; (3) issuing press releases about their purchases; (4) mentioning green power purchases in reports to shareholders, members or stakeholders. If non-altruistic concerns were in fact the principal motivators in purchasing decisions, one would expect that respondents would have engaged in several of these activities.

With the exception of employee outreach, little secondary marketing has taken place. Forty-eight percent indicated that they had educated employees about their green power purchases or had plans to do so. Eighty percent had no plans to do any point-of-sale marketing, 86% had no intention of issuing a press release and 82% had no plans to mention purchases in reports to stakeholders. Secondary marketing efforts were found to be significantly more prevalent among those institutions that indicated they were more motivated by image and marketing concerns. These results support the finding that in this sample more altruistic motives were a principal driver behind green power purchases, followed by employee morale.

In an effort to gain insight into the more general motivational structure underlying purchasing decisions, a factor analysis of the rankings of the several motivations evaluated was conducted using orthogonal (varimax) rotation.⁸ There appear to be two broad patterns of stated motivations to purchase green power: one encompassing more altruistic motives and a second oriented more towards private economic benefits. Consistent with a preliminary correlation analysis,⁹ results from the factor analysis confirm that motivations are organized around two relatively unique factors which together account for 45% of the variation in all variables. Table 2 lists the factor loadings, communalities and variance accounted for by each factor.

The “organizational value” and “civic responsibility” rank variables load heavily on the first factor. With the weightings so similar, the rankings of these two motivations (which range from 1-5) are summed to calculate a *public value index* score (ranging from 1-10), represented by ρ in later analysis. This variable ρ is highly correlated with factor 1 scores ($r = .97$). In theory, the observed variable ρ is a manifestation of $U_i (\alpha y_i)$, or the utility derived from the public benefits associated with the public good one has purchased.

The second factor contains only two items with high loadings, namely the public image enhancement and green marketing considerations. Because the loadings of these two criteria on the second factor are so similar, (.77 and .75), the ranks of these two criteria (ranging from 1-5 respectively) are summed to obtain a *private value index* score (with values between 1-10),

⁸ “Factor analysis” refers to a family of statistical techniques concerned with the reduction of a set of observable variables in terms of a small number of latent factors. Variables that are highly correlated with one another are grouped to form factors, which, it is hoped, will adequately summarize the original variables. The procedure has been developed primarily for analyzing relationships among a number of measurable entities (such as survey items).

represented by ϕ in later analysis. This variable ϕ is highly correlated with factor 2 scores ($r = .96$). The observed variable ϕ is, in theory, a manifestation of U_i (βy_i), or the utility derived from the private benefits associated with making a contribution of y_i to the public good.

TABLE 2
Factor Loadings and Explained Variances: Current Customers

Motivations	Factor 1	Factor 2	Communality
Lower Costs	*	*	.23
Public Image	*	.77	.63
Green Marketing	*	.75	.62
Organizational Values	.78	*	.61
Civic Responsibility	.72	*	.54
Employee Morale	.49	.41	.41
Reduced Regulatory Risk	*	*	.12
Total Variance Explained	22.6%	22.5%	45.1%

⁹ The Pearsonian correlation matrix indicates high correlation between the green marketing and public image variables ($r=0.64$) and between the civic responsibility and organizational value variables ($r=0.57$). The employee morale variable is significantly correlated with all four of these variables (with all four correlation coefficients ≥ 0.4).

Of all motivations considered, lower costs and reduced regulatory risk have the lowest communalities, indicating that they are not uniquely related to either factor. Employee morale loaded on both factors, suggesting that this variable contains both public and private value components.

If we can assume that there is a high degree of correlation between the importance an institution attributes to a particular type of motivation and the value it derives from the benefits associated with that motivation, the empirical evidence presented here does not support our first hypothesis. Recall, it was initially hypothesized that, for the average institutional decision maker, $U_i(\alpha y_i) < U_i(\beta y_i)$.

If we can treat ρ_i and ϕ_i as proxies for $U_i(\alpha y_i)$ and $U_i(\beta y_i)$ respectively, the evidence does not support this hypothesis. Survey results indicate that the majority of respondents derive more utility from the public good component of their contribution than from the private value component. Private value index scores (ϕ_i) exceed public value index scores (ρ_i) for only 10% of the sample, while $\phi_i < \rho_i$ for 65% of respondents.

Within this sample, smaller firms were less likely to stress the importance of public image and green marketing considerations than were larger firms.¹⁰ It is possible that the predominance of good will as a primary motivation behind the green purchasing decisions of this

¹⁰ Linear regression analysis of the variance in the private value index variable was carried out. Results of the analysis suggest that, *ceteris paribus*, larger institutions are more likely to be motivated by image and marketing concerns than smaller institutions. The regression coefficient for the size variable is positive and statistically significant. Other dependent variables included in the model include institution type (public sector/non-profit/for profit), customer type (utility or marketer), size of premium, environmental convictions of patrons and the extent to which the respondent believes green power purchases can be used strategically. For a more complete discussion of this analysis, see Wiser *et al.*, (2000).

customer sample can be explained, at least in part, by the small size of the majority of institutions responding to the survey. Past studies that have stressed the importance of the private benefits associated with participation in voluntary environmental programs have tended to focus on larger firms (Arora and Cason, 1996; Videras and Alberini, 2000; Welch *et al.*, 2000). It may be that good will is a much more influential motivator among small organizations that are trying to strike a balance between business and personal motives.

C. Policy Preferences

When asked about their policy preferences, the majority of green power customers responding to the survey indicated they preferred mandatory public policy measures to voluntary approaches. Table 3 presents the wording used in the survey to describe four alternative means of supporting renewable energy development. Respondents were asked to indicate on a 5-point scale the extent to which they supported the different alternatives, (1 = do not support; 5 = strongly support).

TABLE 3

Summary of Alternative Policy Approaches to Supporting Renewable Technologies

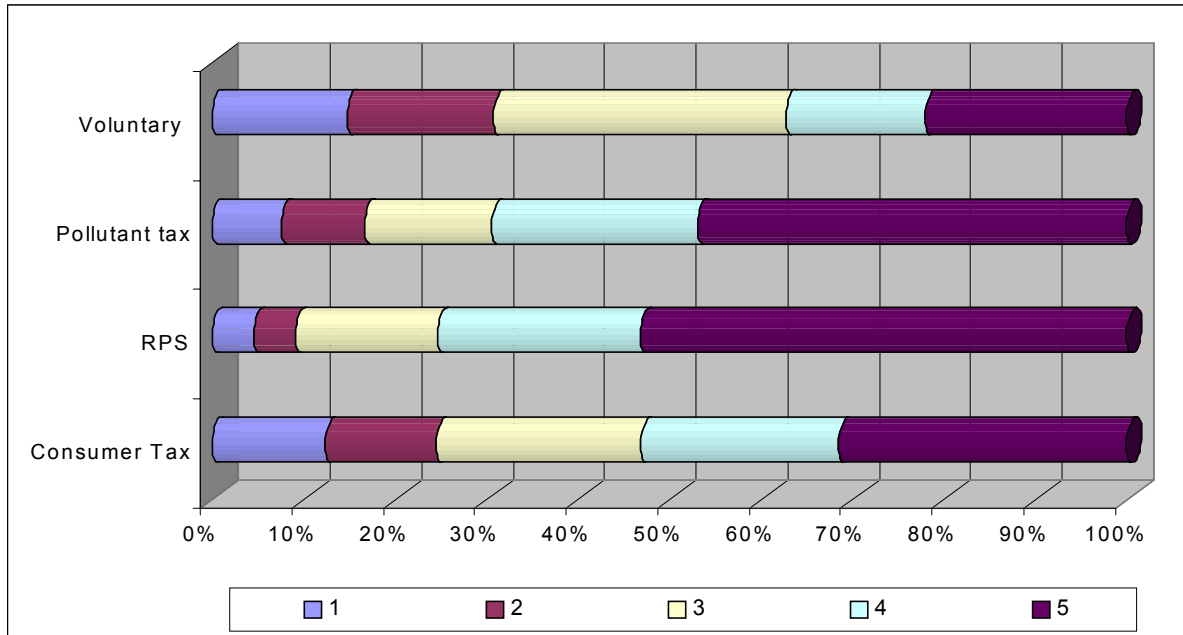
Policy Approach	Survey Description
Public Benefits Charge	“All electricity consumers should pay a little more for their electricity in order to raise funds to finance renewable energy products.”
Renewable Portfolio Standard	“All utilities and/or power suppliers should be required to include a minimum percentage of renewable energy in their supply portfolios.”
Pollutant Tax	“Pollution from electricity generation should be taxed or further regulated.”
Voluntary Programs	“Support for renewables should come from voluntary consumer choice.”

Figure 3 illustrates the findings. The portfolio standard was the most strongly supported of the options, with a mean response of 4.2, followed by a pollutant tax (3.9) and a system-benefit charge (3.5). Among respondents, a voluntary approach to supporting renewable generation is the least preferred alternative with a sample mean of 3.1.

FIGURE 3

Ranking of Policy Approaches to Supporting Renewables

(1 = do not support, 5 = strongly support)



In order to better evaluate the relationship between policy preferences and motivation, responses to the policy preference question were recoded such that respondents were placed in one of three preference categories: (1) strictly prefer voluntary programs to all mandatory regulation; (2) strictly prefer at least one mandatory approach to voluntary regulation; (3) rank voluntary and mandatory approaches equally. Only 12% of respondents indicated that they preferred voluntary approaches to all other alternatives; 61% preferred at least one regulatory

alternative to a voluntary approach; and 27% indicated that voluntary programs were their least preferred approach for supporting renewables.

As shown in Table 4, respondents were also categorized with respect to their stated motivations. Those respondents who had high public value index scores ($\rho > 8$) and low private value index scores ($\phi_i < 4$) were classified as *pure altruists*. *Impure altruists* had high scores for both the public and private value indices ($\rho_i > 8$ and $\phi_i > 7$). Respondents who had low public value index scores ($\rho_i < 4$) and high private value index scores ($\phi_i > 8$) were classified as *purely self-interested*.

TABLE 4

Stated Motivation Categories

Motivation Category	Public Value Index Score (ρ)	Private Value Index Score (ϕ)
Pure Altruist	$\rho > 8$	$\phi < 4$
Impure Altruist	$\rho > 8$	$\phi > 7$
Purely Self-Interested	$\rho < 4$	$\phi > 8$

A chi-square statistic was calculated to test the null hypothesis that there is no relationship between a respondent's policy preference category and motivation category. The cross-tabulation of these two variables is presented in Table 5. The calculated chi-square statistic for a goodness of fit test with $df=4$ is 7.01, which is not significant at the 10% level. Consequently, the null hypothesis cannot be rejected. There is no significant evidence to suggest that customers with higher private value index scores are more likely to favor voluntary regulation.

TABLE 5

Cross-Tabulation of Preference Orderings and Motivation

		Policy Preference Category			
		<i>Actual value (expected value under H_0)</i>			
Motivation Category		Prefer Mandatory	Neutral	Prefer Voluntary	Overall
	Pure Altruist	66 (59)	26 (26)	5 (11)	97 (22%)
	Impure Altruist	202 (207)	91 (91)	45 (40)	338 (76%)
	Purely Self-Interested	4 (6)	3 (2)	2 (1)	9 (2%)
	Overall	272 (61%)	120 (27%)	52 (12%)	444 (100%)

VII. CONCLUSIONS

This research investigates both the motivations and policy preferences of non-residential consumers of green power. Customer motivations appear to be organized around two relatively unique factors: one which measures the degree to which a firm's purchase is made in the public interest, and another which measures the extent to which a firm is concerned with green marketing or image enhancement. The majority of survey respondents de-emphasize public image, marketing and regulatory pre-emption concerns and stress the importance of motivations which load heavily on the "public value" factor. With the majority of respondents reporting that they have made few, if any, efforts to publicize their green power purchases, reported behavior seems consistent with stated motivations.

The findings that (1) the public value associated with increasing renewable generation capacity is a principal motivator for current non-residential green power purchases, and (2) non-residential customers are apparently receiving little material private value from their contributions suggest that voluntary approaches are limited in terms of the support they can offer renewable energy resource development.¹¹ If suppliers are unable to credibly offer private rewards along with their green power products, non-residential green power demand is likely to be limited to the extent that benevolence guides institutional decision-making.

¹¹ This implication stands in contrast to Arora and Cason (1996), who conclude that voluntary environmental initiatives may hold great promise because the largest firms with the most toxic releases are more likely to participate in a toxic reduction program.

With regards to policy preferences, a majority of survey respondents prefer mandatory regulation to voluntary approaches for supporting renewables. There is no evidence that customers more motivated by marketing and image considerations are more likely to favor voluntary programs. With only 12% preferring voluntary programs to mandatory regulation, the following appears to be true of our sample:

$$U_i(\theta y_i) \leq U_i(Y_{MP} - Y_{VP}).$$

In other words, the utility derived from the private benefits associated with purchasing green power does not exceed the utility which would have been derived from the additional renewable generation that would have been provided under mandatory regulation where everyone is obliged to contribute. This assumes that levels of public good provision would be higher under mandatory regulation. These findings can be interpreted in one of two ways. Either policy preferences are simply not a function of the private value accruing from voluntary contributions, or the private benefits reaped by survey respondents rarely reach the point at which they outweigh $U_i(Y_{MP} - Y_{VP})$.

Because the findings of this study are based on a small sample of customers, we cannot assume that the motivations and policy preferences found in this sample are typical of the entire population of non-residential customers. This work offers only preliminary support for two alternative hypotheses, namely that non-residential participation in green power purchasing is primarily motivated by benevolence, and that a majority of respondents favor mandatory regulation in support of renewables.

It is estimated that in the spring of 2000, approximately 66% of residential green power consumers resided in California (similar estimates for non-residential consumers were unavailable, but are assumed to be comparable) (Wiser *et al.*, 2000). Recent developments in the California markets have since forced most green power providers to close shop and return their

California customers to default service providers who purchase from predominantly fossil-fueled generators or large hydro sources (Green-e, 2001). Empirical evidence presented in this paper suggests that future non-residential demand for green power could be very limited. The confluence of limited demand and unstable market infrastructure suggest that the goal of increasing the share of renewables in the fuel mix is best achieved using good, old-fashioned, mandatory regulation.

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