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The *New* Economics of Solar Energy: A Case Study in Demand for Renewable Energy Certificates

Final Report – April 2005

A group project report submitted in partial satisfaction of the requirements for the degree of
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The Group Project is required of all students in the master's of Environmental Science & Management (MESM) Program. It is a four-quarter activity in which small groups of students conduct focused, interdisciplinary research on the scientific, management, and policy dimensions of a specific environmental issue. This Final Group Project Report is authored by MESM students and has been reviewed and approved by:

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Abstract

A recent entry to the world of renewable energy economics is the "renewable energy certificate" (REC). Defined as the *environmental attributes* associated with commodity electricity generated by renewable sources, RECs are a property designation for the public benefits (cleaner air and water) related to "clean" electricity production. A small amount of real-world data is available pertaining to the value of RECs used in voluntary green power and Renewable Portfolio Standard compliance markets, however, little research has been conducted to determine the public's demand for RECs unbundled from commodity electricity.

This paper estimates the public's demand for RECs through the use of an economic model and contingent valuation survey applied to a case study population in Davis, California. The results of the case study suggest there is a greater demand for RECs bundled with commodity electricity and sold as green power, than for those sold in an unbundled form. The model predicts optimal prices for 750kWh of bundled and unbundled RECs in Davis of $21.73 and $18.95 respectively. These numbers are consistent with real world REC offerings. Applying the model to California census data reveals potential areas of high demand for RECs in Contra Costa, Marin, San Mateo, Santa Clara, Ventura, and Los Angeles Counties.

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List of Acronyms

CEC	California Energy Commission
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CRS	Center for Resource Solutions
CV	Contingent Valuation
DOE	Department of Energy
NOAA	National Oceanic and Atmospheric Administration
NREL	National Renewable Energy Laboratories
PG&E	Pacific Gas and Electric
PTC	Production Tax Credit
PUMA	Public Use Microdata Area
PUMS	Public Use Microdata Sample
PURPA	Public Utility Regulatory Policies Act of 1978
PV	Photovoltaic
PVUSA	Photovoltaics for Utility Scale Applications
REC	Renewable Energy Certificate
RPS	Renewable Portfolio Standard
RV	Renewable Ventures LLC
SMUD	Sacramento Municipal Utility District
TRC	Tradable Renewable Certificates
UCD	University of California at Davis
UCSB	University of California at Santa Barbara
WTP	Willingness to Pay

Executive Summary

Problem Statement. Although the demand for renewable energy is growing, the cost of its production can be prohibitive. In particular, electricity generated using solar photovoltaic systems has significant environmental advantages over conventionally produced electricity, but its high production cost renders it unviable in standard electricity markets.

The recent creation of a voluntary secondary market based on Renewable Energy Certificates (RECs), which are the environmental attributes associated with renewable electricity generation, has shown some promise in improving the economic viability of renewable energy. Information is available pertaining to REC purchases in government and commercial markets; however, little is known about the general public demand for RECs.

This research focused on estimating the household demand for RECs, primarily for application in the solar photovoltaic electricity market. The following questions were posed:

- How can the public demand and value of Renewable Energy Certificates (RECs) be determined?
- What is the public demand for RECs, *unbundled* from and *bundled* with commodity electricity?
- What are the characteristics of likely purchasers of RECs?

Renewable Energy Certificates. In order to help recover the costs of photovoltaic electricity generation, a market has been created for RECs. The REC concept breaks renewable energy into two products: 1) the commodity electricity itself, or "brown power", and 2) the environmental attributes associated with producing that electricity from a renewable source (i.e. the REC). RECs encompass the relative benefits associated with renewable energy production, such as cleaner air and water

Currently, there are two vehicles by which RECs can be delivered. One vehicle involves a purchase through the local utility or rival energy service provider in competitive markets, as part of a green pricing program. This is referred to as a "bundled" purchase because the RECs are combined with commodity electricity. The second vehicle involves a purchase through any number of companies and organizations selling REC-only products. This is referred to as an "unbundled" purchase because the RECs are offered by themselves. Under this new market framework, renewable generators can sell RECs and commodity electricity separately.

Significance and Background. The benefits and potential for photovoltaic energy to become a significant source of power in some regions has been broadly recognized. The economics of the solar energy market are changing with the separation of the REC product from commodity electricity to make solar energy more viable. For example, a private market for RECs sold to households could reduce the need for public subsidy programs and liberate state funds for other social programs. This budding expansion of the REC consumer base from primarily government and commercial buyers to include households has created a need for different marketing strategies and understanding of public demand. It is clear that public demand does exist and is largely untapped, as national surveys show that a majority of

Americans rank solar as the number one energy source with regards to the environment, safety, expense, and security1. Recognizing and quantifying the public demand for RECs, both bundled and unbundled, is a key aspect of the new economics of solar energy.

Bundled RECs began infiltrating the market in the early 1990s through "green power" pricing programs. As of 2002, there were 90 utilities nationwide that offered such programs. This represents about 10 percent of all U.S. utilities. While the number of programs has exploded, 10 programs (11 %) are responsible for 75% of the customers. People are willing to pay a $0.50 to $50 per month premium for renewable energy in these utility green pricing programs. A comparison of current green power utility pricing programs shows that even the best programs have only 10% participation. This is well below the stated participation rates of 50 to 80 percent2, illustrating that challenges exist in accurately capturing public REC demand.

Like bundled RECs, there is also evidence that the unbundled REC market is growing. According to Green-e's 2003 audit of unbundled REC markets, the total number of megawatts hours sold in the U.S. increased twelve-fold from the previous year. The number of residential customers grew 34% during this period, but still remains less than 0.5% of the total market.

Because the two vehicles for REC sales have different logistical and marketing needs, it is important to recognize the difference in demand between the two. We estimated separate demand curves for bundled and unbundled RECs.

Approach. Our approach involved designing a model and survey to estimate the public demand for RECs. The city of Davis, California was chosen as the case study because of an existing photovoltaic electricity-generating facility located within the community, called PVUSA (Photovoltaics for Utility Scale Applications). PVUSA is operated by the group project client, Renewable Ventures, LLC.

The first step of the project was the creation of a predictive model. A logistic regression model (logit model) was developed to estimate an individual's willingness to pay for a 750 kWh REC, as a function of the following variables: product description (price, bundled or unbundled REC), demographics (gender, age, income, educational attainment), an indicator of general knowledge regarding renewable energy, an individual's dollar amount of charitable donations, and political affiliation3.

Next, a corresponding contingent valuation survey was developed based on the logit model variables and NOAA panel recommendations described in contingent valuation literature. The overall survey structure was modeled after a similar survey conducted by Wiser[3]. The NOAA recommendations provided survey development guidelines for data collection, value scenario, question type, scenario description, budget constraint, substitutes, and a follow-up

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1 Farhar, Barbara C. 1996. *Energy and the Environment: The Public View*. REPP Issue Brief, No. 3. http://www.repp.org.

2 Wiser, R. and Holt, E., 1999. *Consumer Interest in Green Power*. National Wind Coordinating Committee.

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

question. These guidelines were followed and modified as they applied to the case study. In order to separately capture the demand for bundled and unbundled RECs, two versions of the survey were created: one offered green power (bundled RECs) from the existing utility and the other offered unbundled RECs from a private company.

Once the model and survey were completed, an iterative pretesting process ensued. A preliminary survey was administered, results entered into the model, and a demand curve derived. After each pretest, the survey was revised based on the model output to more accurately capture individual valuation of RECs. After four pretests, the refined survey was administered to case study participants in Davis. The survey respondents were voluntary participants throughout the city during the November 2, 2004 elections.

A thorough analysis of the survey responses was then performed, including deriving a demand curve and calculating the REC price that would maximize revenue in Davis. These demand curves were used to develop a marketing plan targeting the characteristics of individuals most likely to buy a REC. From this information, a pilot sale of RECs via the World Wide Web was implemented. Finally, the model results were extrapolated to other populations within California to assess their likelihood to purchase RECs based on their similarities to the Davis profile. California counties with populations having high probability for REC consumption were consequently identified.

Results and Discussion. The pretests suggested that a significant amount of yea-saying occurred during survey administration, and the survey was modified to include an indicator question that would flag a potential yea-sayer and eliminate his or her survey results from the data set. Other minor modifications made before the final survey was used for the case study can be seen in the sample pre-test surveys in Appendix A.

The demographics of the Davis case study sample set included: 50% male, 50% female, a median annual income range of $40,000- $69,000, and an age range of 25 – 34 years old. This is closely resembles the demographics of the Davis population as a whole, which is 48% male, 52% female, has a median income of $42,454, and a median age of 25.2 years old

The statistically significant variables in the regression analysis (p-value < 0.1) were: the price offering of the REC, whether the REC was sold bundled or unbundled, the location of the polling station at which the survey was administered (for only two of the stations), and annual household income. The signs of the coefficients for each significant variable were consistent with marketing and REC literature research findings: lower price, higher income and a bundled REC corresponded with higher demand.

The model was run with all variables to derive separate demand curves for bundled and unbundled RECs. For each case, the price of a REC had a negative coefficient, meaning the demand curves were strictly downward sloping.

The price for a bundled REC that maximizes revenue was found to be $21.73, with 30.09% of the Davis population expected to buy at that price. The optimal price of an unbundled REC

was $18.95, with 20.17% of the population expected to buy. These prices are consistent with actual REC offerings in green power and unbundled REC markets4.

Marketing and potential markets. The unbundled REC price derived from the case study was used to develop and implement a pilot sale via the World Wide Web. Unbundled RECs were marketed despite a higher demand for bundled RECs because bundled RECs were not available for the purposes of the case study. The RECs marketed for sale were generated at the PVUSA facility and offered in cooperation with Renewable Ventures. Approximately 400 door hangers (Appendix C) were distributed throughout Davis, and the pilot sale resulted in one sale on the website within four weeks. This suggests that although a potential market exists, more time and resources are needed to implement a marketing campaign and diffuse product knowledge before market expectations are reached.

Using the parameters of the model that are also available in public census information, an additional analysis was done to identify populations with similar characteristics to the Davis population most likely to buy a REC. These parameters included REC price, bundled or unbundled, gender, age, education level, and income. From this extrapolation, Contra Costa, Marin, San Mateo, Santa Clara, Ventura, and Los Angeles counties were identified as having the largest potential REC markets in the state of California. It is therefore recommended that education of the public in these areas be a key marketing strategy for any REC producer wishing to sell RECs.

Conclusions. RECs are seen as a crucial market mechanism for increasing the economic viability of renewable energy, particular solar photovoltaic energy. Knowing the demand for RECs can help determine whether or not specific renewable energy projects are feasible.

This study addressed the issue of public demand for RECs through the formation of an economic model and contingent valuation survey that were applied as a case study in Davis, California. A unique aspect of this study involved the use of two vehicles for delivering RECs to the public: bundled and unbundled.

The findings of this study agree with the published literature on RECs, which states that persons with higher income are more likely to purchase RECs. In addition, the optimal REC prices from the estimated demand curves for this study fall within the range of actual market prices for both bundled and unbundled RECs. Contrary to our initial assessment of potentially significant variables, this study found education level, political affiliation, age, gender, amount of charitable donations, and renewable energy knowledge to be statistically insignificant indicators of public demand for RECs.

Based on results from applying the case study model to census data, we recommend REC sellers target the counties of Marin, Contra Costa, San Mateo, Alameda, Santa Clara, Los Angeles, Ventura, Orange and San Diego. Although renewable energy knowledge was found to be insignificant, based on green power marketing literature, we further recommend that educating the public about RECs, renewable energy, and their benefits be a key strategy for any REC provider.

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4 Department of Energy, 2003. www.eere.doe..gov.

Report Organization. This report is organized by first providing a background summary of solar energy, green energy markets, RECs, and contingent valuation. It then explains in detail the approach used in model development and survey design, including presentation of pretest findings and resulting survey revisions. The approach for the case study Davis survey is then explained, followed by a results section comparing sample size demographics with Davis-wide demographics. The results section also presents the modeled demand curves and optimal REC prices based on those curves. Results of the test sale and extrapolation to other California populations are presented, followed by a discussion of results. Finally, marketing recommendations and future actions are presented. In the appendices are found pretest surveys, Davis survey and raw data, the promotional piece used for the test sale and a sample Renewable Energy Certificate for 750 kWh.

Problem Statement

During the latter part of the 20th century the renewable energy sector made great strides in cost reduction and ease of deployment. For example, the cost of electricity generated by wind farms in optimum locations is competitive with the cost of electricity at some coal-fired facilities. The cost of electricity for solar photovoltaic (PV) generation has also decreased, but not to the same extent as wind. A number of state and federal subsidies have been created to encourage renewable technologies; however their widespread use has not been realized. The recent creation of a secondary market based on the environmental attributes (cleaner air and water) associated with renewable electricity generation has shown some promise in furthering the economic viability of renewable energy. These environmental attributes are embodied in an economic market construct commonly referred to as renewable energy certificates (RECs) and are created in parallel with commodity electricity at renewable generation facilities. Under this new market framework, renewable generators are beginning to sell RECs and commodity electricity separately. While there is a small amount of real-world data pertaining to the demand for RECs used in voluntary green power and RPS compliance markets, little research has been conducted to determine the public's demand for pure RECs, unbundled from commodity electricity. The data from voluntary green power markets is helpful, but does not provide the whole picture for two reasons; 1) green power is not available in all areas, and 2) it is difficult to distinguish between the "use-value" of the commodity electricity component and the non-use value of the RECs. Similarly, REC data from RPS compliance markets do not necessarily mirror public demand because they are subject to regulations and price caps.

With the potential need for "free-market environmentalism" to catalyze renewable energy proliferation, the public demand for RECs may be a key indicator in the new economics of renewable energy. In addition, it is important to be cognizant of any difference in demand being contingent upon the manner in which they are delivered. Currently, there are two vehicles by which the RECs can be delivered. One vehicle involves a purchase through the local utility or rival energy service provider in competitive markets, as part of a green pricing program. This is referred to as a "bundled" purchase because the RECs are bundled with commodity electricity. The second vehicle involves a purchase through any number of companies and organizations selling REC-only products. This is referred to as an "unbundled" purchase because the RECs are offered by themselves. This paper will attempt to answer the following questions,

- How can the demand and value of RECs be determined?
- What is the public demand for bundled and unbundled RECs?
- What are the characteristics of a likely purchaser?

The successful identification and implementation of a market mechanism, such as RECs, for increasing the economic viability of renewable energy would provide environmental benefits for the general public. Renewable energy sources have the potential to provide added social benefits because they offer more jobs per unit power than traditional energy sources (Kammen, 2004). A private market for RECs could also reduce the need for public subsidy programs and liberate state funds for other social programs. The group project study addresses the above questions through a case study in Davis, California.

Background

Renewable Energy

For the purpose of this paper, the history of the renewable energy industry will not be discussed. An in-depth account of solar and other types of renewable energy development has been written by Boyle (2004). This paper will focus on the current state of economics pertaining to renewable energy installations, particularly solar, and what is being done in the marketplace to encourage their implementation.

Over the past thirty years the renewable energy sector has made significant strides in making the various technologies more economically viable. Many attribute this to favorable regulation contained within the Public Utility Regulatory Policies Act of 1978 (PURPA). With the goal of helping to provide domestic energy security after the oil embargo of the early seventies, PURPA led to significant development of renewable energy through guaranteed, long-term power purchase agreements. The methodology for determining the price of electricity used in these contracts favored renewables and mitigated the financial risk associated with the high initial capital cost of renewable technologies. PURPA is the major reason why non-hydro renewable energy sources make up 2% of the total electricity production nationally and 10% of the electricity generated in California today (U.S. Energy Information Administration and CEC, 2004). The cost of producing electricity with renewable technologies has dramatically decreased since PURPA was enacted (Figure 1).

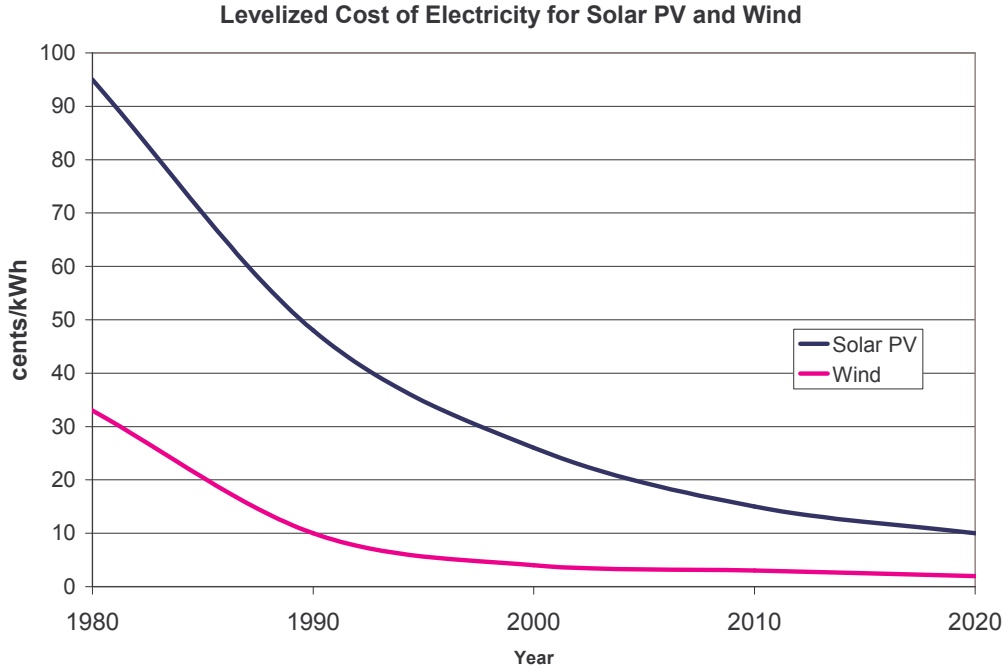

Figure 1. Levelized Cost of Electricity for solar and wind energy. (Source: U.S. DOE 2002).

In order to encourage growth in the renewable energy sector, the federal government and many states provide subsidies and tax incentives. Many of these subsidies were created specifically for solar energy, while others apply to several technologies. Opinions differ as to

why solar receives the most attention, but one major reason stems from public sentiment. National surveys suggest a majority of Americans rank solar as the number one energy source when considering the environment, safety, expense, and security (Farhar 1996). There may also be technical and historical reasons for why solar may be preferred. Traditional practice, dating from before the time of electric lighting, has led to business hours occurring almost completely within the time between sunrise and sunset. This holds true for most of the commercial, industrial, and agricultural sectors that account for almost 65% of California's total electricity consumption (CEC 2002). Because of these accepted business hours and the resulting air conditioning loads of office buildings, the peak California system load correlates closely with available incoming solar radiation. This also means the solar energy generation profile tends to match well with peak system loads. Figure 2 displays the California system-wide electricity load and the generation from a commercial-scale solar facility during a typical summer week in 2004. The slight lag between the daily system load peak and solar PV generation peak is associated with the time required for absorbed solar radiation to transfer as heat through the walls of buildings. Historical market data shows that the highest wholesale prices for electricity occur at midday during the summer months when the system load most closely approaches the total available generation capacity. Under these conditions peak wholesale prices have approached $1/kWh (Borenstein, 2001). This value is well within the NREL estimated cost of electricity for solar PV (See Figure 1) and suggests the solar energy industry would benefit greatly from real-time pricing (RTP) tariffs that match consumption with actual market prices. A recent study by the University of California Energy Institute suggests flat-rate electricity tariffs undervalue solar generation by 29% to 48% in California (Borenstein 2005).

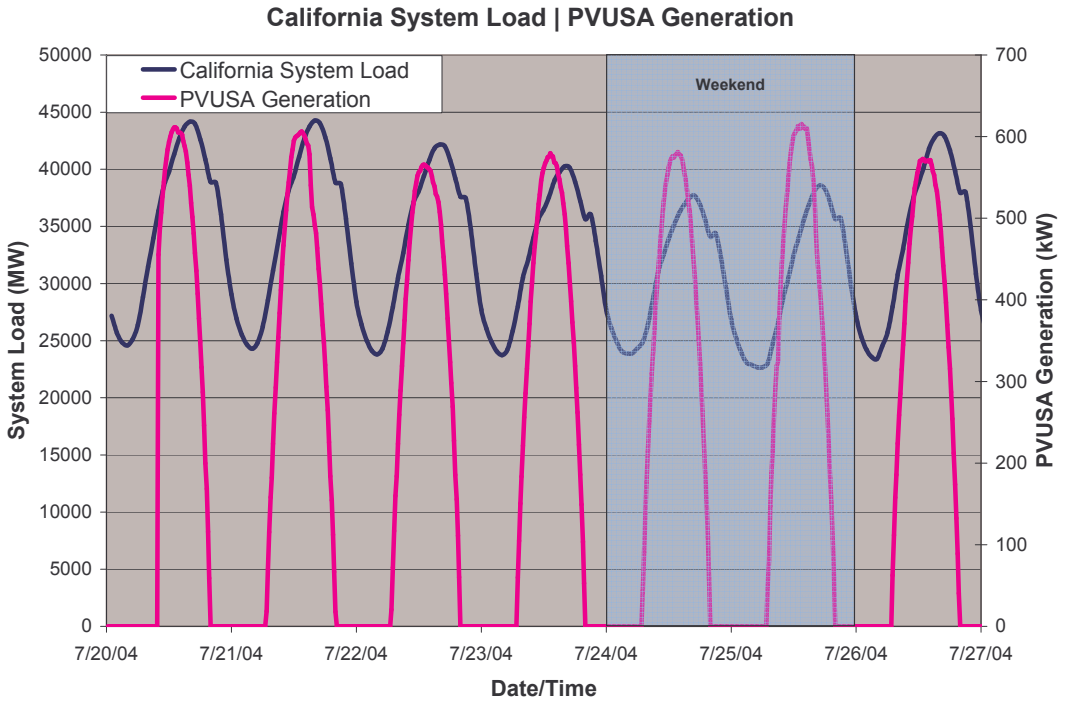

Figure 2. Comparison of the California system load and PVUSA Solar generation for a typical summer week. (Source: California Independent System Operator (CAISO) and Renewable Ventures)

There may also be physical and aesthetic reasons why solar energy has remained at the forefront of renewable energy discussions. Solar PV installations are either static or have

very slow moving parts and are thus less susceptible to mechanical failures. Additionally, as the recent fervor over the Cape Wind project in Nantucket Sound has proven, the aesthetics of wind energy may continue to be a significant political barrier to its widespread adoption. By contrast, solar energy installations are often on rooftops and out of public view. Politicians have used public support and the aforementioned technical arguments to enact several tax incentives and subsidies for solar energy.[5]

Tax Incentives. The federal government currently offers a 10% investment tax credit on all PV installations. California offers a 15% state tax credit, but the system owner and the site owner must be one in the same, making it difficult for commercial facilities under lease agreements to gain any benefits. Several states, including California, waive property taxes on solar equipment. Perhaps the most well-known tax incentive is the recently renewed Production Tax Credit (PTC). This incentive has catalyzed significant growth in the wind energy sector, but until recently was not available to solar projects.[6] One final incentive contained under the tax umbrella is accelerated depreciation. Owners of PV systems can depreciate the entire cost of the system in just six years. This provides concentrated tax relief that is normally spread over 20-25 years for capital equipment.

Rebates. Another incentive used for renewable energy is a flat-fee rebate. These programs are generally administered by the state energy agency or public utilities commission. They offer a certain dollar amount per watt of installed capacity and are typically funded by a public benefit charge on utility bills. California has two such programs for PV installations: one administered by the CEC, and the other by the California Public Utility Commission (CPUC). These programs have been criticized because they do not provide an incentive for performance. California is currently preparing a pilot program using a production-based incentive, whereby rebates are paid on a dollar per kWh basis similar to the PTC and the feed-in tariff offered in Germany.[7]

The various incentives listed previously have been successful in some regions, but have not completely opened the door for widespread deployment of solar and other renewable energy technologies. The primary reason for this is the relatively high cost of producing electricity using renewable generation when compared to traditional sources such as coal. This disparity

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5 A comprehensive list of incentives for the fifty US states and all types of renewable energy is administered by the North Carolina State University Solar Center and can be found at www.dsireusa.org.

6 The Federal Production Tax Credit (PTC) offers a credit based on the number of kWh generated. However, it cannot be claimed in parallel with the investment tax credit which provides more benefit for PV installations.

7 In 1990 The German Government instituted a "feed-in tariff" requirement for renewable energy whereby independent producers of renewable electricity received guaranteed contracts for production from the utilities. The price calculation methodology was mandated by the state to favor renewable energy and led to significant market penetration until electricity prices fell in the late 1990's. The tariff was extended in 2000 with a change in the contract guarantors from the utilities to the State. The new plan guarantees contracts with favorable rates for twenty years and has thus far proven to be extremely effective in promoting solar and wind energy (Palmer 2004).

in cost is exacerbated by a market failure within the electricity sector whereby the external costs of air and water pollution from power plants is not internalized in the retail price consumers pay. Improperly valuing, or failing to value at all, the external costs of traditional generation causes renewable generation to look even more expensive. However, positive public sentiment has led to the advent of green pricing programs and Renewable Portfolio Standards8 (RPS) that are currently paving the way for a secondary market centered on the environmental attributes (cleaner air, and water) associated with renewable electricity generation. Many believe the green power and environmental attribute markets have the potential to dramatically increase the economic viability of all renewable energy sources, including solar energy. The following sections provide a more in depth discussion of these markets.

Green Power Markets

Utility Green Pricing Programs. The appearance of green power pricing programs has blossomed since the early 1990s. As of 2002, there were 90 utilities that offered green pricing programs. This represents about 10 percent of all U.S. utilities. While the number of programs has exploded, 10 programs (11 %) are responsible for 75 % of the customers. People are willing to pay a $0.50 to $50 per month premium for renewable energy in these utility green pricing programs. A comparison of current green power utility pricing programs shows that even the best programs only have 10% participation. This is well below the stated participation rates of 50 to 80 percent (Wiser and Holt, 1999). On a price per kWh basis utility green power programs cost anywhere from 0.7 to 17.6 cents more than standard tariffs.

Table 1: Price premiums for bundled RECs in the top ten existing green utility markets, by sales. (DOE, 2004)

Utility Name	Price/ kWh (¢)	Price/ 750 kWh ($)
Austin Energy	2.85-3.3	21.38- 24.75
Portland General Electric	1.7-3	12.75-22.50
Sacramento Municipal Utility District	.5-1.0	3.75- 7.50
PacifiCorp	1.95	14.63
Xcel Energy	2	15.00
Los Angeles Department of Power & Water	3	22.50
Tennessee Valley Authority	2.7	20.25
We Energies	2	15.00
Alliant Energy	2	15.00
Puget Sound Energy	2	15.00

Unbundled REC Markets. Selling unbundled RECs is a slightly different process. There is not a built in customer pool to draw from There is also solid evidence that the unbundled REC market is growing from year to year. According to Green-e's 2003 audit of various

8 RPS legislation requires utilities to purchase or generate a certain percentage of electricity using renewable technologies.

REC markets, the total number of megawatts hours sold in the U.S. increased twelve-fold, from 150,000 to 1.8 million. The number of residential customers grew 34% from 2002 to 2003. Table 2 compares existing unbundled REC prices in current markets.

Table 2: Price premiums for unbundled RECs in existing markets. (DOE, 2004)

Company Name	Price premium/ kWh (¢)	Price premium/ 750 kWh ($)
3 Phases Energy Services	2	15
Bonneville Environmental Foundation	2	15
Community Energy	2.5	18.75
EAD Environmental	1.2-1.5	$9 - 11.25
Maine Interfaith Power & Light	2.0-4.0	$15 – 30
Mainstay Energy	2.0-20.0	$15 – 150
Mass Energy / People's Power and Light	5	37.5
Native Energy	1	7.5
PG&E National Energy Group	4	30
Pacific Renewables, Inc.	3	22.5
Renewable Choice Energy	2.0-4.0	$15 – 30
Sterling Planet	1.6	12
Sun Power Electric Corporation	3.6	27
Waverly Light & Power	2	15
WindCurrent	2.5-3.0	$18.75 - 22.50

Renewable Energy Certificates (RECs)

History. Before describing the history of REC markets it is important to know exactly what a REC entails. RECs are defined as the environmental attributes associated with renewable electricity generation; specifically, the relative environmental benefits everyone receives (i.e. cleaner air and water) when renewable generation displaces the use of traditional sources such as coal. It is difficult to say where the idea for a market based on the REC concept originated, but many attribute the formalization of the idea to Rob Harmon at the Bonneville Environmental Foundation in 1999.[9] Around this same time, many states were moving in the direction of utility restructuring or deregulation. Based on the positive public sentiment towards renewable energy sources reported by Farhar (1993 and 1996), it was expected that, in a restructured market, a number of ESPs would be offering products based on the procurement of electricity generated by renewable energy facilities. With the knowledge that the most ideal locations for renewable energy were not always in the same area as the people who wanted green electricity, Mr. Harmon began thinking of ways to get solar and wind power, or at least the idea of renewable energy, to those who wanted them most. The end result involved splitting the electricity generated at renewable facilities into two parts; (1) commodity electricity and (2) environmental attributes. The idea of splitting the electricity generation into two parts worked well with the pending need for a verification regime for green pricing programs and Renewable Portfolio Standards, both of which were expected to be commonly associated with utility restructuring legislation. The Bonneville Environmental Foundation named the environmental attributes "green tags" and they would soon take on other titles including green certificates, tradable renewable certificates (TRCs), and renewable energy certificates (RECs). RECs can be bundled with commodity electricity and sold as "green electricity" in the primary market, or sold unbundled as stand alone RECs in a secondary market (see Figure 3).

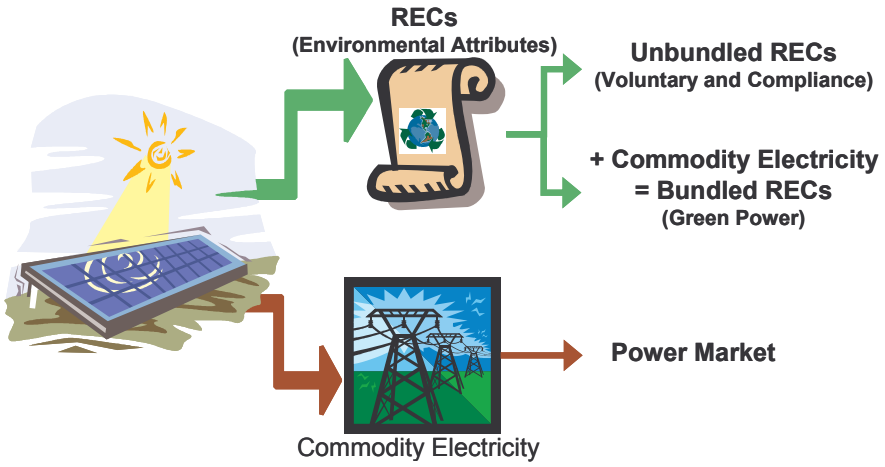

Figure 3. Flowchart of REC market creation and distribution.

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9 Mr. Harmon received the 2004 Green Power Pioneer Award from the EPA for his efforts related to the formation of REC markets.

The REC market can be split into two distinct categories, voluntary and compulsory. The voluntary market includes RECs used in green pricing programs and unbundled REC transactions. Compulsory or compliance markets exist in states with RPS legislation where utilities are required to procure a certain percentage of their wholesale electricity from renewable sources or purchase an appropriate number of unbundled RECs to "green" commodity electricity contracts.

Voluntary REC Market. The voluntary REC markets involve two potential vehicles for sale. The first is green pricing programs or bundled RECs. This market generally occurs in states with utility restructuring. The RECs are bundled with commodity electricity and sold as green power.[10] Unbundled RECs have primarily been sold to commercial or governmental organizations for their green marketing value. A smaller amount of unbundled RECs have been sold in the residential market as offsets for carbon emissions associated with personal activities. Consumer demand for these products has led to several independent certification services to ensure veracity. The "green-e program" is the most prominent certification service for RECs measured on a kWh basis and is administered by the non-profit Center for Resource Solutions (CRS). A limited amount of products are based on tons of CO2 offset and are generally certified by the Climate Cool program administered by the non-profit Climate Neutral Network.

Compliance REC Market. There are eighteen states with enacted RPS legislation (Figure 4). Thirteen of these states allow the use of tradable RECs as a flexibility mechanism for compliance.[11] However, most of the trading programs include a price cap that can distort the true value of the RECs.

International Markets. The REC market in Europe has developed more rapidly and with a higher level of participation than in the U.S. This may have been in preparation of the Kyoto Protocol entering into force and the potential for RECs to become usable carbon offsets. It also appears that Europeans have readily accepted that parts of the continent are better suited for various renewable energy sources than others. At the same time, European countries are close enough to one another that electricity generation emissions of all types are transboundary (e.g. Chernobyl and acid rain). A transnational REC program allows for a trading among a common renewable pool that benefits the entire continent. The Renewable Energy Certificate System with offices in the UK and Holland was created to facilitate REC trading for voluntary green pricing programs and currently includes sixteen European nations.

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10 Most green pricing programs rely on bundled products and are not certified using RECs. The actual amount of RECs used to certify products in green pricing programs rose for 11% in 2002 to 33% in 2003. (Bird 2004)

11 The CPUC is currently accepting formal comments regarding the potential for a REC trading program to fulfill California RPS requirements.

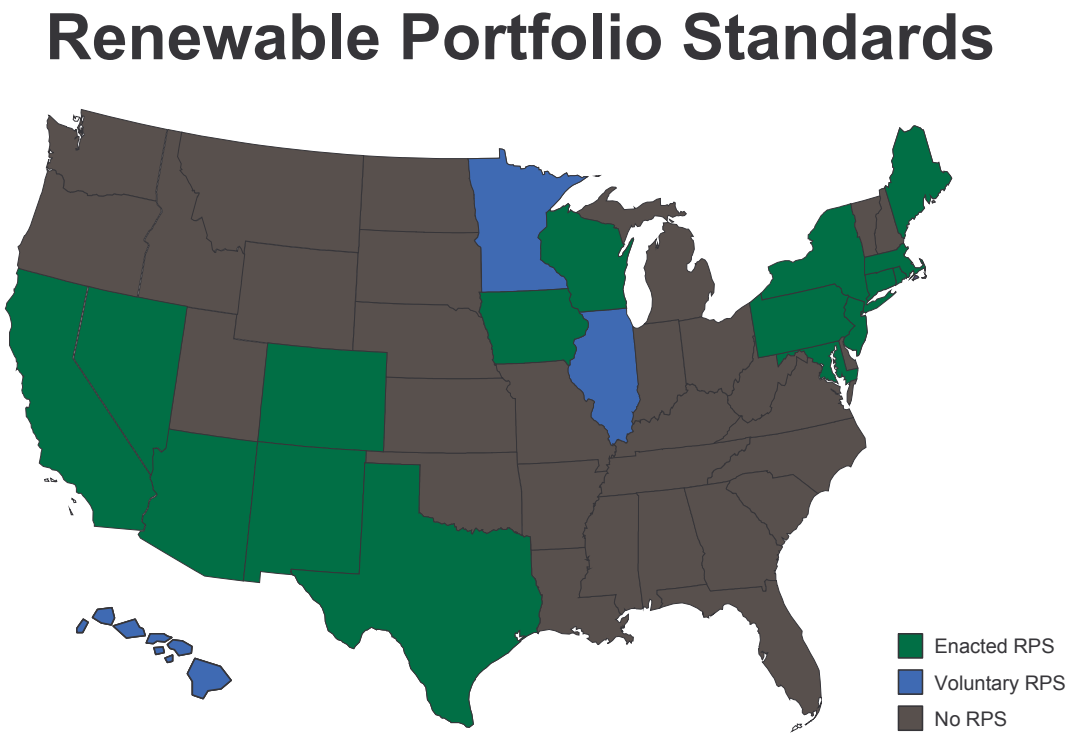

Figure 4. States with Renewable Portfolio Standard (RPS) legislation

Related Research

Little has been written regarding the theory behind voluntary purchase of unbundled RECs on a residential level. CRS (2003) has published data related to RECs certified by their "green-e" program and sold to consumers in an unbundled form. However, less than 0.5% of the sales involve residential costumers. There is a fair amount of literature covering the demand for green electricity products. Along with similar CRS data for green electricity, several studies related to green pricing programs have been conducted by Bolinger (2001), Wiser (2004) and Golove, et al (2004). Several utilities have performed surveys to help determine the public's willingness to pay for renewable electricity. A summary of survey results for such studies performed in the 1990's can be found in Farhar (1993). Data on actual response to green pricing programs has been summarized by Bird and Swezey (2003). Wiser (2003) has performed a contingent valuation survey for determining willingness to pay (WTP) for renewable energy. A related study concerning public preferences regarding energy sources can bound found in Farhar (1993 and 1996). Because of the public good aspect of renewable energy, and more specifically the environmental attributes associated with RECs, a number of these studies rely on contingent valuation theory. A summary of this economic theory can be found in the next section.

Contingent Valuation

Placing monetary value on public goods such as ecosystem services and clean air are essential to a properly operating economic system. When values for public goods are not

recognized, economic systems suffer market failures in the form of externalities. Externalities become an even more significant problem when information asymmetries exist whereby consumers are not fully aware of the external costs. This idea is summarized by Hanemann (1994) when he writes, "In the presence of externalities, market transactions do not fully capture preference." (p.19) In order to realize the value of public goods many economists rely on non-market valuations contingent upon hypothetical scenarios. This method, known as contingent valuation (CV), was first formulated by Ciriacy-Wantrup (1947) in order to determine existence value.

History. Although it was conceived in 1947, CV did not become prominent until after the creation of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)[12] in 1980. The CERCLA language included a sleeper provision that allows government agencies to sue for damages to natural resources resulting from the discharge of hazardous waste. In 1986 the Department of Interior published regulations specifying what damages were compensable under CERCLA. These regulations were then amended in 1989 after several legal challenges including a D.C. Circuit Court decision that instructed the Department of Interior to assess "use" and "non-use" values equally and to consider CV as a valid valuation technique. These rules were brought to center stage when the Exxon Valdez oil spill occurred. The potential costs related to existence values were enormous and caught the attention of Congress.[13] Consequently, the Oil Pollution Act of 1990 was created and resulted in the formation of an expert panel of economists organized under the auspices the National Oceanic and Atmospheric Administration (NOAA). This panel was created to develop damage assessment regulations and did so by embracing the CV method.

There are numerous recommendations provided by the NOAA Panel, however Portney (1994) recognizes seven major recommendations as the heart of the panel's findings. These recommendations are summarized below.[14]

Data Collection. There are three basic methods for conducting any survey;[15] phone, mail, or personal interview. A majority of the literature, including the NOAA Panel, recommend personal interviews before telephone surveys and telephone surveys before mail surveys. Personal interviews of "significant duration" are thought to elicit the most conservative values, although telephone interviews are noted for their low cost and centralized administration. (Arrow et al, 1993)

Value Scenario. The NOAA panel suggests the hypothetical scenario proposed in the survey should have the goal of eliciting the respondent's WTP either to prevent a bad outcome or get a good outcome in the future. It should not be used to estimate the amount a person is willing to accept as compensation for a negative event that has already occurred.

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12 CERCLA is commonly known as "Superfund."
13 The loss would later be estimated at over $3 billion using CV methods. (Carson et al., 1992)
14 Paul Portney was a member of the NOAA Panel on Contingent Valuation
15 Informal web-based surveys are widely used but not considered appropriate for formal or academic research due to inherent biases and difficulty in obtaining a random sample.

Question Type. The main question pertaining to the value to be elicited should be posed in a referendum format. The name suggests the scenario must involve a collective action, however, Champ (2002) points out that the term referendum is often used in the CV literature to describe a closed, dichotomous-choice question regardless of whether or not it pertains to a collective or voluntary measure.

Scenario Description. It is recommended that the scenario be detailed and robust in its description. The scenario should be realistic, consequential, and instill a sense of commitment (Hanemann 1994).

Budget Constraint. The NOAA Panel suggests that survey respondents should be reminded that choosing to pay for the program presented in the hypothetical scenario would mean less personal funds are available for other things. The theory that respondents may not take budget constraints into account has been documented by Kemp et al (1992).

Substitutes. Related to budget constraints is the recommendation that survey respondents are reminded of substitutes to the program or policy presented in the hypothetical scenario. The necessity of a "substitutes" reminder is questioned in research by Loomis et al (1994) where no significant difference was found between respondents that were reminded of substitutes and those that were not.

Follow-up Question. The final major recommendation offered by the NOAA Panel is to include one or more follow-up questions related to the main WTP inquiry. This is done to ascertain whether or not the respondent understood the WTP question and to provide some insight as to the thought process behind their answer.

This project deals with a valuation method that is most similar to contingent valuation. Defining a person's willingness to pay for green power, or bundled RECs, is not purely a contingent valuation scenario because green power is an actual market good. However, determining the value of the environmental attributes embodied by a REC, unbundled from the commodity electricity, would be considered non-market valuation. The difficulty is differentiating between the value of commodity electricity and the environmental attributes associated with the RECs. This can also be defined as the difference between "use" and "non-use" value. In this case the electricity has a "use" value and the RECs have a "non-use" value. It is important to realize that knowing one's willingness to pay for green electricity only gives an implicit estimate for the "use" value of the commodity. It does not necessarily give an accurate measurement of the "non-use' value associated with environmental attributes (Krutilla, 1967). Because of the abstract nature of RECs, this project treats them as a non-market good, and follows the protocol for contingent valuation research.

Profiling Green Consumers

The results from the contingent valuation survey and modeling method can then be used to identify the target consumer.

Who is willing to pay? Many studies, including this one, have been done in order to understand the nature of green consumerism. Profiling potential buyers proves to be a difficult task at times, but it can be done. People across a complex mix of demographic

variables all show interest in the environment. People also hold different ideas of what constitutes an environmental attribute. The coupling of these two ideas makes it hard to define the environmental consumer, yet there are some general trends when it comes to identifying them by their demographic characteristics. In some surveys, all things being equal, people are more willing to support the environment if they are younger, more educated, and wealthier. The results for Davis generally follow these same trends. However, there are slight discrepancies about the statistical significance of these variables. There are also certain attitudinal indicators, such as liberalism that are telling when it comes to identifying the green consumer. Sometimes it is hard to separate the demographic variables from these attitudinal variables.

From this notion of the possible buyers in this market, marketers are faced with the problem of how to generate new customers. Then, once a customer base is established, the question becomes how to retain and grow the base. Not only are renewable energy marketers faced with these common market problems, they also have to deal with the free-riding dilemma. The free-riding dilemma occurs when a public good is offered on the market and it can be enjoyed by everyone, even if they do not pay for it. In this case, the environmental benefits provided by generating renewable, clean electricity are realized by the public if an individual pays for them or not.

One type of consumer is motivated by the good of society. Altruistic consumers are the easiest consumers to target. In the eyes of these consumers, buying a REC offers them the chance to affect good on the greater whole. Altruists take the good of their communities into consideration when making decisions regarding energy purchases to buy the REC.

Another type of consumer makes decisions based on their own needs and wants. The private interest consumer's motivation to buy a REC is self-preservation. Marketing to this sector must stress that purchasing renewable energy is in their best interests. This consumer must feel that the product has value to them. The REC must improve their current situation some how in order for the purchase to make sense. Consumers that feel bad for polluting can be classified as guilty consumers. These people feel pressure to offset any problems they might cause in their everyday consumption of goods.

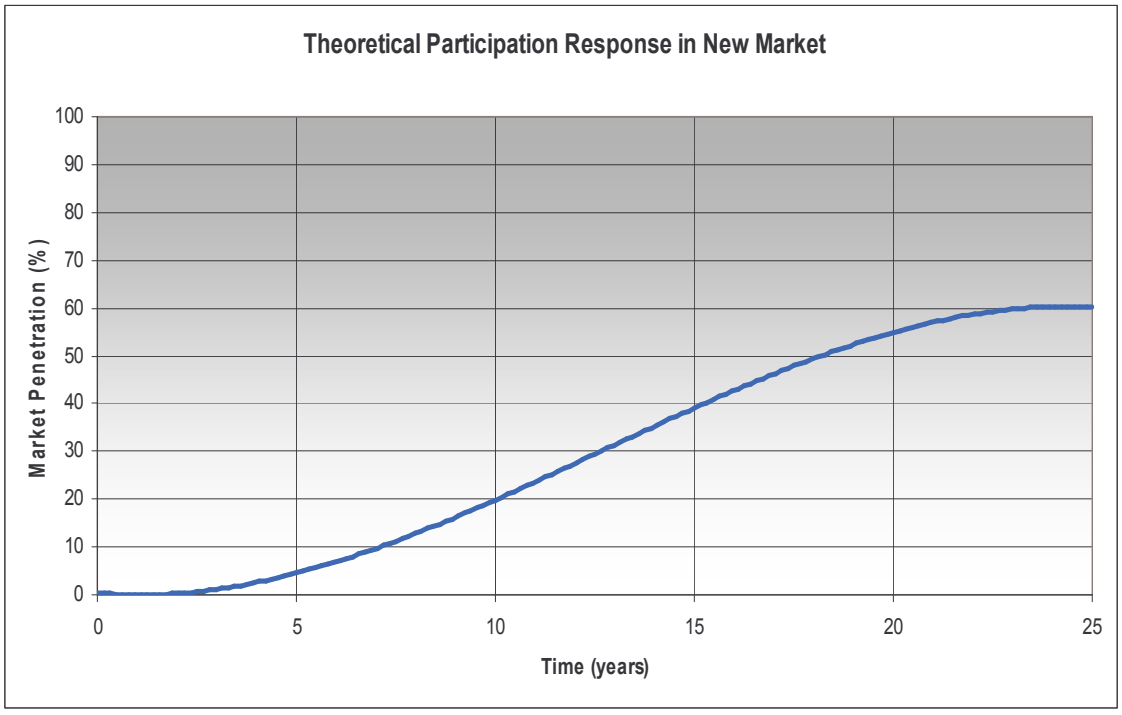
Public Perception of Green Power. In today's social climate, environmental issues are considered serious by the general public. Consumers, when asked whether the environment is important, say issues such as the greenhouse effect and auto air pollution are very serious problems (Ottman 1998). Most evidence suggests that people want to keep the environment clean. However, even though people state that the environment is a concern, the numbers of people who act are fewer than expected (Ottman 1998, Wiser and Holt, 1999). In marketing RECs to the public, the disparity between people's stated willingness and actual willingness has to be overcome.

Market Research vs. Actual Experience. Most research conducted on green power markets shows people are willing to pay for the environmental benefits of renewable energy production. Multiple studies show that 50 to 80 percent of Americans are willing to pay a premium for renewable energy and/or environmental protection. In fact, a research conducted by the Edison Electric Institute showed that 60 percent of households would pay $6 or more, 40 percent would pay $11 per month, and 22 percent would pay $21 per month

for electricity generated from sources that more environmentally friendly (Wiser and Holt, 1999). This evidence suggests that people value green products. These results also illustrate that the results of the survey conducted in this study were typical of other studies.

The gap between the stated WTP and revealed WTP might be due to a natural market penetration lag. When a market emerges, initial growth is slow. Growth is limited at first by the time it takes for information to percolate to the masses. The initial consumers who will buy the RECs will be trend setters, also known as innovators. Then, as more time elapses and more people are educating about the product, the early adopters will enter the market. Finally, once the advertising and word-of-mouth campaigns take effect, the majority of the population will enter the market. Figure 5, below, shows the general shape of the curve that illustrates the theoretical response of consumers to a new market. This is typical response to a burgeoning market. The goal is to grow the consumer base to the majority and beyond.

Figure 5: Typical market diffusion response for the initial growth stages.



While the evidence from market research shows that people state a high WTP for environmental goods, the reality of the situation indicates the opposite. While research shows that more than 50 percent of people state a level willingness-to-pay, the participation rates in existing utility green pricing programs are much lower. In real world situations, the consumer subscription rate to green power programs ranges from 1 to 11 percent but typically hovers in the range of 1 to 2 percent.

One of the reasons for the chasm between stated and actual scenarios stems from the free-riding scenario created by the public good paradigm. Everyone realizes the benefits generated by producing green electricity whether a person supports the production of green energy or not. In this sense, the production of solar energy is a public good. In general,

because people reap the benefits whether they invest in the good or not, people will tend to free-ride on the coattails of others' good will. Research shows that the free-riding effect grows over time. After each purchasing period, people learn that the benefits to the environment will be realized whether or not they participate in the program. This gives the public incentive to free-ride.

When proceeding with the recommendations we must consider this discrepancy between the stated willingness-to-pay and the actual willingness-to-pay and its cause.

What Role Does Education Play? Education seems to be the bridge between the stated willingness-to-pay and the actual willingness-to-pay. Protecting the environment is a societal value which most people will say they agree with. However, some people do not act on behalf of their values. One of the issues preventing people from following their values is their knowledge of the current technological climate. The question is whether or not people know that alternatives to traditional energy sources exist and are viable. By educating the targeted markets through newspaper, television or radio advertising, people will be more willing to invest in renewable sources. Research done by Smart Power indicates that once people understand that renewable energy sources are a viable option now, not just in the future, that they are willing to purchase (Keane 2004). Their national advertising campaign stresses the fact that renewable energy sources are numerous enough at present to supply enough power to a major city like Chicago.

There may also be an information asymmetry with the respect to public knowledge of the harmful effects of pollution compared to the knowledge of the corporation generating the emissions. People might not have a full understanding of how much pollution electricity generation actually causes. This might account for some of the discrepancies between the stated concern for the environment and the WTP to protect it.

Effective Environmental Marketing Practices

Once the contingent valuation survey is completed, the issue becomes what to do with the information gathered. The results can be used to properly market RECs to the most appropriate sectors of the population. In order to be effective, some general marketing principle can be applied to the REC market.

Increase Consumer Participation. Research suggests a few different ways to entice customers into this new market. First, the company can take advantage of the sense of social responsibility a person might feel. In a way, this can be viewed as the guilt of the masses. Second, the company can assure the customer that their contribution towards renewable energy makes a difference. This gives the public a sense of involvement. Third, the company should focus on customer satisfaction after the sale. The more the company can do to retain its customer base the better off the program will be. Fourth, the company can make the REC more tangible by bundling it with other more usable goods. If the public perceives a higher value it will be more willing to pay (Wiser 1998).

Stress Social Responsibility. One way to market a product in smaller communities is the use of word-of-mouth advertising. People in communities usually exert some peer pressure on each other. This exploitation of civic duty is most effective in smaller groups of people

because the smaller the group, the greater affect each member has on the group. While most evidence suggests that this works primarily in groups of less than ten people, there is some evidence to suggest that social pressure works in larger communities (Ostrom 1990). If a strong sense of civic duty and communal awareness resides within the community, then this could be a good tactic to drum up interest in the market. In order for this tactic to work there must be some form of communication between the members of the community. The driving force behind this technique requires a bond between the members of the community. This method of quasi self-policing should reduce the free-riding effect.

Another reason community plays a large part in the growth of the environmental market is the fact that environmental effects can be perceived as local. For this reason, local companies tend to do better when selling environmentally beneficial products to certain communities. Companies that have roots in the community in which they want to sell the product have an advantage over nationally or internationally owned subsidiaries. People like knowing that they are directly benefiting from the environmental good they are purchasing.

Because this method relies on a word of mouth approach, the promotion of the RECs might best be placed in areas such as CO-OP newsletters, community bulletins, and other sources of this nature. If the client can effectively establish that the community as whole benefits from the product, this communal approach will work very well.

Assure Customers Their Contribution Makes a Difference. Consumers of environmental goods like to know their contribution makes a difference. Perception of effectiveness is important in the psyche of the consumer. If the marketing can convey a sense of involvement and leadership to the consumer, the consumer will be more likely to buy the REC. For example, if Renewable Ventures would like to expand its operations, it can offer the consumer RECs under conditional terms. If the company sells a certain amount of RECs, it would raise enough money to expand its operations. If the company does not sell enough, the consumer gets its money back. The use of provision points in marketing can be effective in spurring new customers. If expansion is desired, the use of provisional point selling might be one option that mitigates the risk involved. The consumer will also perceive that their contribution is integral to the growth of the company. Consumers of environmental goods like to feel involved. The marketing should foster a sense of leadership in the community (Wiener and Doescher, 1991).

Enhance Private Value. Consumers are more likely to buy a product if it is of a higher value to them. One way to increase the value of a REC is to bundle it with another good. Another similar way to achieve a higher value for the consumer is to offer discounts on other goods. For example if you buy a REC, you receive a coupon for a free smoothie. A third way to enhance the value of the REC is to emphasize that the environmental benefits are personal. For example, by purchasing a REC, the consumer is effectively lowering the pollution levels in their own community. Any way to make the REC more tangible will increase the chance that people will buy (Cornes and Sandler, 1986).

SMUD conducted market research to show the effects of bundling products with the public goods provided by solar energy production. When customers were asked their WTP for unbundled solar energy, 26% answered yes. When the same product was offered with a guarantee that electricity prices would not vary, 49% answered yes (Osborn, 1997). In this

case, the public goods are the environmental benefits gained when producing cleaner electricity and the private good is the knowledge that electricity rates are stabilized.

Emphasize customer retention. A problem for any company is customer retention. Not only should the company focus on gaining new customers, they should retain current customers. One way to promote retention is to offer incentives to stay. Incentives usually come in the form of discounts, gifts, or even public recognition.

Another way to retain customers is to get longer term commitments. By signing people up for a year instead of a month, mitigating learning (free-riding) effects, the company can maintain more customers. However, long-term commitments scare some people, so the benefits of lessening the learning effects must be weighed against the cost to customer flexibility.

Research Approach

Several steps were involved in accomplishing the goals of the group project. First, a model was created, with support from literature research, in order to link various population characteristics with an individual's willingness to pay for a REC. Next, a corresponding contingent valuation survey was developed based on the aforementioned NOAA protocol. Once the model and survey were completed, an iterative pretesting process ensued. A preliminary survey was administered, results entered into the model, and a demand curve derived. After each pretest, the survey was revised based on the model output to more accurately capture individual valuation of RECs. After four pretests, the refined survey was administered under a case study in Davis. A thorough analysis of the results was performed, including deriving a demand curve and calculating the optimal REC price for Davis residents. From this information, a pilot sale of RECs via the World Wide Web was performed. Additionally, a profile of the most likely REC consumer was obtained, and populations within California were assessed for their likelihood to purchase RECs based on their similarities to the Davis profile. Locations with populations having high probability for REC consumption were also identified. The following subsections summarize the methodology for each of these steps.

Model Development

The research approach began with the development of the model.

The Model. In order determine the price at which revenue is maximized, the demand for RECs must first be predicted. This was done by estimating an equation to describe a person's likelihood to purchase a REC given various explanatory variables including price and various demographics.

Through researching contingent valuation, it was found that the generalized least-square, logit and probit models are often used to analyze discrete choice data. (Wiser, 2003) The latter two models are used because of their ability to limit the dependent variable between 1, indicating a "yes" answer and 0, indicating "no." (Sellar, et al, 1986) The logit model was chosen for this project because of existing familiarity with it and its simplicity. Further, it often provides similar results to the probit model. (Sellar, et al, 1986 and Duffy, et al, 1989) The logit model's form is as follows.

Probability("yes") = exp(Z) / (1 + exp(Z))

$$Z = X_i B_i$$

Probability("yes") is the predicted probability that the individual will purchase the REC product.

Xi is a vector of explanatory variables for each individual, such as demographics.

Bi are the coefficients of the explanatory variables.

Assumptions of the model. The model assumes the probability of "yes" from each respondent is mutually independent and that the explanatory variables do not have to be distinct. Additionally, it assumes the function Z is linear and hence, as the explanatory variables change, Z will change in a linear way. Lastly, it assumes that the mean probability("yes") changes with the explanatory variables, however its functional form does not change. (Lindsey, 1997)

Explanatory Variables. The explanatory variables fall into three categories: demographic, other characteristics, and product specific. The demographic and other characteristics were determined by examining the demographics and characteristics of people who were participating in green pricing programs. This information was found in a report by the National Renewable Energy Laboratory (NREL) part of the Department of Energy (DOE) (Bird, et al, 2004) and by a report published by The National Wind Coordinating Committee (NWCC) (Wiser and Holt, 1999). These studies and others (see Recommendations for Marketing below) found that the level of electricity education also played a role in determining buyers of RECs. Hence, a variable to capture existing levels of knowledge regarding renewable electricity consumption was included. Additionally, two similar studies have been conducted, in which certain demographics and characteristics were found to be statistically significant (Wiser, 2003 & Rowlands, et al, 2003). Specifically in Rowlands, et al "liberalism" and "altruism" were found to be significant in determining purchases of RECs. Wiser, et al also found "altruism" to be significant. Lastly, two separate vehicles for delivering RECs were considered to determine the difference in demand for bundled and unbundled RECs. Hence, these were also explanatory variables. Table 3 contains a list of all explanatory variables included in the survey and subsequent analysis.

Table 3. Explanatory variables used in case study model.

Variable	Description
Product Description	
Price	Monthly price offered for renewable energy certificates equivalent to 750 kWh: $2, $8, $12, $16, $20
Bundled	Sold with electricity: 1 if yes, 0 if no
Demographics	
Gender	Male or female: 1 if male, 0 if female
Age	Age in years
Income	Household income
Educational attainment	Number of years of education
Other Characteristics	
Renewable Energy Knowledge	Correctly answered the % of US electricity generation that is from renewable sources, excluding hydro: 1 if yes, 0 if no
Donate	Annual dollar amount respondent donates to charitable causes
Political Affiliation	To gauge "liberalism," the political party the respondent voted for in last presidential election: republican, democrat, other

Derivation of logit model and coefficients. The two most frequently used methods for making inferences on logistic regression data are weighted least squares and maximum likelihood. The iterative reweighted least squares method via the statistical software R was used to determine the coefficients (Bi) based upon survey data. The determined logit model then predicted an individual's probability of purchasing RECs, as a function of the characteristics in Table 3.

The logit model was first tested on a fabricated data set based on a preliminary survey. This was done to ensure that the logit model would accurately reflect actual data. One at a time a explanatory variable was purposely skewed to reflect a correlation between it and willingness to purchase. Then in R, it was ensured that the explanatory variable was statistically significant and hence, the estimated model reflected the correlation.

Demand curve and price at which revenue is maximized. After a survey was administered, the data was entered into the model. The coefficients were then estimated in R and the logit model, *Probability("yes")* was estimated.

$$Logit(Price, Z)_N = Probability(\text{“yes”})_N$$

Proportion of predicted buyers = $(\sum_N Logit(price, Z)) / N$

price is systematically varied
Z is all other explanatory variables for each respondent held constant
N is the sample size.

A demand curve was derived from the model in the following manner. The probabilities of buying a REC for each individual in the survey were summed and then divided by the total number of individuals in the sample; this number represents the proportion of the sample that would buy at the given price. The price was then changed, and a new proportion calculated from the sample. Iterations were done for every price between $0 and $30 at $0.01 intervals. Each iteration created a point on the demand curve such that an estimated continuous curve could be constructed. The derived demand curve includes all variables of the model, regardless of their statistical significance because the use of more variables. Typically, adding variables to mathematical models results in increasing predictive accuracy. The calculations were computed and demand curves created using a program coded in Matlab computing language.

Revenue is a function of price, the proportion of predicted buyers, and the size of the potential market. Given, the proportion of predicted buyers and the size of the potential market are constant, where revenue is maximized is dependent upon price. This point was also determined using a program coded in Matlab. While possible to solve analytically, the number of variables greatly increases the complexity and hence is made much easier to solve numerically.

Additional demand curves were generated by systematically varying other independent variables: income, age, and bundled.

The process of deriving the logit model, generating the demand curve, and determining the price at which revenue is maximized was completed for three pretest surveys. The application to the test surveys increased the familiarity with the process such that upon the final survey many of the possible kinks had already been worked through.

Calculation of marginal elasticities.
Initially, the first-order derivative of *Probability(“yes”)* was determined. The derivative was then used to calculate the marginal elasticities for each explanatory variable at their average values based on the Davis data set.

Interpretation of marginal elasticities.
Marginal elasticity is the effect of a unit increase in the value of an explanatory variable on an individual’s probability of purchasing a REC. To illustrate, suppose two individuals respond with the same values for each explanatory variable on the survey, except person A’s income is $10,000 less than the person B’s. Person B’s probability of purchasing a REC will be

different from person A's by the amount of $10,000 multiplied by the marginal elasticity of income.

Survey Development

The CV survey for this project was developed using an iterative technique involving several drafts and pre-testing. The initial survey was created based on NOAA panel recommendations described in CV literature by Arrow et al (1993), Portney (1994), Hanemann (1994) and Diamond (1994). The overall survey structure is modeled after a similar survey conducted by Wiser (2003).

Survey Anatomy

Data Collection. Four different modes for survey deployment were considered for the survey. These include email/web-based, standard mail, telephone and personal interviews. Based on recommendations found in the CV literature referenced earlier, it was decided that personal interviews would be used. However, given the time and resource limitation of this project, the interviews were conducted in a more informal manner by soliciting passersby in public locations. This was considered an appropriate compromise given the fact that many proponents of the CV method have protested the NOAA recommendation of personal interviews on the grounds that it is too costly (Portney 1994).

Value Scenario/Question Type. The value scenario used in this survey had the intention of determining the respondents' WTP to support future renewable energy. A closed, dichotomous-choice question was used in accordance with NOAA recommendations. After the first three pre-tests, a second "no" option was included in order to give respondents, who might have been answering "yes" untruthfully, another alternative. It was suspected that some respondents were answering "yes", not because they were willing to pay, but because they felt guilty about answering "no". The affect of guilt on public behavior has been documented in Kotchen (2004) and is related to CV literature written by Andreoni (1989) pertaining to survey respondents answering a certain way to receive a "warm glow" feeling. The second "no" option on the survey included phrasing to allow respondents to experience the "warm glow" feeling, regardless of whether they answered "yes" or "no" to the willingness to pay question.

Scenario Description. Two hypothetical scenarios were used in this survey. The difference in the two scenarios involved the party whom the respondents would pay. In one version the payment went to the local utility as part of a green pricing program. This is referred to as the "bundled version" because the RECs are bundled with commodity electricity. In the second version the payment went to a private company providing a pure REC product. This is referred to as the "unbundled version" because the RECs are offered by themselves.

In both cases the payment was voluntary and did not involve a collective action decision such as a tax. A voluntary scenario was used because it is more inline with the potential options available to the project client. Although it may not provide as realistic a scenario as a tax, the voluntary scenario tends to provide more conservative results than a true referendum scenario. This has been observed by Carson (1997), Taylor (1998) and Hanemann (1996) with respect to donations for public causes and is thought to be a product of the public's fear of free-riding under a voluntary scenario. However, Carson (1997) and Carson et al (1992)

contends that voluntary payment vehicles can still suffer from overbidding due to strategic behavior. The data presented in Wiser (2003) suggests this is not always true.

Two methods were used to instill a sense of commitment when answering the survey. First, each survey contained an opening sentence that included the suggestion that the survey responses would be used "to help shape future energy policy." Second, the scenario included a three-year commitment of payments to support renewable energy.

The original survey was extremely long and detailed. After consulting with the UCSB Survey Center, the survey was shortened to a more digestible length for impromptu interviews. The final survey included an informational cover sheet to provide further clarification of the scenario.

Budget Constraints and Substitutes. In order to provide a budget constraint reminder the statement, "money spent to support renewable energy decreases the amount available for other household items and charities," was included on the informational cover sheet included with every survey. In addition, the second and third survey questions asked respondents to rank various charitable causes and to answer a multiple choice question asking how much they donated to charitable organizations in the past year.

Potential substitutes were presented in the survey info sheet by stating, "Increasing the supply of renewable energy is one of several ways to reduce the environmental impacts of electricity production." Other options were implicitly suggested by providing a list of potential drawbacks from renewable energy.

Follow-up Question. Per the NOAA Panel recommendation, the original survey included a single follow-up question to determine the reasons behind the respondent's answer to the main WTP question. Originally, the question was used to determine why the respondent answered "no". After the initial pretests it was clear that protest "yes" or yea-saying answers would be more of a problem and the question was modified to determine why the respondent answered in the affirmative.

Pretest I

A local shopping and restaurant plaza approximately 0.25 miles from UCSB campus was chosen as the location for the initial pretest survey. This site was chosen both for convenience and for its population's similarities to the actual test population. Both Davis and Santa Barbara are known for being socially and environmentally conscious, and both towns are home to University of California campuses. Davis and Santa Barbara are also similar in population size: the US Census Bureau estimated a 2003 population of 64,000 for Davis and 88,000 for Santa Barbara (US Census Bureau, 2005).

The pretest consisted of requesting passersby to fill out a two page survey with 8 questions (See Appendix A for survey sample. Note that the last two questions were written for the Davis population only, and respondents for the pretest were instructed not to fill them out). The initial pre-test survey included two scenarios. In the first scenario, the subject was asked whether they would support a hypothetical program in which households voluntarily pay a monthly charge on their electricity bill to support renewable energy. This is referred to as

the bundled version, since the REC is bundled with brown electricity. The second scenario proposed the same program, but stated that payments would be made to an independent company instead of the electricity provider. This is referred to as the unbundled version. Respondents were given a survey with one of the two scenarios and either $2, $8, or $13 as the monthly price of a 750 kWh REC. Thus, six versions of the survey were administered throughout the pretest.

The pretest time and duration were chosen in order to obtain a small sample of surveys from a variety of individuals, including professionals on their way to work, students in the area between or before classes, and shoppers of all ages and backgrounds. Surveying lasted for an hour and occurred on a Monday morning.

The weather was cooperative on the day of the pretest, and a total of 25 completed surveys were collected from all age, income, and gender classes. Subjects spanned education levels from high school to graduate degrees. Raw data results are shown in Appendix C. Only two "no" responses were received for the contingent valuation question, which asked if a respondent would financially support a renewable energy program. One negative response was for a REC price of $13 with the unbundled program, and the other was for a REC price of $2 with the bundled program.

Yea-saying is a potential pitfall with CV and environmental surveys in general; but that is not to say that all of the yes answers are from yea-saying. That is to say, acquiescence bias existed because respondents tended to agree with the question regardless of what REC price was offered to them. It was possible that by proposing a hypothetical scenario in which households could voluntarily pay for RECs, subjects were supporting the program rather than indicating a willingness to pay for RECs themselves. It is also possible that subjects responded in the positive because they thought "yes" was the answer expected of them as socially conscious community members taking a survey for student administrators.
Due to results of the first pretest, comments from the respondents, and observations during pretest administration, the survey was revised in the following ways: the graphical presentation was slightly altered to be more visually aesthetic, and more versions of the survey were created to reflect a wider range of REC price offerings (see Appendix A).

Pretest II

The second pre-test was administered in early October, 2004, during a weekend tour of solar-powered buildings in Davis, California. It was a self-guided tour, taking place all day, providing a longer time frame during which to collect surveys. Because it was in Davis, the subjects reflected a portion of the actual test population. However, solar tour participants are presumably already interested in solar electricity, and thus the sample was biased. This is a sample population most likely to purchase RECs, probably at a higher price, and it was expected that the survey results would reflect this.

There were eight versions of the survey for pretest II, again proposing the same bundled and unbundled scenarios, but for the following prices: $2, $8, $14, $20. The surveys were administered slightly differently from Pretest I since it was not possible to approach individuals on the tour. Instead, individuals are given a survey at the beginning of the tour and asked to return it at the end of the tour. All survey participants filled out and returned surveys immediately.

A total of 56 surveys were completed, again with a wide range of age, gender, and income levels. The sample population as a whole was highly educated, with a mean education rating of over 5, equating to a bachelor's degree. A total of 14 subjects responded "no" to the REC scenario question. Raw data scores are shown in Appendix C. The resulting optimal REC price to maximize revenue was $77.95..

After further review and consideration of Pretest II results, a number of changes were made to reduce yea-saying and increase survey accuracy. This included using a general university logo instead of a logo that said "Donald Bren School of Environmental Science and Management" to decrease possible preconceived notions of an expected "yes" answer from the respondents. Aesthetics were again altered, verbiage was decreased, and tables and graphics were removed to make the survey shorter in length, more readable, and increase white space. Additionally, an informational cover sheet was added to the survey in an attempt to better inform subjects of the benefits and drawbacks of renewable energy, encouraging them to respond to the survey so that their stated preferences more accurately reflected revealed preferences. Some important changes in questioning were implemented as well. Question 1, asking if a subject had ever bought green electricity before, was removed. In order to evaluate the subject's knowledge of renewable energy, the pertinent question was changed from a self-reporting assessment on a scale of 1-5, to a multiple choice question asking the subject how much US electricity is derived from renewable sources. Also, to help subjects better consider the tradeoffs involved in how their money is spent (i.e. that income is not an indefatigable resource), a question was asked regarding an individual's willingness to donate to various charitable causes. An additional yes-no question followed, asking if they actually did donate to those causes. A new question asked why a respondent would be unwilling to pay for renewable energy if they answered no to the scenario. Finally, the number of price offerings was adjusted to derive a more accurate demand curve from the data (see Pretest III). These changes are shown in the Pretest III Survey, a sample of which is in Appendix A.

Pretest III

Pretest III was administered in mid-October in the same location and manner as Pretest I, both for reasons of comparison and convenience. However, the pretest lasted three hours instead of one. Prices offered on the bundled and unbundled versions of pretest III were: $2, $8, $11, $14, $20, and $30. The weather was again favorable, and 40 surveys were completed by generally well educated subjects from a range of income, gender and age brackets. Twelve respondents replied that they would not pay the stated amount to support renewable energy (see Appendix C for results). The calculated demand curve for this data set is also shown in the Appendix, but an optimal price could not be obtained because the curve is continually upward sloping.

Based on these results and observations, the survey was modified to again reduce yea-saying and better reflect revealed preferences of the study population. Price offerings for supporting renewable energy were adjusted once again. Also, emphasis was placed on yearly costs instead of monthly costs of supporting renewable energy within the proposed program. Next, instead of asking if the subject donates to charitable causes, the question was rephrased to ask how much the subject donates to these causes. The key question as to whether a respondent

would pay to support renewable energy was adjusted to include an option that said "No, I would not pay this much, but would pay a lower amount." This was added to enable respondents to feel less guilty about saying "no" to a social cause, which Kotchen (2004) had found to be a significant factor in determining likelihood of purchase. A question directly related to yea-saying was also added, asking the subject to circle or state why they responded affirmatively that they would be willing to support renewable energy. This was changed from the previous pretest, in which respondents were asked why they would not support it. Choices for the new question include "renewable energy should be supported at any cost". If a respondent circled this choice, it was a strong indicator that they were yea-saying because they were likely not taking into account their budget constraint. The sample was thus eliminated from the data inputted into the model and demand curve derivations. Finally, a business-sized detachable card was added to the end of the survey containing a website where respondents could find more information about renewable energy and the group project. The website was maintained by a group project member and tagged with a counter to tabulate the number of hits from each version of the survey. This was added as an additional indicator of respondents' interest in RECs, assuming that a respondent who visited the website was more likely to buy a REC.

Pretest IV

The final pre-test was administered in late October in order to test the final draft of the survey before actual surveying in Davis. It was administered in the same time and manner as pretests I and III, for approximately three hours. REC prices offered in the survey scenarios were $2, $8, $11, $14, and $20. Survey administrators encouraged subjects to return their survey to a box instead of to the administrator in order to increase anonymity and thus the subject's comfort level in replying with realistic answers. This was another measure taken to reduce yea-saying.

A total of 39 surveys were completed, with 20 negative replies to the "would you pay" question. However, there were 10 surveys eliminated for yea-saying because the respondent circled "renewable energy should be supported at any cost". In addition, one survey was eliminated because the respondent wrote in a protest no. Website hits related to the survey were negligible. Raw data and derived demand curves can be seen in Appendix C. The resulting demand curve yielded an optimal price of $40.15. However, the demand curve for the combined data sets of pretests II, III, and IV shows an optimal price of $22.72.
No major changes were made for the Davis survey except for price offerings.

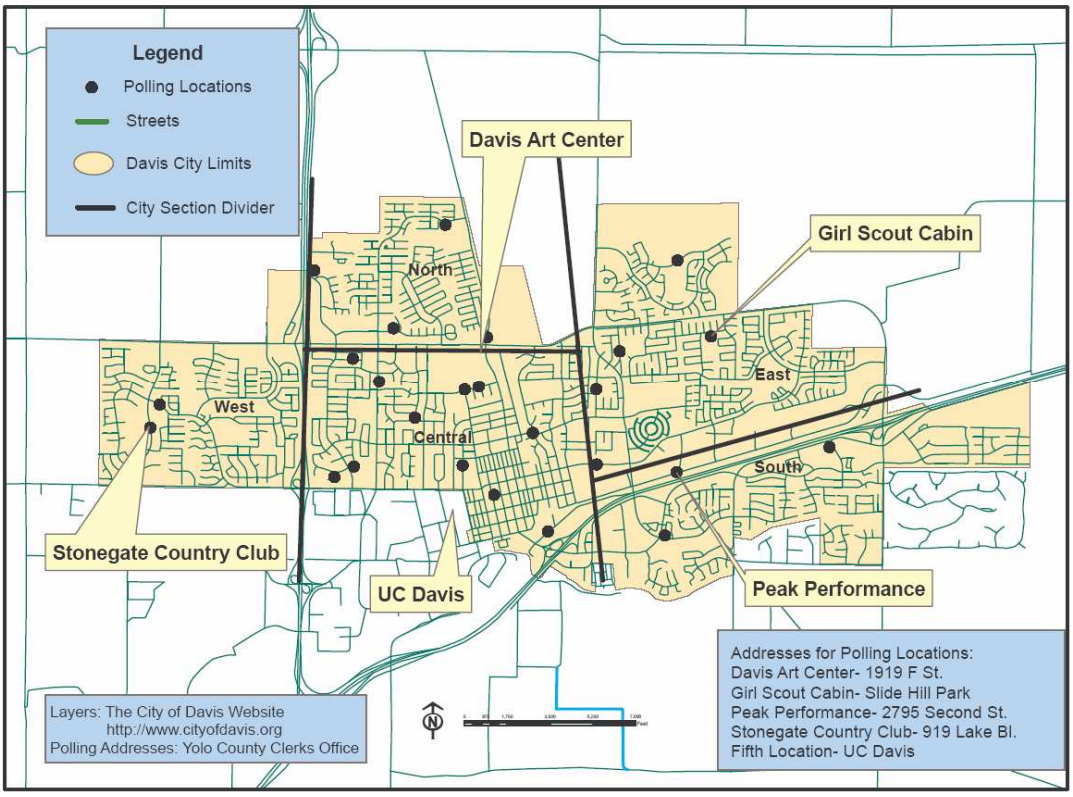
Case Study: Davis, California

The model and survey were applied as a case study in Davis, California. This area was chosen in support of a partner relationship with Renewable Ventures LLC, the owner/operator of the Photovoltaics for Utility Scale Applications (PVUSA) Facility in Davis. The case study included 397 survey responses, application of the demand model to survey data, and an internet-based REC sale.

Survey

The Davis survey was administered on election day, November 2, 2004, to residents as they were leaving polling stations throughout the city. Five polling stations were chosen for surveying based on recommendations from the Yolo County Clerk, Freddie Oakley (personal communication) for sites with populations representative of the Davis community and having high volumes of voters. The stations included: the Davis Arts Center, UC Davis campus, a Girl Scout Cabin in Slide Hill Park, Stonegate Country Club, and Peak Performance. These sites can be seen on the map in Figure 6.

Figure 6. Locations of Davis case study survey sites.



Price offerings for the bundled and unbundled versions of the survey were $2, $8, $12, $16, and $20. A greater number of prices were offered within the same range of values ($2-$20), to give more data points for the demand curve derivation. It was expected that the addition of the yea-saying question and other measures would reduce the yea-saying responses on the survey. A demand curve slightly lower than those from the Santa Barbara pretests was predicted, since corrections were made to the survey to minimize yea-saying. Results of the test are shown and discussed in the Results section.

Test Sale

A test sale followed analysis of the Davis test results. The sale attempted to emulate actual REC sale conditions as much as possible, using the optimal price derived from the survey. The RECs were marketed as an unbundled product, independent of commodity electricity. The purpose of the test sale was to find an additional indicator of demand for RECs in Davis. Another intention of the test sale was to determine the effectiveness of web based sales as a mechanism for REC purchase and distribution.

Four hundred marketing pieces in the form of doorhangers (see Appendix C) were distributed on foot to homes in the neighborhoods surrounding the locations of actual surveying. The pieces reflected literature research on REC marketing and incorporated recommended strategies such as: selling RECs over the internet, including a gift with purchase, encouraging residents to feel a sense of social responsibility, and reminding residents of the "close to home" location of the PVUSA facility (See "Recommendations for Marketing RECs in Davis" Section). The marketing pieces directed the reader to a website where RV RECs could be bought online: www.PVUSAsolar.com. A sticker supporting solar energy was advertised as a promotional gift to motivate buyers. The RECs are being sold at $25/750 kWh. Although the optimal price predicted by the model for an unbundled REC was approximately $22, the pilot sale price was rounded up to $25 to include shipping and handling charges, and the cost of the sticker.

Extrapolation to Other Populations

To further gauge the viability of the REC market, the model results were applied to other geographic areas in California.

Application of demand model to California. Using Census data, we were able to apply a reduced model derived from the survey to other regions in California. We assumed the REC was unbundled and priced at $21.38, the price at which revenue would be maximized based on the Davis data.

The Data. The Commerce Department makes available for public use a stratified sample of individual respondent data from the 2000 Census. More specifically, the samples are from 15.8% of all housing units that took the long-form Census. The samples are offered in two sets, a 1% and 5% and are called Public Use Microdata Samples (PUMS). The 5% PUMS divide each state into geographic areas, typically by county, where the population does not exceed 100,000. These areas are called Public Use Microdata Areas (PUMAs). Counties with high populations can have more than one PUMA if the 100,000 limitation is exceeded. Nationwide, the 5% PUMS provide individual records for over 14 million people. The 1% PUMS are delineated based upon a 400,000 population limitation. The 1% PUMS provide individual records for 2.8 million people. To predict demand of unbundled RECs in areas within California, we applied our derived demand model to the 5% PUMS sample.

Data extraction and conversion. The software program, MicroAnalyst was used to extract the records of Californians, ages eighteen and over from the US PUMS dataset. A Matlab program was then created to convert the PUMS data from the coded values to numerical values needed for our model. Additionally, a second Matlab program was created to separate

the records out by PUMA to ensure the calculations of predicted buyers performed more efficiently.

The reduced model and calculations. In addition to defining the offered REC product as being unbundled and priced at $18.95 the other explanatory variables of the model to predict demand were limited to the explanatory variables used in our survey as well as those in the 2000 Census. Those included gender, age, educational attainment, and household income. The model was as follows.

probability("yes") = exp(Z) / 1+exp(Z)

$Z = X_iB_i$ (X_i: Price, Bundled, Gender, Age, Educational Attainment, Household Income.)

To predict the total number of people in each given PUMA that would purchase a REC, we multiplied the probability("yes") by the weights (Weights) as provided by the Census. The weights represent the relative frequency of a similar type of person in the PUMA. They are used to estimate total populations of particular types of people within the PUMA sample. Within a particular PUMA, for each person in the sample (N) the probability("yes") was multiplied by the Weight. The products are summed to obtain the total number of people predicted to purchase within the PUMA. This is represented mathematically below.

$$\text{Predicted buyers in a particular PUMA} = \sum_N ((Logit(\$21.38, Z)_N) * Weight_N))$$

To calculate the proportion of predicted buyers within each PUMA, the above total was divided by the sum of $Weight_N$.

Uncertainties. These estimates are based upon our model, the weights discussed above, and the U.S. Census data. The uncertainties associated with our model stem from the possible sampling errors of our survey and the assumptions of the model as were previously stated. The uncertainties related to the 2000 Census and its weights are also related to sampling and non-sampling errors of the protocol used by the U.S. government. The sampling error is a result of the data not being obtained from 100% of the population. The non-sampling errors are a result of the various complex operations used to collect and process the data. (US Department of Commerce, 2004)

Geographic Representation. Following the calculation of the predicted proportion of buyers in each PUMA, the results are represented geographically using GIS. In order to illustrate the results of the predicted buyers in each county throughout California, a map was created in ArcGIS. GIS layers, including counties, PUMS, and cities were extracted from census website. Then the predicted buying information was joined with the California PUMS shape file. Before the data was joined three new attributes were created to match the outputs from the MicroAnalyst and Matlab outputs. In order to join the data to the existing dataset, an excel spreadsheet was used to match the PUMS from the generated data to the PUMS in GIS layer. Once the PUMS were matched, the data was imported and saved into the existing attribute table associated with the PUMS layer. After all the required data were synthesized, PUMS areas were assigned specific buying percentages, through a process of defining colors to certain percentage ranges. The percentages ranged from 19 to 35 %, so, for the purpose of simplicity, the PUMS were group into four categories based on their percentage. The resultant map showed four distinct colors indicating in which percentage range each PUMS

fell. The PUMS with relatively high buying percentages were then matched with their corresponding counties.

Results

Survey

Three hundred seventy-nine surveys were completed. The raw data for the Davis Survey are found in Appendix B. Eighty surveys were eliminated from the data set for potential yea-saying. Demographically, the sample population was a close match to the overall Davis population, as shown in Table 4. The demographics of the sample set were 50% male, 50% female, a median annual income range of $40,000- $69,000, and an age range of 25 – 34 years old. Davis as a whole is 48% male, 52% female, and has a median income of $42,454 and a median age of 25.2 years old (DOE).

Table 4. Demographics comparison of case study sample population to city of Davis population

Demographic	Survey Sample	City of Davis
Male	50%	48%
Female	50%	52%
Median Income	$40,000-69,000	$42,454
Age	25-34	25.2

Source:CAPWEB, http://www.capweb.net/politics/USA/CA/Yolo/Davis/

Model

All modeling was done on the Davis dataset after yea-saying surveys had been eliminated. Some of the optimal prices for RECs fall outside of the range of bid prices for the RECs, meaning the optimal price was extrapolated instead of interpolated. The highest bid price for a REC was $20.

The parameters of the model showing a significance level of greater than 0.1 were: the price offering of the REC, whether the REC was sold bundled or unbundled, the location of the polling station at which the survey was administered (for only two of the five polling stations), and annual household income. Table 5 presents the coefficient estimates, p-value value, and marginal elasticities for each parameter in tabular form. The optimal REC price, regardless of whether the REC was bundled or unbundled, was $20.62/750 kWh, at which 24.98% of the population is predicted to buy.

Table 5. Summary of Davis Survey Results using all modeled parameters ("full form")

Coefficients:	Estimate	Pr(>|z|)		ME
informed	0.109	0.693		0.026
donate	0.001	0.113		0.000
bid	-0.069	0.001	*	-0.016
bundled	0.713	0.005	*	0.170
male	0.062	0.813		0.015
age	-0.017	0.177		-0.004
education	-0.022	0.691		-0.005
income	0.000	0.096	*	0.000
partydemocrat	0.756	0.513		0.180
partyother	0.905	0.439		0.215
partyrepublican	0.327	0.771		0.078
electricpge	-0.117	0.719		-0.028
electricsmud	-0.010	0.974		-0.002
take_info	0.201	0.544		0.048
locationgirlscout	0.024	0.960		0.006
locationpeak	-0.909	0.076	*	-0.216
locationstone	-0.194	0.690		-0.046
locationucd	-0.999	0.079	*	-0.238

Explanations:

ME	Marginal Elasticity
Significance code: *	$p < 0.1$
informed	respondent is informed about renewable energy
donate	amount respondent donates to charitable causes
bid	price offered for REC
bundled	REC offered as bundled product (instead of unbundled)
male	respondent is male
age	respondent's age range
education	respondent's education level
income	respondent's income range
partydemocrat	respondent votes democrat
partyother	respondent votes neither democrat nor republican
partyrepublican	respondent votes republican
electricpge	respondent prefers PGE
electricsmud	respondent prefers SMUD
take_info	respondent took information card from survey
locationgirlscout	survey taken at girl scout cabin
locationpeak	survey taken at Peak Performance station
locationstone	survey taken at Stonegate Country Club
locationucd	survey taken on UC-Davis campus

The model was also run for only the significant parameters, excluding polling location (since not all locations were significant, no polling stations were considered in the reduced form of the regression). The results of this reduced form regression are shown in Table 6.

Table 6. Reduced form regression results, modeling only parameters with p < 0.1 (excluding location)

Coefficients:	Estimate	Pr(>|z|)		ME
bid	-0.079	5.03E-07	***	-0.019
bundled	0.571	0.015	*	0.138
income	5.55E-06	0.064	+	1.3E-06

ME = Marginal Elasticity
Signif. codes: `***' 0.001 `**' 0.01 `*' 0.05 `+' 0.1

The price offering ("bid") had a negative coefficient with a marginal elasticity of -0.02 ($p < 0.000$). The marginal elasticity is the change in proportion of people willing to buy a REC for each unit increase in the given parameter. For example, if the price of the 750kWh REC increased by $1, and all other factors were held constant, the proportion of the population who would buy that REC would decrease by 0.02. Although this affect was slight, it is statistically highly significant, and thus a good indicator of a respondent's willingness to pay for a REC. As one would expect, this result shows that a higher price leads to a decreased proportion of individuals who would buy a REC.

The vehicle of sale for a REC ("bundled") showed a positive coefficient and a marginal elasticity of 0.14 ($p < 0.015$), meaning Davis residents showed a greater willingness to pay for bundled RECs than unbundled. Since the "bundled" parameter is dichotomous (either the REC is bundled or it isn't), the marginal elasticity shows us the difference in demand between bundled and unbundled RECs. In other words, if the exact same population were given the choice of buying a REC bundled or unbundled, and all other factors were kept the same, then 13.8% more people would buy the bundled REC16.

The coefficient for income level was also positive, with a very small marginal elasticity of 1.3E-06 ($p < 0.064$). The means that if two person's incomes differed by $10,000, the person with the higher income would be 1.3% more likely to buy a REC. The signs of each significant parameter were consistent with marketing and REC literature research findings.

The optimal price for a REC, again regardless of whether it was bundled or unbundled, was determined using the reduced model, accounting only for parameters that had a significance of $p < 0.1$. The optimal price was found to be $18.50 /750 kWh, at which 30.12 % of the population is expected to buy.

Figures 7 and 8 show estimated demand curves accounting for whether the REC is bundled or unbundled, which directly addresses one of the primary questions of the group project.

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16 The marginal elasticity is a change in proportion of population estimated to buy a REC/unit. Changing this from proportion to percent requires a increase in magnitude by a factor of 100.

Figure 7. Estimated Demand Curve for Bundled RECs in Davis.

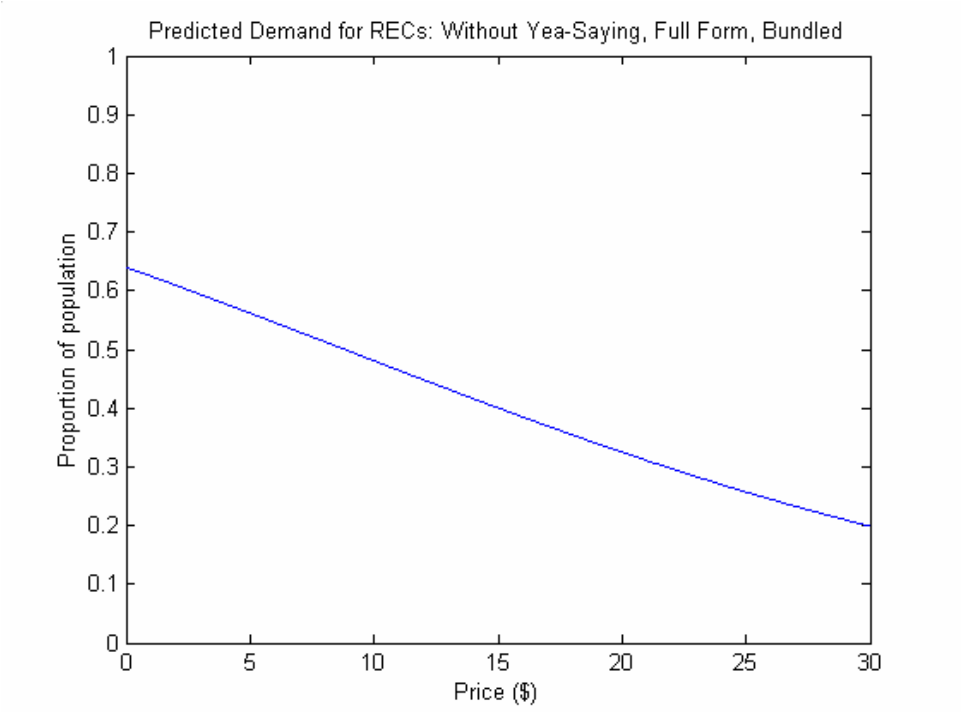
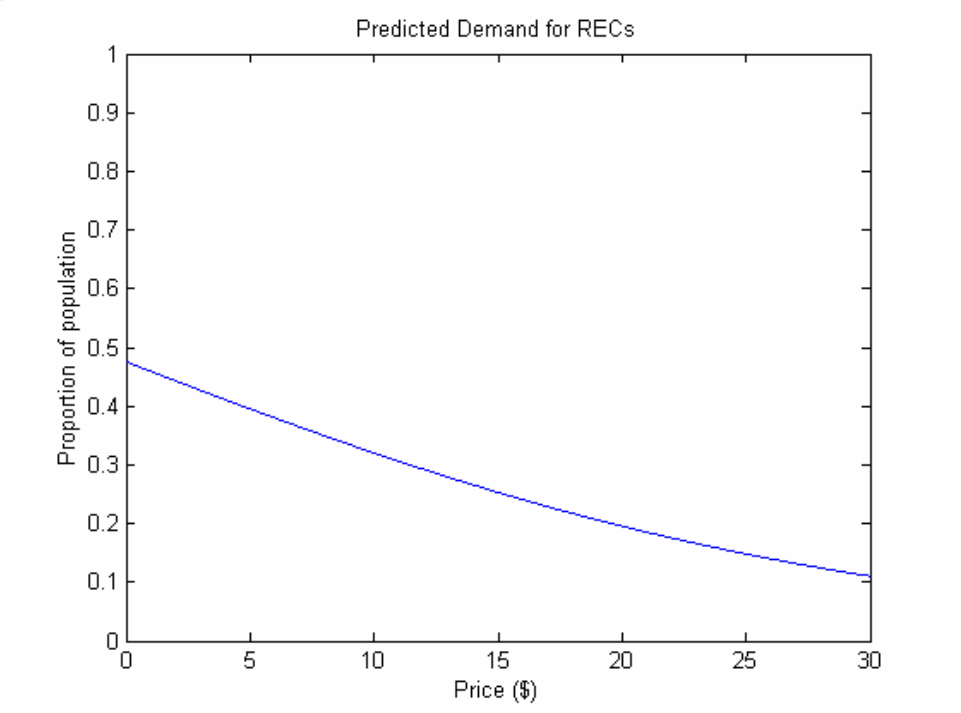


Figure 8. Estimated Demand Curve for Unbundled RECs in Davis.



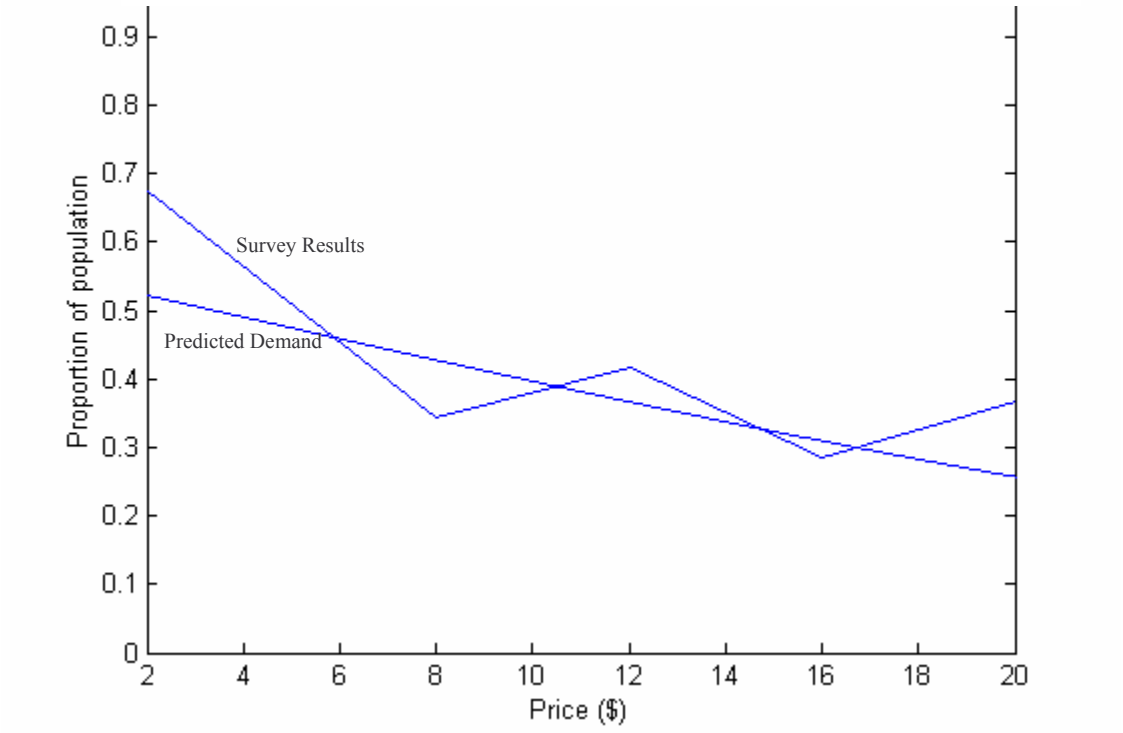
The optimal price for a bundled REC was $21.73, with 30.09% of the Davis population expected to buy at that price. The optimal price for an unbundled REC was $18.95, with 20.71% of the population expected to buy. These prices are consistent with actual REC prices being sold in the country today (see Tables 1 & 2). The prices also reflect that people are slightly more willing to pay a premium for a bundled REC than an unbundled REC.

Table 7 breaks down the proportion of population predicted to buy RECs based on bid price, while Figure 9 compares the modeled demand curve with the actual survey results:

Table 7. Predicted proportions of the population willing to buy RECs at various bid prices.

Full Form Regression					
Price	$2	$8	$12	$16	$20
Proportions Estimated to buy a REC	67%	34%	42%	29%	37%

Figure 9. Predicted Demand for RECs vs. Actual Proportions at Bid Prices.



Test Sale

After four weeks of distribution of a single round of promotional doorhangers marketing REC sales in Davis, one REC sale was completed.

Extrapolation of Results: California

Extrapolation to other possible markets in California was determined using the Microanalyst/GIS results discussed in the survey section. Nine counties were identified as possible markets based on the high percentage of buyers predicted by the model and subsequent analysis (see Table 8).

Table 8: California Counties with a high predicted percentage of REC buyers.

County	Buying Percentage
Marin	27
San Mateo	32
Alameda	28
Orange	30
Ventura	27
Los Angeles	31
San Diego	27
Contra Costa	34
Santa Clara	34

The buying percentages for counties in California were estimated with the regression model using price, bundled, gender, age, education, and income. The results of the regression are listed in Table 9.

Table 9. Regression results of the model used to extrapolate to other parts of California (reduced).

Coefficients:	Estimate	Pr(>|z|)		ME
REC price offering	-0.073	0.000	*	-0.017
REC is bundled	0.608	0.012	*	0.146
Survey participant is male	0.018	0.942		0.004
Age of survey participant	-0.001	0.923		0.000
Education level	-0.012	0.704		-0.003
Annual household income	0.000	0.077	*	0.000

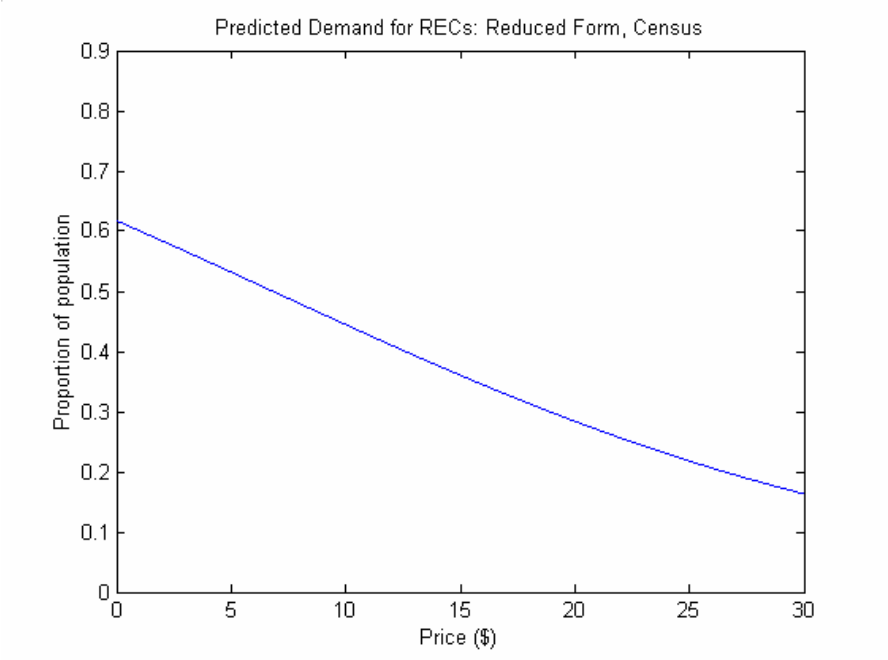
ME = Marginal Elasticity
Signif. codes: * P< 0.1

These results from the extrapolated census data show that the significant parameters ($p < 0.1$) were price, bundled, and income. This is consistent with the other findings from the survey. Of note is that both age and education level show negative coefficients, meaning a higher age and lower education level predict a greater willingness to pay, which contradicts both

literature findings and current market sales for RECs. However, these coefficients are also statistically insignificant, and therefore not considered for REC marketing recommendations.

The demand curve for the applied census model in figure 10 illustrates the same general trends as other demand curves from the survey. Using the reduced form of the model, including only price, bundled, gender, age, education, and income, the price and percentage of buyers that maximized the revenue are $21.66 and 34.98% respectively.

Figure 10. Demand curve resulting from model used to extrapolate to other parts of California.



Discussion

Model and Survey

The results of the pretest surveys confirmed literature which states that contingent valuation surveys are difficult to perform in such a way as to obtain true willingness to pay. However, the results of the actual Davis test suggest that a reasonable estimate of residents' WTP for RECs was attained, since the results are consistent with actual REC market prices (See Tables 1 & 2). The amount of yea-saying in the Davis survey predicted from a single indicator (question 4b) suggests that biased answering was prevalent. Eighty of 395 surveys were removed from the data pool as a result of this indicator. Subjects likely wanted to please administrators of survey by answering as they thought they were expected to, or failed to answer realistically given a hypothetical scenario. Stated preferences often do not match

revealed preferences. However, the NOAA contingent valuation protocol was generally followed for each survey iteration. Using the yea-saying question as an indicator to eliminate potentially biased surveys before the model analysis of the data likely increased the accuracy of the parameter coefficient estimates, despite decreasing the sample size of the test. The resulting optimal REC price for an unbundled product is approximately 2.5 cents per kWh. This value falls at the low end of the price range of 2.5-3.5 cents per kilowatt hour found in similar markets for RECs (Table 2).

Also, the sample population for the test survey was not randomly selected as is the ideal for a scientific survey. However, the sites were chosen to represent the diversity within Davis, and a comparison of demographic characteristics between the sample population and the population of Davis as a whole show adequate representation for gender, age and income (see Table 4).

The fact that REC price, resident income level, and whether the REC is bundled or not were found to be significant factors in determining demand supports current literature findings regarding willingness to pay for RECs. Contrary to some published literature, parameters such as age, education, and political affiliation were found to statistically insignificant in this case study. Often, contingent valuation studies on the RECs reflect different demographic and lifestyle factors being significant, emphasizing the difficulties in accurately determining public willingness to pay via contingent valuation surveying. An second Davis survey with resources allowing for more time and depth of questioning would be a means of verifying the case study results. Additionally, it is important to note that certain variables in addition to those measured in this study may be important indicators of willingness-to-pay, and could be a direction for further research.

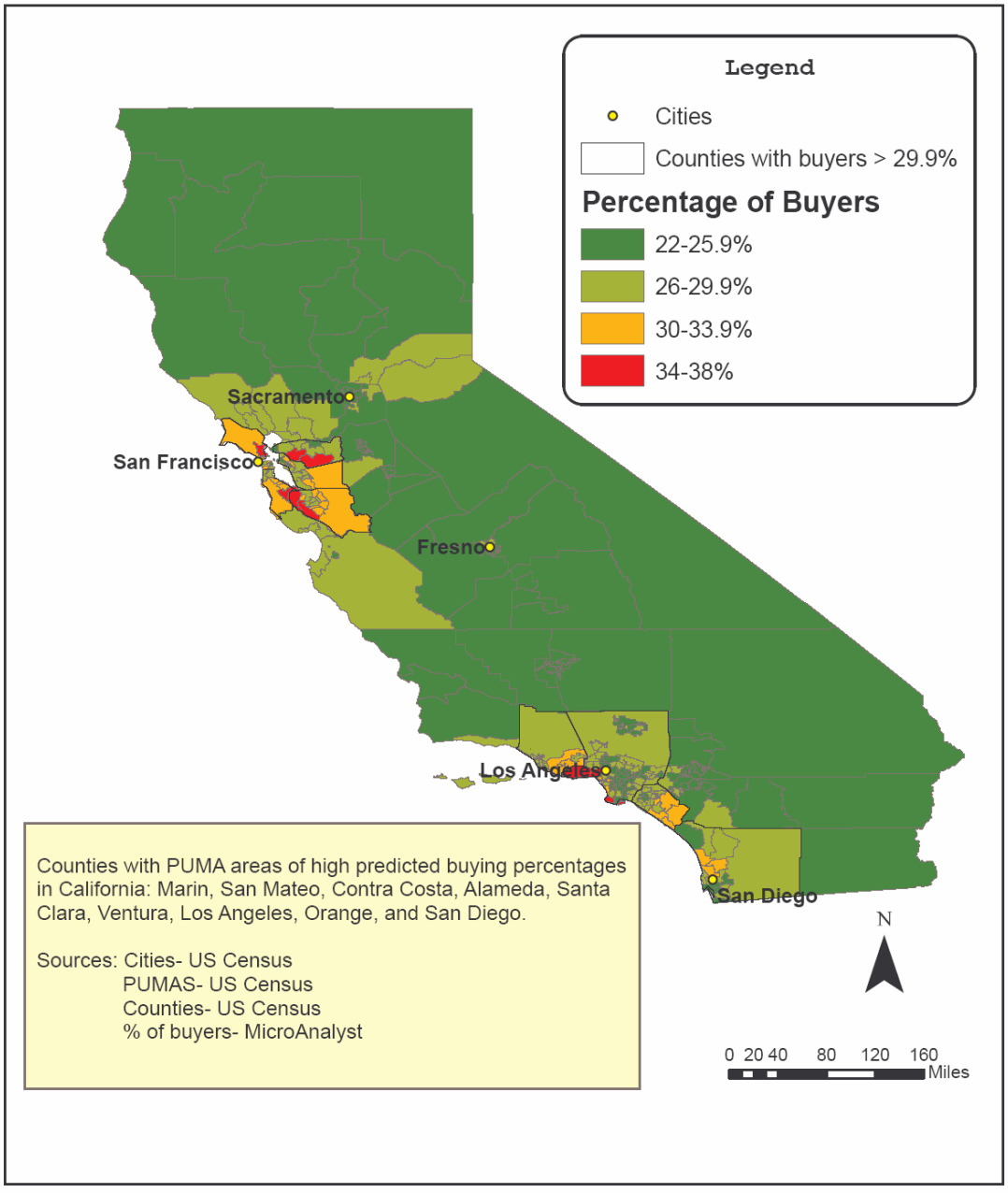
Test Sale

The test sale results likely diverged from predicted results because the REC market in Davis has not yet been penetrated. Wiser, et al. (2001) emphasizes that RECs are a new market, and that it takes time to create a consumer base for any new market, particularly green power. As the market grows, and potential consumers are increasingly educated about the product, it is expected that actual product sales would more closely match predicted results.

Model Extrapolation: California

The results of extrapolation indicate where the best places to focus possible growth and marketing in California. If the client plans to expand its operations, it might want to consider what areas of California are best to explore. The map in Figure 11 illustrates the results of the extrapolation analysis. After careful analysis, the map shows that Marin, Contra Costa, San Mateo, Alameda, Santa Clara, Los Angeles, Ventura, Orange and San Diego counties are the most beneficial places to seek possible expansion.

Figure 11. Map of potential REC markets in California



Marketing RECs

Once a good understanding of the green consumer has been established, marketing can be considered. To take full advantage of the knowledge acquired from the survey and model results, first the options for the sales vehicle should be taken into account. Then, specific marketing options can be implemented.

Profiling the Green Consumer

Who is willing to pay? The only statistically significant demographic predictor of green consumption in this study was income. The estimated coefficient for income was very flat, but positive (coeff estimate = 7.6E-06, $p < 0.096$) suggesting that the more money a household earns, the more likely the household is to buy a REC. This is consistent with similar studies' conclusions. While the other variables, such as age, education, gender, political affiliation, charitable donations, and utility preference, can not be statistically distinguished from zero, the signs of the coefficients might still help to understand trends in the marketing demographics. The age variable can not be distinguished from zero; however the coefficient is negative (-0.017, $p< .177$), which indicates that the younger the population in Davis might be more willing to buy RECs. In this model, the coefficient on education was negative (-0.022, $p< 0.691$), suggesting that more educated consumers may be less likely to buy RECs (though only slightly). However, education was found in some studies to be a good indication of whether or not people are willing to buy.

Marketing Options and Recommendations in Davis

Options. Based on the results of the research, there are two basic avenues Renewable Ventures can take:

1. Sell unbundled RECs directly to consumers
2. Bundle the RECs with the existing utility

Unbundled. Selling unbundled RECs directly to the local public through various channels of communication is the most logical choice. While people state a higher value for bundled RECs the difference is not great enough to warrant the significant time, energy and money in order to implement a joint venture with the utilities in the area. Like any market the amount of customers grows slowly at first. Growth of new markets follows an S-shaped curve. Slow growth gives way to fast growth which finally gives way to a flattening of new customers. As more and more REC products are offered and people are educated about their beneficial attributes, more people are enticed to buy these products. One of the major obstacles to selling RECs is the education factor. Some research shows most people are in favor of using renewable sources of energy. However, most people think renewable energy is still a futuristic idea. Based on current companies in the market of selling RECs, the internet is the most common forum to sell RECs. By using a website along with some advertising in the community, Renewable Ventures should be able to foster a relationship with residents in Davis. In order to give the customer some flexibility when purchasing a REC, they should be offered in a few different size blocks. In general, these blocks represent approximately 25%,

50%, 75% and 100% of the purchaser's electricity use. For an average Davis resident, the blocks offered might be 150, 350, 550, and 750 kWh. The price charged for these RECs is base on the 750 kWh estimation of $18.95. Smaller blocks are adjusted accordingly. Another way to break down the amount of renewable energy purchased is to sell 100 kWh blocks.

Bundled. The option of selling the RECs through the local utility is another possibility. However, this would require an agreement with the utility in question, PG&E. The logistics of selling RECs through a bundled product are more involved than selling unbundled RECs straight to the consumer. The benefit of offering the bundled product is twofold. First, the results of the survey show that people are more willing to invest in renewable energy when a more tangible good is involved. Second, utilities have built in customer base that is easy to target. The participation rate will most likely hover around 2 %, but, depending on the amount of customers, this might be enough to sell all the possible RECs produced from PVUSA.

Marketing Recommendations in Davis. General marketing principles influence who the target consumers are over time. The goal of the client is to grow the consumer base to sufficiently cover all the RECs produced in any given year.

The initial target market consists of those people with stronger pro-environmental tendencies. The amount of energy, time and money needed to incorporate these people into the consumer base is low. While a broad range of people are willing to spend money on supporting the environment, if all other attributes are equal, previous research shows that people willing to buy RECs are generally younger, more educated and wealthier. The results of this survey indicate only that wealthier people are more willing to buy RECs. We can classify this group as the "innovators and early adopters" (Wiser and Holt, 1999) or as the "True-Blue Greens and Greenbacks" (Ottman, 1998). These innovators are people willing "to pay extra for environmentally preferable products." They are the altruists. Once the environmental altruists are educated about REC availability, the local environmental attributes that PVUSA provides, and the effect they can have on their own community, a chain of events will be set in motion. The community or social pressures will be exerted driving the more marginal environmental players to considering buying RECs.

There are a few basic marketing recommendations for the Davis community that employ the previously stated good marketing techniques. All the techniques that should be emphasized in Davis revolve around the sense of community. There are niches in Davis where the sense of social propriety is strong. These areas of the community can be exploited to sell the appropriate amount of RECs. There are a few built in social institutions in Davis that can serve as the driving force to marketing the RECs. First, the university is the largest employer in town. It also houses a large student population. There are also communities within the university that will be more apt to buy. These groups such as environmentally focused clubs and departments can be targeted. Next, the co-ops and farmers market are good market targets to involve the community. Consumers that shop in these areas tend to be environmentally inclined.

Any advertising should emphasize the fact that PVUSA is a local facility. The environmental benefits to society are felt in the community where the RECs are being marketed. There are a

few major marketing implications of the facility being local: one, the environmental and health benefits of clean energy sources are realized in the community and two, locals can feel a sense of environmental pride. While the energy produced does not necessarily go to the people of Davis they at least get the sense of good will that comes with the generation of clean energy sources.

Another avenue to pursue in the marketing of RECs is the offsetting of pollution generated by persons in the community. This is a way of exacerbating the guilt people might feel from using the energy they currently use. There are multiple ways to emphasize people's energy consumption habits. First, the marketing can attempt to get people to offset the amount of electricity they use in their house every week. Another option is get people to offset the amount of pollution they cause by driving each day. Davis is famous for its cycling affinity, so people are already conscious on some level that driving causes detriment to the environment. A few other common focus points are air travel and recreational activities, especially ones that involve being in nature (skiing, boating, etc.). Using guilt to promote sales can be a good marketing technique to sell environmental products. If the marketing makes people aware of the harm that these activities have to the environment, they might be willing to purchase more RECs. The key to this method is to have a pollution calculator accessible to the consumer, most likely on a website, so they can answer a few questions to find exactly how many RECs they need to purchase in order to offset their activities. Currently various websites have examples of pollution footprint calculators which can be used as a model for Renewable Ventures (e.g. www.safeclimate.com/calculator and www.airhead.org/Calculator).

Recommendations for marketing RECs elsewhere

Other cities/ demographic populations. By using the using the PUMS census data, we can isolate counties that might be good areas in which to expand the sale of RECs. Using a combination of MicroAnalyst, Matlab, and ArcGIS, we are able to map California based on the percentage of people per PUMA who are willing to buy RECs at the price of $18.95 per 750kWh. Similar marketing techniques used in Davis will most likely be effective in these areas.

Marketing to businesses. Another option Renewable Ventures might pursue is the sale of RECs to businesses that want to green their images. In general, it might be harder to get the highest premium for RECs as business take into account the bottom line more often than not. There are examples of companies that want to make sure there environmental footprint is as small as possible. In these cases, RV could still sell RECs at a high premium. One possibility to investigate is the University of California, Davis (UCD). It might be possible to influence student groups to pressure the administration to purchase RECs from RV. UCD currently has long-term agreements with other energy companies to purchase their electricity which would hinder negotiations.

Future Recommendations

While the results of the study fall within an expected range of values established in the literature by other renewable energy producers, only actual implementation will truly validate the results. Also, improvements can be made to tease out even more accurate prices. With more abundant resources the resolution of the study would be refined. In the future, RV

might consider doing a more extensive study of both Davis and any other areas they want to explore. The sample size was limited by time and money restrictions due to the nature of the project. The larger the sample size is the more accurate the data. Different survey questions might be considered to determine the effect of offering smaller blocks of energy per REC instead of varying the price.

Conclusion

Renewable energy certificates (RECs) are seen as a potentially crucial market mechanism for increasing the economic viability of renewable energy. Knowing the demand and value of RECs can help determine whether or not specific renewable energy projects are implemented. Unfortunately, there is only a limited amount of historical data available from voluntary green power and compulsory RPS markets and little research has been performed to determine the public demand and value of the non-use portion of renewable energy embodied in unbundled RECs.

This paper addressed the issue of public demand for RECs through the formation of an economic model and contingent valuation survey that were applied as a case study in Davis, California. The model and survey design were structured in accordance with related research in the fields of contingent valuation for environmental goods and previous studies pertaining to public preference for green power. The unique aspect of this study involved the use of two vehicles for delivering RECs to the public. This took form as two basic versions of the survey, one offering green power from the existing utility and the other offering unbundled RECs from a private company. In addition to the model and survey, a test sale was performed to provide further evidence of the actual public demand for RECs within Davis.

The model presented in this study found that optimal prices to maximize revenue for 750kWh are $19 for an unbundled product and $22 for a bundled product. These prices are consistent with what is offered in existing green power and unbundled REC markets. The findings diverge from existing green power markets with regards to subscription levels. The model predicts 30% and 20% of the public will purchase bundled and unbundled REC products respectively. Actual green power programs have subscription levels that are generally less than 5% and the simple test sale results suggest initial penetration rates of less than one percent. This disparity, however, is consistent with other models and surveys pertaining to public demand and willingness-to-pay for environmental goods and ecosystem services. A potential reason for why the disparity occurs is related to the theoretical s-curve for market penetration. The percentage of people willing to purchase RECs predicted by the model may correspond to a period on the s-curve when the “late-majority” and “laggards” are entering the market. In reality, REC markets are extremely young and better characterized as existing in the “innovator” or “early adopter" phases.

Research shows marketing efforts that focus on independently increasing education, emphasizing social responsibility, assuring their customers their contributions make a difference, and seeking to increase the RECs private value will likely increase the rate of participation among the general public. This study showed that variables such as income, REC price, and whether the REC is bundled or unbundled are significant in estimating public demand for RECs. This finding is consistent with published literature. It also showed that variables such as education, age, gender, political affiliation, and general knowledge about

renewable energy use were not significant indicators of demand. This is inconsistent with some published literature, providing incentive for further studies on REC demand. Based on the reduced model derived from the case study survey, efforts to sell RECs in California will likely see the best results in the counties of Marin, Contra Costa, San Mateo, Alameda, Santa Clara, Los Angeles, Ventura, Orange and San Diego.

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Appendix A: Sample Pretest Surveys

University of California, Santa Barbara
Donald Bren School of
Environmental Science & Management

The University of California is conducting this independent survey to help shape future energy policy. <u>There are no right or wrong answers to these questions</u>. We want to know <u>your</u> preferences.

The answers you provide will be used as part of a graduate research project related to electricity generation. All the information derived from the survey is confidential. Your name and identity will never be associated with your answers.

1. Before the California energy crisis in 2001, California residents were offered "green electricity." Did you ever purchase it?
   1. No.
   2. Yes.
   3. I can't remember.

2. How much do you know about the environmental impacts of electricity production?

Nothing				A Lot
1	2	3	4	5

Background Information.
Renewable energy sources in the U.S. include wind turbines, solar power, geothermal, and biomass. Below are some potential "benefits" and potential "drawbacks" of renewable energy.

Benefits	Drawbacks
Reduces our dependence on any one type of electricity generation	May not be available when we need it because the supply of some types of renewable energy depends on weather
Preserves the amount of natural gas and coal for future generations	Could be more costly than other ways of reducing pollution
Can create new jobs	May not be abundant enough for widespread use
Stimulates new technologies	Receives subsidies, requiring tax budget allocation
May be less threatening to the environment	Could have some environmental drawbacks

When answering the following question, please consider that the money you spend to support renewable energy will decrease the amount of money available for other household items and charities. Keep in mind that increasing the supply of renewable energy is one of several ways to reduce the environmental impacts of electricity production.

3. Suppose your local City Council is considering a program where all homes and businesses would be given the opportunity to **voluntarily** help support renewable energy. **By paying a $2 per month charge on their electric utility bill for 3 years, homes and businesses will help increase the supply of renewable energy.** This charge will be used to build more renewable energy projects and support existing ones. Because the program is voluntary, some homes and business may not decide to support it.

Data from the US EPA shows that for each household, a charge of $8 / month for three years will provide the same environmental benefits as not driving a car a total of 192,000 miles. If every home and business

(over)

Parent sample

3. (continued)
were to pay this surcharge, renewable energy production in the United States would increase from 2% to 18%.

Remembering that all homes and businesses in your city will be able to individually decide whether or not to contribute, and that many homes may decide not to pay, would your household voluntarily **pay the $2 a month charge for 3 years**? *Please circle one.*

1. No 2. Yes

Question for "Unbundled Product" Version of Survey:

3. Suppose your local City Council is considering a program where all homes and businesses would be given the opportunity to **voluntarily** help support renewable energy. **By paying $13 per month for three years to an independent company, homes and business will help increase the supply of renewable energy.** This charge will be used to build more renewable energy projects and support existing ones. Because the program is voluntary, some homes and business may not decide to support it.

Data from the US EPA shows that for each household, a charge of $8 / month for three years will provide the same environmental benefits as not driving a car a total of 192,000 miles. If every home and business
3. (continued)
were to pay this surcharge, renewable energy production in the United States would increase from 2% to 18%.

Remembering that all homes and businesses in your city will be able to individually decide whether or not to contribute, and that many homes may decide not to pay, would your household voluntarily **pay the $13 a month charge for 3 years**? *Please circle one.*

1. No 2. Yes

About you.
These last few questions will help us understand how well you and other respondents of the survey represent local residents. *Please circle the corresponding choice.*

4. Gender: Male Female

5. Age.
1. 18 to 24 years.
2. 25 to 34 years.
3. 35 to 44 years.
4. 44 to 54 years.
5. 55 to 64 years.
6. 65 years or over.

6. What is the highest grade or year of school you have completed?
1. Grade school.
2. High school.
3. Some college but no degree.
4. Associate degree.
5. Bachelor's degree.
6. Post graduate.

7. Below is a list of income categories. Which income category best describes your household's income for the year 2003, before taxes?

(over)

Pretest Sample

1. Less than $10,000.
2. $10,000 - $39,999.
3. $40,000 - $69,999.
4. $70,000 - $99,999.
5. $100,000 or more.

8. In the last presidential election, from which party was the candidate you voted for?
   1. Republican.
   1. Democratic.
   3. Other.

9. If you could choose between SMUD (Sacramento Municipal Utility District) and PG&E (Pacific Gas and Electric Company) as your electricity provider, which would you choose?
   1. SMUD
   2. PG&E
   3. Neither/I have no preference

10. Where do you live?
   1. Davis
   2. Sacramento
   3. Woodland
   4. Winters
   5. Vacaville
   6. Other

Thank you for your time.

Pretest I Sample

(over)

University of California, Santa Barbara
Donald Bren School of
Environmental Science & Management

The University of California is conducting this independent survey to help shape future energy policy. There are no right or wrong answers to these questions. We want to know your preferences.

The answers you provide will be used as part of a graduate research project related to electricity generation. All the demographic information derived from the survey is confidential. Your name and identity will never be associated with your answers.

1. Before the California energy crisis in 2001, California residents were offered "green electricity." Did you ever purchase it? *Please circle one.*

1. No. 2. Yes. 3. I can't remember.

2. How much do you know about the environmental impacts of electricity production? *Please circle one.*

Nothing 1 → 2 → 3 → 4 → A Lot 5

Background Information
Renewable energy sources in the U.S. include wind turbines, solar power, geothermal, and biomass. Below are some potential "benefits" and potential "drawbacks" of renewable energy.

Renewable Energy Benefits	Renewable Energy Drawbacks
Reduces dependence on single electricity source	Some types are weather dependent
Preserves fossil fuels for future generations	Can be a more costly way of reducing pollution
Can create new jobs	May not be abundant enough for widespread use
Stimulates new technologies	Receives tax supported subsidies
May be less threatening to the environment	Could have some environmental drawbacks

When answering the next question, please consider the following:
- **money spent to support renewable energy decreases the amount available for other household items and charities.**
- **increasing the supply of renewable energy is one of several ways to reduce the environmental impacts of electricity production.**
- **the average electricity bill in Yolo County is $86/month.**

3. Suppose your local City Council is considering a program where all homes and businesses would be given the opportunity to **voluntarily** help support renewable energy. **By paying a $20 per month surcharge on their electric utility bill for 3 years, homes and businesses will help increase the supply of renewable energy.** This surcharge will be used to build more renewable energy projects and support existing ones. Because the program is voluntary, some homes and business may not decide to support it.

Data from the US EPA shows that,
- for each household, a surcharge of $20 per month for three years provides the same environmental benefits as not driving a car a total of 480,000 miles.

Pilot Test Sample

- if every home and business were to pay this surcharge for three years, renewable energy production in the United States would increase from 2% to 42%.

(over)

University of California, Santa Barbara
Donald Bren School of
Environmental Science & Management

3. Continued

When answering the question please remember the following:

- All homes and businesses in your city will be able to individually decide whether or not to contribute.
- The average electricity bill is $86/month without the surcharge.

With the previous information in mind, would your household voluntarily **pay the $20 per month surcharge on your electricity bill for 3 years (equal to $240 per year and $720 over the life of the program in addition to your normal electricity bill)**? *Please circle one.*

1. No, I would not pay the surcharge.
2. Yes, I would pay the surcharge.

Question for "Unbundled Product" Version of Survey:

With the previous information in mind, would your household voluntarily **pay the $8 per month fee to a private company for 3 years (equal to $96 per year and $288 over the life of the program)**? *Please circle one.*

1. No, I would not pay the fee.
2. Yes, I would pay the fee.

About you.

These last few questions will help us understand how well you and other respondents of the survey represent local residents. *Please circle the corresponding choice.*

4. Gender: *Please circle one.*
   1. Male
   2. Female

5. Age. *Please circle one.*
   1. 18 to 24 years.
   2. 25 to 34 years.
   3. 35 to 44 years.
   4. 44 to 54 years.
   5. 55 to 64 years.
   6. 65 years or over.

6. What is the highest grade or year of school you have completed? *Please circle one.*
   1. Grade school.
   2. High school.
   3. Some college but no degree.
   4. Associate degree.
   5. Bachelor's degree.
   6. Post graduate.

7. Below is a list of income categories. Which income category best describes your household's income for the year 2003, before taxes? *Please circle one.*
   1. Less than $10,000.
   2. $10,000 - $39,999.
   3. $40,000 - $69,999.
   4. $70,000 - $99,999.
   5. $100,000 or more.

8. In the last presidential election, from which party was the candidate you voted for? *Please circle one.*
   1. Republican.
   2. Democratic
   3. Other

Pilot Test II Sample

9. If you could choose between SMUD (Sacramento Municipal Utility District) and PG&E (Pacific Gas and Electric Company) as your electricity provider, which would you choose?

1. SMUD 2. PG&E 3. Neither/I have no preference

10. Where do you live? *Please circle one.*

1. Davis
2. Sacramento
3. Woodland
4. Winters
5. Vacaville
6. Other

Thank you for your time.

****Please return this survey to the UCSB representative who distributed them or in the drop box located at the PVUSA site.**

Pretest II Sample

UCSB

UNIVERSITY OF CALIFORNIA, SANTA BARBARA

The University of California is currently performing research to help shape future energy policy. This independent survey is meant to gauge public opinion regarding electricity generation. There are no right or wrong answers to these questions. We want to know your preferences. **Your name and identity will never be associated with your answers.** ***Please place the completed survey in the labeled box. Thank you.***

Background Information.
Renewable energy sources in the U.S. include wind turbines, solar power, geothermal, and biomass. Below are some potential "benefits" and potential "drawbacks" of renewable energy.

Renewable Energy **Benefits**	Renewable Energy **Drawbacks**
Reduces dependence on single electricity source	Some types are weather dependent
Preserves fossil fuels for future generations	Can be a more costly way of reducing pollution
Can create new jobs	May not be abundant enough for widespread use
Stimulates new technologies	Receives tax supported subsidies
May be less threatening to the environment	Could have some environmental drawbacks

When completing the survey, please consider the following:

- Money spent to support renewable energy decreases the amount available for other household items and charities.
- Increasing the supply of renewable energy is one of several ways to reduce the environmental impacts of electricity production.
- The average electricity bill is $86/month.

Data from the US EPA shows that,

- If each household in the US spent $8 per month for three years to support renewable energy, it would provide the same environmental benefits as not driving a car a total of 192,000 miles.
- If every home and business were to spend $8/month for three years to support renewable energy, the electricity used in the US would increase from 2% to 18% from renewable sources.

PLEASE COMPLETE SURVEY ON THE FOLLOWING PAGE (FRONT/BACK)

Pretest Not Available

UCSB

UNIVERSITY OF CALIFORNIA, SANTA BARBARA

The University of California is conducting this independent survey to help shape future energy policy. **There are no right or wrong answers to these questions. We want to know your preferences.** Your name and identity will never be associated with your answers.

Q1. Before the California energy crisis in 2001, California residents were offered the choice of "green electricity." Did you ever purchase it? *Please circle one*

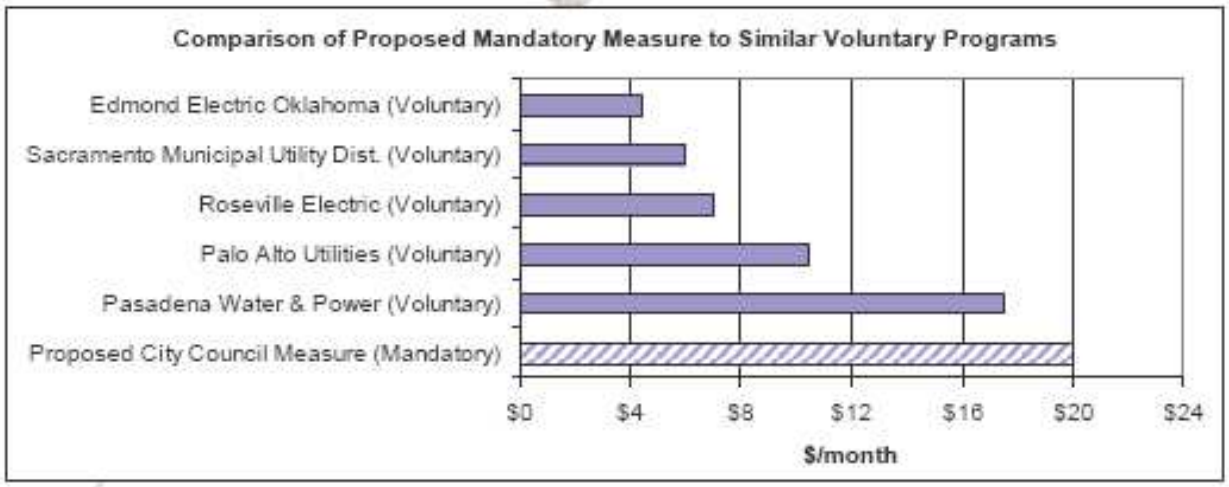
1. No. 2. Yes. 3. I can't remember.

Q2. How much of the electricity used in the US is derived from renewable energy sources (Renewable energy sources include wind turbines, solar power, geothermal, and biomass.)? *Please circle one.*

1. less than 5%.
2. between 5% and 25%.
3. between 25% and 50%.
4. between 50% and 75%.
5. greater than 75%

Q3. Suppose your local City Council is considering a measure that would give all residents the choice to **pay $20 per month for three years to a private company, unrelated to your electricity provider, to support existing and new renewable energy generation.** How would you vote on this measure?

Please read/review the following information before answering Q3.



- The tax would **cost $240 per year and $720 over the life** of the program
- The average electricity bill is $86/month.
- Money spent on renewable energy decreases the amount available for other items and charities.
- The tax may diminish the negative environmental impacts of other electricity production.
- You would continue to pay your normal electricity bill in full to your current provider.

Please circle one.

IR Sample

1. No (I **would not** support this measure.)

2. Yes (I **would** support this measure.)

(over)

Q4. Gender: *Please circle one.*

1. Male 2. Female

Q5. Age. *Please circle one.*

4. 18 to 24 years.
5. 25 to 34 years.
6. 35 to 44 years.
4. 44 to 54 years.
5. 55 to 64 years.
6. 65 years or over.

Q6. What is the highest grade or year of school you have completed? *Please circle one.*

1. Grade school.
2. High school.
3. Some college but no degree.
4. Associate degree.
5. Bachelor's degree.
6. Post graduate.

Q7. Below is a list of income categories. Which income category best describes your household's income for the year 2003, before taxes? *Please circle one.*

1. Less than $10,000.
2. $10,000 - $39,999.
3. $40,000 - $69,999.
4. $70,000 - $99,999.
5. $100,000 or more.

Q8. In the last presidential election, from which party was the candidate you voted for? *Please circle one.*

1. Republican. 2. Democratic 3. Other

Q9. If you could choose between SMUD (Sacramento Municipal Utility District) and PG&E (Pacific Gas and Electric Company) as your electricity provider, which would you choose? *Please circle one*

1. SMUD 2. PG&E 3. Neither/I have no preference

Q10. Where do you live? *Please circle one.*

1. Davis
2. Sacramento
3. Woodland
4. Winters
5. Vacaville
6. Other

Thank you for your time.

Pretest III Sample

UCSB

UNIVERSITY OF CALIFORNIA, SANTA BARBARA

The University of California is currently conducting research to help shape future energy policy. This independent survey is meant to gauge public opinion regarding electricity generation. **There are no right or wrong answers to these questions.** We want to know **your** preferences. **Your name and identity will never be associated with your answers.** ***Please place the completed survey in the labeled box. Thank you.***

Background Information.
Renewable energy sources in the U.S. are wind turbines, solar power, geothermal, and biomass. Below are some potential "benefits" and potential "drawbacks" of renewable energy.

Renewable Energy **Benefits**	Renewable Energy **Drawbacks**
Reduces dependence on foreign energy sources	Some types are weather dependent
Preserves fossil fuels for future generations	Can be a more costly way of reducing pollution
Can create new jobs	May not be abundant enough for widespread use
Stimulates new technologies	Receives tax supported subsidies
May be less threatening to the environment	Could have some environmental drawbacks

When completing the survey, please consider the following:

- Money spent to support renewable energy decreases the amount available for other household items and charities.
- Increasing the supply of renewable energy is one of several ways to reduce the environmental impacts of electricity production.

Data from the US EPA shows that,

- If a single household spent $8 per month for three years to support renewable energy, it would provide the same environmental benefits as not driving a car a total of 192,000 miles.
- If every home and business were to spend $8/month for three years to support renewable energy, the fraction of renewable electricity used in the US would increase sixteen percentage points.

PLEASE COMPLETE SURVEY ON THE FOLLOWING TWO PAGES

Pretest Version

UCSB UNIVERSITY OF CALIFORNIA, SANTA BARBARA

There are no right or wrong answers to these questions. We want to know **your** preferences. Your name and identity will never be associated with your answers.

Please place the completed survey in the labeled box. Thank you.

Q1. Based on what you have heard and read, how much of the electricity used in the US would you say is derived from renewable energy sources (Renewable energy sources include wind turbines, solar power, geothermal, and biomass.)? *Please circle one.*

1. less than 5%.
2. between 5% and 25%.
3. between 25% and 50%.
4. between 50% and 75%.
5. greater than 75%

Q2. Please tell us how important the following issues/causes are to you.
Circle one number for each issue.

	Not Important		Neutral		Very Important
Homelessness / Poverty	1	2	3	4	5
Disease Research	1	2	3	4	5
Education	1	2	3	4	5
Wildlife Conservation	1	2	3	4	5
Religious Charities	1	2	3	4	5
Renewable Energy	1	2	3	4	5
Political Organizations	1	2	3	4	5

Q3. Roughly how much money did you donate to charitable causes in the past year? *Please circle one*

1. zero
2. $1 to $100
3. $101 to $500
4. $501 to $1,000
5. more than $1,000

Please consider the following scenario,

Suppose your electricity provider asked you **to pay an additional $240 per year on your utility bill for three years to support renewable energy.** Your utility would use this premium to pay for the added costs of generating an amount of renewable electricity equal to that used by a typical household (700kWh/month).

Preliminary Information for "Unbundled Product" version of survey:

Please consider the following scenario,

Suppose a private renewable energy company, unassociated with your electricity provider, asked you to **pay them $240 per year for three years to support renewable energy**. In return you would receive a document certifying your support for renewable energy and the company would use the money to generate an amount of renewable electricity equal to that used by a typical household (700kWh/month).

When answering Q4 consider that,

- The average household spends $1,032 per year on electricity (equal to $86/month).
- Similar renewable energy programs in other areas range from $48 to $192/yr ($4 to $16/month).
- Less than 1% of Californians pay premiums to support renewable energy.

Q4a. Would you **pay your electricity provider the additional $240 per year for 3 years to support renewable energy generation** (equal to $20 per month and $720 over the life of the program)?

Pretest IV Sample

Please circle one.

1. NO, I **would not pay**. (Please proceed to Q5)

2. NO, I **would not pay** this much, but would pay a lower amount. (Please proceed to Q5)

3. YES, I **would pay**. (Please proceed to Q4b)

Q4b. (If YES) Please circle the following reasons that explain why you would pay to support renewable energy. *Please circle ALL that apply.*

1. Traditional (fossil fuel) electricity sources are dirty and insecure.
2. The benefits far outweigh the expense.
3. I'm confident my electricity provider will effectively use the collected money.
4. Renewable energy should be supported at any cost.
5. Other (Please Specify)_____

Q5. Gender: *Please circle one.*

1. Male 2. Female

Q6. Age. *Please circle one.*

1. 18 to 24 years.
2. 25 to 34 years.
3. 35 to 44 years.
4. 44 to 54 years.
5. 55 to 64 years.
6. 65 years or over.

Q7. What is the highest grade or year of school you have completed? *Please circle one.*

1. Grade school.
2. High school.
3. Some college but no degree.
4. Associate degree.
5. Bachelor's degree.
6. Post graduate.

Q8. Which income category best describes your household's income for the year 2003, before taxes? *Remember your answers will remain completely confidential. Please circle one.*

1. Less than $10,000.
2. $10,000 - $39,999.
3. $40,000 - $69,999.
4. $70,000 - $99,999.
5. $100,000 or more.

Q9. With which political party are you registered? *Please circle one.*

1. Republican. 2. Democratic 3. Other

Q10. If you could choose between SMUD (Sacramento Municipal Utility District) and PG&E (Pacific Gas and Electric Company) as your electricity provider/utility, which one would you choose?

1. SMUD 2. PG&E 3. Neither/I have no preference

Thank you for your time.

Please return survey to the labeled box.

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Thank you for taking the survey.

For more information regarding renewable energy and green pricing programs please visit,

www.bren.ucsb.edu/~pvusa/survey20b

Pretest IV Sample

Appendix B: Sample Davis Survey and Raw Survey Results

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UNIVERSITY OF CALIFORNIA, SANTA BARBARA

The University of California is currently conducting research to help shape future energy policy. This independent survey is meant to gauge public opinion regarding electricity generation. **There are no right or wrong answers to these questions.** We want to know **your** preferences. **Your name and identity will never be associated with your answers.** ***Please place the completed survey in the labeled box. Thank you.***

Background Information.
Non-hydroelectric renewable energy sources in the U.S. are wind turbines, solar power, geothermal, and biomass. Below are some potential "benefits" and potential "drawbacks" of renewable energy.

Renewable Energy **Benefits**	Renewable Energy **Drawbacks**
Reduces dependence on foreign energy sources	Some types are weather dependent
Preserves fossil fuels for future generations	Can be a more costly way of reducing pollution
Can create new jobs	May not be abundant enough for widespread use
Stimulates new technologies	Receives tax supported subsidies
May be less threatening to the environment	Could have some environmental drawbacks

When completing the survey, please consider the following:

- Money spent to support renewable energy decreases the amount available for other household items and charities.
- Increasing the supply of renewable energy is one of several ways to reduce the environmental impacts of electricity production.

Data from the US EPA shows that,

- If a single household spent $8 per month for three years to support renewable energy, it would provide the same environmental benefits as not driving a car a total of 192,000 miles.
- If every home and business were to spend $8/month for three years to support renewable energy, the fraction of renewable electricity used in the US would increase sixteen percentage points.

PLEASE COMPLETE SURVEY ON THE FOLLOWING TWO PAGES

Davis Survey Sample

UCSB UNIVERSITY OF CALIFORNIA, SANTA BARBARA

There are no right or wrong answers to these questions. We want to know **your** preferences. Your name and identity will never be associated with your answers.

Please place the completed survey in the labeled box. Thank you.

Q1. Based on what you have heard and read, how much of the electricity used in the US would you say is derived from non-hydroelectric renewable energy sources (i.e. wind turbines, solar power, geothermal, and biomass.)? *Please circle one.*

1. less than 5%.
2. between 5% and 25%.
3. between 25% and 50%.
4. between 50% and 75%.
5. greater than 75%

Q2. Please tell us how important the following issues/causes are to you.

Circle one number for each issue.

	Not Important				Very Important
Homelessness / Poverty	1	2	3	4	5
Disease Research	1	2	3	4	5
Education	1	2	3	4	5
Wildlife Conservation	1	2	3	4	5
Religious Charities	1	2	3	4	5
Renewable Energy	1	2	3	4	5
Political Organizations	1	2	3	4	5

Q3. Roughly how much money did you donate to charitable causes in the past year? *Please circle one*

1. zero
2. $1 to $100
3. $101 to $500
4. $501 to $1,000
5. more than $1,000

Please consider the following scenario,

Suppose your electricity provider asked you **to pay an additional $24 per year on your utility bill for three years to support renewable energy.** Your utility would use this premium to pay for the added costs of generating an amount of renewable electricity equal to that used by a typical household (700kWh/month).

Preliminary Information for "Unbundled Product" version of survey:

Please consider the following scenario,

Suppose a private renewable energy company, unassociated with your electricity provider, asked you to **pay them $24 per year for three years to support renewable energy**. In return you would receive a document certifying your support for renewable energy and the company would use the money to generate an amount of renewable electricity equal to that used by a typical household (700kWh/month).

When answering Q4 consider that,

- The average household spends $1,032 per year on electricity (equal to $86/month).
- Similar renewable energy programs in other areas range from $48 to $192/yr ($4 to $16/month).
- Less than 1% of Californians pay voluntary premiums to support renewable energy.

Survey Sample

Q4a. Would you **pay your electricity provider the additional $24 per year for 3 years to support renewable energy generation** (equal to $2 per month and $72 over the life of the program)?
Please circle one.

1. NO, I **would not pay**. (Please proceed to Q5)

2. NO, I **would not pay** this much, but would pay a lower amount. (Please proceed to Q5)

3. YES, I **would pay**. (Please proceed to Q4b)

Q4b. (If YES) Please circle the following reasons that explain why you would pay to support renewable energy. *Please circle ALL that apply.*

1. Traditional (fossil fuel) electricity sources are dirty and insecure.
2. The benefits far outweigh the expense.
3. I'm confident my electricity provider will effectively use the collected money.
4. Renewable energy should be supported at any cost.
5. Other (Please Specify)_____

Q5. Gender: *Please circle one.*

1. Male 2. Female

Q6. Age. *Please circle one.*

1. 18 to 24 years.
2. 25 to 34 years.
3. 35 to 44 years.
4. 45 to 54 years.
5. 55 to 64 years.
6. 65 years or over.

Q7. What is the highest grade or year of school you have completed? *Please circle one.*

1. Grade school.
2. High school.
3. Some college but no degree.
4. Associate degree.
5. Bachelor's degree.
6. Post graduate.

Q8. Which income category best describes your household's income for the year 2003, before taxes? *Remember your answers will remain completely confidential. Please circle one.*

1. Less than $10,000.
2. $10,000 - $39,999.
3. $40,000 - $69,999.
4. $70,000 - $99,999.
5. $100,000 or more.

Q9. With which political party are you registered? *Please circle one.*

1. Republican. 2. Democratic 3. Other/Not Registered

Q10. If you could choose between SMUD (Sacramento Municipal Utility District) and PG&E (Pacific Gas and Electric Company) as your electricity provider/utility, which one would you choose?

1. SMUD 2. PG&E 3. Neither/I have no preference

Thank you for your time.
Please return survey to the labeled box.

Thank you for taking the survey. For more information regarding this survey and renewable energy please visit,
www.bren.ucsb.edu/~pvusa/survey2b

Davis_Bnd_2

Davis Survey Sample

ID	informed	donate	bid	bundled	yes	no_yes	yay_say	male	age	education	income	republican	democrat	other	smud	pge	neither	take_info	girlscout	peak	stone	ucd	art
1	0	1	16	1	0	0	0	0	21	14	25000	0	0	1	0	0	1	1	1	0	0	0	0
2	0	1000	16	0	0	1	0	0	49.5	20	55000	0	1	0	1	0	0	1	1	0	0	0	0
3	0	1	20	0	0	1	0	0	21	14	25000	0	1	0	1	0	0	1	1	0	0	0	0
4	0	501	16	1	1	0	0	0	49.5	16	55000	1	0	0	0	1	0	1	1	0	0	0	0
5	1	101	12	0	0	1	0	1	39.5	16	25000	0	1	0	1	0	0	1	1	0	0	0	0
6	0	1	20	1	0	1	0	1	49.5	14	25000	1	0	0	0	1	0	1	1	0	0	0	0
7	0	101	12	1	1	0	0	1	39.5	20	100000	1	0	0	0	1	0	1	1	0	0	0	0
8	1	501	8	0	0	1	0	0	49.5	20	100000	0	1	0	1	0	0	1	1	0	0	0	0
9	1	101	8	1	1	0	0	0	39.5	16	55000	0	1	0	1	0	0	0	1	0	0	0	0
10	1	501	16	1	1	0	0	1	59.5	20	85000	0	1	0	1	0	0	1	1	0	0	0	0
11	1	1	20	0	0	0	0	0	21	16	25000	0	0	1	1	0	0	1	1	0	0	0	0
12	1	501	12	0	0	0	0	1	49.5	20	100000	0	1	0	1	0	0	1	1	0	0	0	0
13	0	101	8	0	0	1	0	0	21	14	10000	1	0	0	1	0	0	1	1	0	0	0	0
14	0	0	20	1	0	0	0	1	21	16	10000	1	0	0	0	0	1	1	1	0	0	0	0
15	1	1	2	0	1	0	0	1	49.5	6	100000	0	1	0	0	0	1	1	1	0	0	0	0
16	0	501	12	1	1	0	0	0	39.5	16	85000	0	1	0	0	0	1	1	1	0	0	0	0
17	1	1000	8	0	1	0	0	1	49.5	20	100000	0	1	0	0	0	1	1	1	0	0	0	0
18	1	1000	20	1	1	0	0	0	39.5	20	85000	0	1	0	0	0	1	1	1	0	0	0	0
19	1	0	16	0	0	1	0	1	29.5	16	25000	0	0	1	0	0	1	1	1	0	0	0	0
20	0	1000	20	0	1	0	0	0	49.5	16	85000	0	1	0	0	0	1	1	1	0	0	0	0
21	1	501	2	1	1	0	0	1	29.5	20	25000	0	1	0	0	0	1	1	1	0	0	0	0
22	1	501	2	0	1	0	0	0	49.5	14	25000	0	0	0	1	0	0	1	1	0	0	0	0
23	1	101	16	1	1	0	0	0	21	14	55000	0	1	0	0	0	1	1	1	0	0	0	0
24	0	501	12	0	0	1	0	1	29.5	16	25000	0	0	1	1	0	0	1	1	0	0	0	0
25	0	101	8	1	1	0	0	1	39.5	12	25000	0	0	1	0	0	1	1	1	0	0	0	0
26	0	1000	12	1	1	0	0	1	59.5	20	100000	0	1	0	0	1	0	1	1	0	0	0	0
27	0	101	2	0	1	0	0	0	59.5	20	85000	0	0	1	0	0	1	1	1	0	0	0	0
28	1	501	12	1	1	0	0	1	39.5	16	100000	0	1	0	1	0	0	1	1	0	0	0	0
29	1	101	2	0	0	1	0	0	49.5	20	100000	0	1	0	1	0	0	1	1	0	0	0	0
30	0	1	8	0	0	1	0	0	49.5	20	25000	0	1	0	1	0	0	1	1	0	0	0	0
31	1	101	12	0	1	0	0	1	29.5	16	55000	0	1	0	1	0	0	0	1	0	0	0	0
32	1	501	20	0	0	0	0	1	59.5	20	85000	0	1	0	0	0	1	1	1	0	0	0	0
33	1	101	16	1	0	0	0	1	59.5	20	85000	0	1	0	1	0	0	1	1	0	0	0	0
34	0	1000	20	1	0	1	0	0	59.5	14	25000	1	0	0	0	1	0	0	1	0	0	0	0
35	1	501	12	0	1	0	0	1	49.5	14	85000	1	0	0	0	0	1	1	1	0	0	0	0
36	0	1000	12	1	1	0	0	0	39.5	20	85000	0	1	0	1	0	0	1	1	0	0	0	0
37	0	101	2	1	1	0	0	0	29.5	20	55000	1	0	0	0	0	1	0	1	0	0	0	0
38	1	101	8	1	1	0	0	1	49.5	20	85000	0	1	0	0	0	1	1	1	0	0	0	0
39	1	501	20	1	0	1	0	0	49.5	14	55000	0	1	0	0	0	1	1	1	0	0	0	0
40	0	1	2	1	0	0	0	1	39.5	16	55000	1	0	0	0	1	0	0	1	0	0	0	0
41	1	501	12	0	0	0	0	1	49.5	14	100000	1	0	0	0	0	1	1	1	0	0	0	0
42	1	501	20	1	1	0	0	1	49.5	20	100000	0	1	0	0	0	1	1	1	0	0	0	0
43	1	1	8	1	0	0	0	1	59.5	14	55000	0	1	0	0	1	0	1	1	0	0	0	0
44	1	101	16	1	1	0	0	0	29.5	20	55000	0	1	0	1	0	0	1	1	0	0	0	0
45	1	1000	20	0	1	0	0	0	49.5	20	100000	0	1	0	1	0	0	1	1	0	0	0	0
46	0	0	8	0	0	0	0	1	21	14	10000	0	1	0	0	1	0	1	1	0	0	0	0
47	0	501	2	1	1	0	0	0	39.5	14	55000	0	1	0	1	0	0	1	1	0	0	0	0
48	0	101	16	0	0	0	0	0	59.5	20	25000	0	1	0	0	0	1	1	1	0	0	0	0
49	1	1000	12	1	0	1	0	1	39.5	20	100000	0	0	1	1	0	0	1	1	0	0	0	0
50	1	501	12	0	1	0	0	1	59.5	20	55000	0	1	0	0	1	0	1	1	0	0	0	0
51	1	501	12	1	1	0	0	0	39.5	16	25000	1	0	0	1	0	0	1	1	0	0	0	0
52	0	1	2	0	1	0	0	1	29.5	20	25000	0	0	1	0	0	1	1	1	0	0	0	0

ID	informed	donate	bid	bundled	yes	no_yes	yay_say	male	age	education	income	republican	democrat	other	smud	pge	neither	take_info	girlscout	peak	stone	ucd	art
53	1	1000	8	0	0	1	0	0	29.5	16	55000	1	0	0	1	0	0	1	1	0	0	0	0
54	0	1	20	0	1	0	0	1	21	20	25000	0	1	0	0	1	0	0	1	0	0	0	0
55	1	1	16	1	1	0	0	1	21	14	25000	1	0	0	0	1	0	1	1	0	0	0	0
56	0	1	16	0	0	0	0	0	49.5	16	20000	1	0	0	1	0	0	1	1	0	0	0	0
57	1	1	8	1	1	0	0	0	29.5	16	25000	0	0	1	0	0	0	1	1	0	0	0	0
58	0	1	16	0	0	1	0	0	39.5	16	85000	0	1	0	0	0	1	1	1	0	0	0	0
59	1	501	2	0	1	0	0	0	39.5	20	100000	0	1	0	1	0	0	0	1	0	0	0	0
60	0	101	8	0	0	1	0	0	39.5	16	100000	1	0	0	0	1	0	0	1	0	0	0	0
61	1	101	20	1	1	0	0	0	39.5	20	25000	0	1	0	1	0	0	1	1	0	0	0	0
62	1	101	20	0	0	0	0	1	21	16	25000	0	0	1	0	0	1	0	1	0	0	0	0
63	1	1	16	0	1	0	0	0	59.5	16	55000	0	1	0	1	0	0	1	1	0	0	0	0
64	1	1	8	0	0	0	0	1	21	14	85000	0	1	0	0	0	1	1	1	0	0	0	0
65	0	101	12	1	0	0	0	1	59.5	20	85000	0	0	1	1	0	0	1	1	0	0	0	0
66	1	101	8	1	0	1	0	0	29.5	16	25000	1	0	0	0	0	1	1	1	0	0	0	0
67	0	101	2	0	0	1	0	0	59.5	16	85000	1	0	0	0	0	1	0	1	0	0	0	0
68	0	1000	20	0	0	1	0	1	59.5	14	25000	1	0	0	1	0	0	1	1	0	0	0	0
69	1	1000	16	0	0	0	0	1	65	20	100000	1	0	0	0	1	0	1	1	0	0	0	0
70	0	101	20	1	1	0	0	0	39.5	16	85000	0	1	0	0	0	1	1	1	0	0	0	0
71	1	501	2	1	1	0	0	1	65	20	25000	0	1	0	1	0	0	1	1	0	0	0	0
72	0	0	16	0	0	1	0	1	29.5	16	25000	0	1	0	1	0	0	1	1	0	0	0	0
73	1	1	12	1	0	1	0	0	39.5	20	10000	1	0	0	0	1	0	1	1	0	0	0	0
74	0	101	12	1	0	1	0	0	49.5	16	85000	0	1	0	0	0	1	1	0	1	0	0	0
75	0	0	2	1	0	0	0	0	59.5	16	25000	0	1	0	0	0	1	0	0	1	0	0	0
76	1	1000	8	0	0	1	0	0	49.5	14	85000	0	1	0	0	0	1	1	0	1	0	0	0
77	1	1000	8	1	1	0	0	0	49.5	20	85000	1	0	0	1	0	0	1	0	1	0	0	0
78	1	1000	12	1	1	0	0	1	39.5	16	100000	0	1	0	1	0	0	0	0	1	0	0	0
79	1	1	2	1	1	0	0	0	29.5	16	55000	0	1	0	0	0	1	0	0	1	0	0	0
80	1	1	2	0	1	0	0	0	21	14	85000	0	1	0	0	0	1	1	0	1	0	0	0
81	1	1	8	1	0	1	0	1	29.5	14	55000	0	1	0	0	1	0	0	0	1	0	0	0
82	0	101	2	0	1	0	0	1	39.5	16	85000	1	0	0	0	0	1	1	0	1	0	0	0
83	1	1000	20	1	0	1	0	1	29.5	14	100000	0	0	1	0	1	0	1	0	1	0	0	0
84	0	1	8	0	1	0	0	0	29.5	20	25000	0	1	0	0	0	1	0	0	1	0	0	0
85	0	1	20	0	0	0	0	0	29.5	12	25000	0	1	0	0	1	0	0	0	1	0	0	0
86	0	0	12	0	0	1	0	0	29.5	14	25000	0	0	1	0	1	0	0	0	1	0	0	0
87	0	1	20	1	1	0	0	1	21	14	10000	1	0	0	0	1	0	1	0	1	0	0	0
88	1	1	16	0	0	1	0	1	21	12	10000	0	1	0	0	0	1	1	0	1	0	0	0
89	0	101	16	1	0	0	0	0	21	14	10000	0	0	1	0	1	0	1	0	1	0	0	0
90	0	1	16	0	0	1	0	0	29.5	14	85000	0	1	0	0	0	1	1	0	1	0	0	0
91	0	1	20	1	1	0	1	0	59.5	16	100000	0	1	0	0	0	1	1	0	1	0	0	0
92	1	1	2	1	1	0	1	1	21	14	25000	0	0	1	0	0	1	1	0	1	0	0	0
93	1	1000	12	1	0	0	0	1	59.5	20	100000	0	1	0	0	1	0	0	0	1	0	0	0
94	0	0	8	0	0	1	0	1	21	16	10000	0	1	0	0	0	1	0	0	1	0	0	0
95	1	1	16	1	0	1	0	1	29.5	16	85000	0	1	0	0	0	1	1	0	1	0	0	0
96	1	1000	12	0	1	0	1	0	65	20	100000	0	1	0	1	0	0	1	0	1	0	0	0
97	1	1000	20	0	0	0	0	0	49.5	16	100000	0	1	0	0	1	0	0	0	1	0	0	0
98	0	1	16	0	1	0	1	1	29.5	16	100000	1	0	0	0	0	1	0	0	1	0	0	0
99	0	0	8	1	1	0	1	0	21	14	10000	1	0	0	1	0	0	1	0	1	0	0	0
100	1	1	12	0	0	0	0	1	21	14	25000	0	0	1	1	0	0	0	0	1	0	0	0
101	0	1000	16	1	0	0	0	1	39.5	14	85000	1	0	0	0	1	0	1	0	1	0	0	0
102	1	101	2	1	0	1	0	1	59.5	20	85000	1	0	0	0	0	1	1	0	1	0	0	0
103	0	1	16	0	0	0	0	0	29.5	20	55000	1	0	0	0	1	0	1	0	1	0	0	0
104	0	501	12	0	0	0	0	1	59.5	16	85000	1	0	0	1	0	0	0	0	1	0	0	0

ID	informed	donate	bid	bundled	yes	no_yes	yay_say	male	age	education	income	republican	democrat	other	smud	pge	neither	take_info	girlscout	peak	stone	ucd	art
105	0	501	20	0	0	0	0	0	49.5	20	55000	0	0	1	0	0	1	1	0	1	0	0	0
106	1	101	16	1	1	0	0	1	59.5	20	100000	0	1	0	0	1	0	0	0	1	0	0	0
107	1	501	20	0	0	1	0	0	29.5	16	25000	0	1	0	1	0	0	1	0	1	0	0	0
108	1	1	2	1	1	0	1	0	49.5	20	25000	0	0	1	0	0	1	1	0	1	0	0	0
109	1	0	8	0	0	1	0	1	21	14	25000	1	0	0	1	0	0	0	0	1	0	0	0
110	0	101	2	0	0	1	0	0	39.5	14	100000	0	1	0	0	0	1	1	0	1	0	0	0
111	0	501	12	1	0	1	0	0	59.5	20	100000	0	1	0	1	0	0	1	0	1	0	0	0
112	1	1	12	1	1	0	1	1	49.5	14	10000	0	1	0	0	1	0	0	0	1	0	0	0
113	0	501	12	0	1	0	0	0	29.5	20	55000	0	0	1	0	0	1	1	0	1	0	0	0
114	0	1	20	1	1	0	1	0	21	14	10000	0	1	0	0	1	0	1	0	1	0	0	0
115	0	1	2	0	1	0	0	0	29.5	14	25000	0	1	0	0	1	0	1	0	1	0	0	0
116	1	1	8	1	1	0	1	1	29.5	16	85000	1	0	0	0	1	0	0	0	1	0	0	0
117	1	101	20	1	1	0	0	0	39.5	6	100000	0	1	0	1	0	0	1	0	1	0	0	0
118	0	0	8	1	1	0	1	0	21	14	55000	0	1	0	0	1	0	0	0	1	0	0	0
119	1	1000	8	0	1	0	0	1	65	20	100000	0	1	0	0	1	0	1	0	1	0	0	0
120	1	1000	2	1	1	0	1	1	49.5	20	100000	1	0	0	1	0	0	1	0	1	0	0	0
121	0	1	2	0	0	0	0	1	39.5	16	25000	1	0	0	1	0	0	1	0	1	0	0	0
122	1	501	20	0	0	1	0	0	59.5	20	55000	0	0	1	0	0	1	1	0	1	0	0	0
123	0	101	20	0	0	1	0	0	29.5	20	25000	0	1	0	0	0	1	0	0	1	0	0	0
124	1	1000	16	1	0	0	0	1	21	16	100000	1	0	0	0	1	0	1	0	1	0	0	0
125	1	1	12	1	0	1	0	0	65	20	10000	0	1	0	0	0	1	1	0	1	0	0	0
126	1	1000	20	1	0	1	0	1	59.5	20	85000	0	1	0	0	0	1	1	0	1	0	0	0
127	0	1000	16	0	0	0	0	0	39.5	20	100000	1	0	0	0	0	1	0	0	1	0	0	0
128	1	1	2	0	1	0	1	1	39.5	20	55000	0	0	1	1	0	0	0	0	1	0	0	0
129	0	1	8	0	1	0	1	0	21	14	100000	1	0	0	0	0	1	1	0	1	0	0	0
130	1	1	8	0	1	0	1	0	29.5	16	25000	0	1	0	0	0	1	1	0	1	0	0	0
131	0	501	12	1	1	0	1	0	65	14	55000	0	1	0	0	0	1	1	0	1	0	0	0
132	1	1000	20	1	0	0	0	0	39.5	14	100000	1	0	0	0	0	1	1	0	1	0	0	0
133	0	1	2	0	1	0	0	0	29.5	20	25000	0	1	0	0	0	1	0	0	1	0	0	0
134	0	1000	8	1	0	1	0	1	59.5	20	100000	0	0	1	0	0	1	1	0	1	0	0	0
135	0	101	20	1	0	1	0	0	21	14	55000	1	0	0	0	1	0	1	0	1	0	0	0
136	0	501	16	1	0	1	0	0	39.5	20	100000	0	1	0	0	0	1	1	0	1	0	0	0
137	0	101	16	0	0	1	0	0	21	14	55000	0	1	0	0	1	0	1	0	1	0	0	0
138	0	1	12	0	0	1	0	1	21	14	85000	0	0	1	0	0	1	1	0	1	0	0	0
139	1	101	8	1	0	1	0	1	49.5	16	55000	0	1	0	0	0	1	0	0	1	0	0	0
140	0	1	2	0	1	0	1	0	29.5	16	25000	0	1	0	0	1	0	1	0	1	0	0	0
141	0	1	20	0	1	0	1	0	49.5	14	85000	0	0	1	0	0	1	1	0	1	0	0	0
142	1	1	16	1	0	1	0	1	29.5	20	25000	0	1	0	0	0	1	1	0	1	0	0	0
143	1	101	2	1	1	0	1	1	59.5	16	85000	0	1	0	0	0	1	1	0	1	0	0	0
144	0	101	20	1	1	0	0	1	39.5	20	100000	0	0	1	0	0	1	0	0	1	0	0	0
145	0	101	16	0	1	0	0	1	21	14	85000	1	0	0	0	0	1	1	0	1	0	0	0
146	1	1	8	1	1	0	0	0	21	12	25000	0	1	0	0	0	1	1	0	1	0	0	0
147	1	1	20	0	0	0	0	1	29.5	12	25000	0	1	0	0	1	0	1	0	1	0	0	0
148	0	1	2	1	1	0	0	0	49.5	14	55000	0	1	0	1	0	0	1	0	1	0	0	0
149	0	501	12	1	1	0	1	0	39.5	20	85000	0	1	0	0	0	1	1	0	1	0	0	0
150	1	101	12	0	0	0	0	1	65	20	85000	0	0	1	0	0	1	1	0	1	0	0	0
151	1	501	8	0	1	0	0	1	49.5	16	85000	0	1	0	1	0	0	1	0	1	0	0	0
152	1	1000	12	0	1	0	1	0	49.5	20	100000	0	1	0	0	0	1	1	0	1	0	0	0
153	1	1	16	1	0	0	0	1	21	14	10000	1	0	0	0	1	0	1	0	0	1	0	0
154	1	101	2	1	1	0	0	0	49.5	20	100000	0	1	0	0	0	1	1	0	0	1	0	0
155	0	101	2	1	1	0	1	0	39.5	14	55000	0	1	0	0	0	1	1	0	0	1	0	0
156	1	1000	16	0	0	0	0	0	49.5	16	100000	1	0	0	0	0	1	1	0	0	1	0	0

ID	informed	donate	bid	bundled	yes	no_yes	yay_say	male	age	education	income	republican	democrat	other	smud	pge	neither	take_info	girlscout	peak	stone	ucd	art
157	0	0	20	1	0	1	0	1	29.5	14	25000	1	0	0	1	0	0	1	0	0	1	0	0
158	0	1	12	0	0	1	0	0	29.5	16	25000	0	0	1	0	0	1	0	0	0	1	0	0
159	1	101	8	1	1	0	1	1	29.5	14	25000	0	0	1	0	0	1	0	0	0	1	0	0
160	1	1	16	1	1	0	0	1	49.5	20	85000	0	1	0	0	1	0	1	0	0	1	0	0
161	1	501	16	1	1	0	0	0	49.5	16	55000	0	0	1	0	1	0	1	0	0	1	0	0
162	1	101	20	0	0	1	0	0	65	16	85000	1	0	0	0	0	1	0	0	0	1	0	0
163	1	501	8	0	0	0	0	1	49.5	14	85000	1	0	0	1	0	0	1	0	0	1	0	0
164	1	1	12	1	1	0	0	1	59.5	16	85000	1	0	0	0	1	0	1	0	0	1	0	0
165	0	1	20	0	1	0	1	1	21	16	25000	1	0	0	0	0	1	1	0	0	1	0	0
166	1	0	20	0	0	1	0	1	29.5	20	25000	0	1	0	0	0	1	1	0	0	1	0	0
167	0	101	8	1	1	0	1	1	21	14	25000	0	0	1	1	0	0	1	0	0	1	0	0
168	0	1000	16	0	1	0	1	1	49.5	14	100000	1	0	0	1	0	0	1	0	0	1	0	0
169	0	501	12	0	0	1	0	1	59.5	20	85000	0	1	0	0	1	0	0	0	0	1	0	0
170	1	1000	2	0	1	0	1	1	65	20	100000	0	0	1	1	0	0	0	0	0	1	0	0
171	1	1	16	0	0	1	0	1	39.5	20	55000	0	1	0	1	0	0	1	0	0	1	0	0
172	0	0	12	0	1	0	1	1	21	14	10000	0	1	0	0	1	0	1	0	0	1	0	0
173	0	501	2	1	1	0	1	1	59.5	20	85000	0	1	0	0	0	1	1	0	0	1	0	0
174	0	501	16	1	1	0	1	0	49.5	14	100000	0	1	0	0	0	1	1	0	0	1	0	0
175	0	101	8	0	1	0	0	0	59.5	16	55000	1	0	0	0	0	0	1	0	0	1	0	0
176	1	101	20	0	0	0	0	1	39.5	20	85000	0	1	0	0	0	1	0	0	0	1	0	0
177	0	101	2	0	1	0	1	1	29.5	16	55000	0	1	0	0	0	1	1	0	0	1	0	0
178	1	101	12	1	0	0	0	1	29.5	20	25000	0	1	0	1	0	0	1	0	0	1	0	0
179	0	501	8	1	0	1	0	1	29.5	16	25000	1	0	0	0	0	1	0	0	0	1	0	0
180	0	101	20	0	0	1	0	0	49.5	20	55000	0	1	0	0	0	1	1	0	0	1	0	0
181	0	1	16	1	0	1	0	0	39.5	20	100000	0	0	1	0	0	1	1	0	0	1	0	0
182	1	101	12	1	1	0	1	0	29.5	14	10000	0	0	1	1	0	0	1	0	0	1	0	0
183	1	1000	20	1	1	0	1	1	49.5	16	100000	0	1	0	1	0	0	0	0	0	1	0	0
184	1	101	12	0	0	1	0	0	59.5	20	100000	0	1	0	0	0	1	1	0	0	1	0	0
185	1	1000	12	0	1	0	1	0	39.5	20	55000	0	1	0	1	0	0	1	0	0	1	0	0
186	0	101	20	1	1	0	1	0	39.5	14	100000	0	1	0	0	0	1	1	0	0	1	0	0
187	1	1	16	0	1	0	1	1	29.5	20	55000	0	0	1	0	0	1	1	0	0	1	0	0
188	1	1000	8	0	1	0	0	1	65	20	100000	0	1	0	1	0	0	1	0	0	1	0	0
189	1	101	2	0	0	1	0	1	59.5	20	55000	0	1	0	0	0	1	1	0	0	1	0	0
190	1	1	8	1	0	1	0	1	39.5	16	55000	1	0	0	1	0	0	0	0	0	1	0	0
191	0	0	2	1	1	0	1	1	29.5	16	25000	0	1	0	1	0	0	1	0	0	1	0	0
192	0	501	2	0	0	1	0	1	49.5	20	55000	0	0	1	0	0	1	1	0	0	1	0	0
193	0	0	16	1	1	0	0	0	21	12	100000	0	1	0	1	0	0	0	0	0	1	0	0
194	1	1000	8	0	0	1	0	0	49.5	20	55000	0	0	1	0	0	1	1	0	0	1	0	0
195	1	1000	12	1	1	0	0	1	49.5	20	100000	0	0	1	1	0	0	1	0	0	1	0	0
196	0	101	2	1	1	0	0	0	49.5	20	100000	0	0	1	0	0	1	1	0	0	1	0	0
197	0	0	20	1	0	1	1	1	21	14	25000	0	1	0	0	1	0	1	0	0	1	0	0
198	0	1	16	0	1	0	0	1	29.5	16	55000	0	0	1	0	1	0	1	0	0	1	0	0
199	0	1000	12	0	0	0	0	0	29.5	16	85000	1	0	0	0	1	0	1	0	0	1	0	0
200	0	1	12	0	0	1	0	1	21	16	10000	1	0	0	0	0	1	1	0	0	1	0	0
201	0	1	8	1	1	0	0	0	49.5	20	100000	0	1	0	0	1	0	1	0	0	1	0	0
202	1	1	12	1	1	0	0	1	59.5	20	100000	1	0	0	0	0	1	0	0	0	1	0	0
203	0	101	2	1	1	0	0	0	39.5	16	25000	0	0	1	0	0	1	1	0	0	1	0	0
204	1	1	20	0	0	0	0	1	39.5	20	85000	0	1	0	0	0	1	1	0	0	1	0	0
205	1	501	2	1	1	0	1	0	59.5	20	100000	0	1	0	1	0	0	1	0	0	1	0	0
206	1	501	20	1	0	1	0	0	39.5	14	100000	0	1	0	0	1	0	1	0	0	1	0	0
207	0	1	16	1	1	0	1	0	21	14	100000	0	1	0	0	0	1	1	0	0	1	0	0
208	1	501	8	1	1	0	0	1	29.5	20	85000	0	1	0	0	0	1	1	0	0	1	0	0

ID	informed	donate	bid	bundled	yes	no_yes	yay_say	male	age	education	income	republican	democrat	other	smud	pge	neither	take_info	girlscout	peak	stone	ucd	art
157	0	0	20	1	0	1	0	1	29.5	14	25000	1	0	0	1	0	0	1	0	0	1	0	0
158	0	1	12	0	0	1	0	0	29.5	16	25000	0	0	1	0	0	1	0	0	0	1	0	0
159	1	101	8	1	1	0	1	1	29.5	14	25000	0	0	1	0	0	1	0	0	0	1	0	0
160	1	1	16	1	1	0	0	1	49.5	20	85000	0	1	0	0	1	0	1	0	0	1	0	0
161	1	501	16	1	1	0	0	0	49.5	16	55000	0	0	1	0	1	0	1	0	0	1	0	0
162	1	101	20	0	0	1	0	0	65	16	85000	1	0	0	0	0	1	0	0	0	1	0	0
163	1	501	8	0	0	0	0	1	49.5	14	85000	1	0	0	1	0	0	1	0	0	1	0	0
164	1	1	12	1	1	0	0	1	59.5	16	85000	1	0	0	0	1	0	1	0	0	1	0	0
165	0	1	20	0	1	0	1	1	21	16	25000	1	0	0	0	0	1	1	0	0	1	0	0
166	1	0	20	0	0	1	0	1	29.5	20	25000	0	1	0	0	0	1	1	0	0	1	0	0
167	0	101	8	1	1	0	1	1	21	14	25000	0	0	1	1	0	0	1	0	0	1	0	0
168	0	1000	16	0	1	0	1	1	49.5	14	100000	1	0	0	1	0	0	1	0	0	1	0	0
169	0	501	12	0	0	1	0	1	59.5	20	85000	0	1	0	0	1	0	0	0	0	1	0	0
170	1	1000	2	0	1	0	1	1	65	20	100000	0	0	1	1	0	0	0	0	0	1	0	0
171	1	1	16	0	0	1	0	1	39.5	20	55000	0	1	0	1	0	0	1	0	0	1	0	0
172	0	0	12	0	1	0	1	1	21	14	10000	0	1	0	0	1	0	1	0	0	1	0	0
173	0	501	2	1	1	0	1	1	59.5	20	85000	0	1	0	0	0	1	1	0	0	1	0	0
174	0	501	16	1	1	0	1	0	49.5	14	100000	0	1	0	0	0	1	1	0	0	1	0	0
175	0	101	8	0	1	0	0	0	59.5	16	55000	1	0	0	0	0	0	1	0	0	1	0	0
176	1	101	20	0	0	0	0	1	39.5	20	85000	0	1	0	0	0	1	0	0	0	1	0	0
177	0	101	2	0	1	0	1	1	29.5	16	55000	0	1	0	0	0	1	1	0	0	1	0	0
178	1	101	12	1	0	0	0	1	29.5	20	25000	0	1	0	1	0	0	1	0	0	1	0	0
179	0	501	8	1	0	1	0	1	29.5	16	25000	1	0	0	0	0	1	0	0	0	1	0	0
180	0	101	20	0	0	1	0	0	49.5	20	55000	0	1	0	0	0	1	1	0	0	1	0	0
181	0	1	16	1	0	1	0	0	39.5	20	100000	0	0	1	0	0	1	1	0	0	1	0	0
182	1	101	12	1	1	0	1	0	29.5	14	10000	0	0	1	1	0	0	1	0	0	1	0	0
183	1	1000	20	1	1	0	1	1	49.5	16	100000	0	1	0	1	0	0	0	0	0	1	0	0
184	1	101	12	0	0	1	0	0	59.5	20	100000	0	1	0	0	0	1	1	0	0	1	0	0
185	1	1000	12	0	1	0	1	0	39.5	20	55000	0	1	0	1	0	0	1	0	0	1	0	0
186	0	101	20	1	1	0	1	0	39.5	14	100000	0	1	0	0	0	1	1	0	0	1	0	0
187	1	1	16	0	1	0	1	1	29.5	20	55000	0	0	1	0	0	1	1	0	0	1	0	0
188	1	1000	8	0	1	0	0	1	65	20	100000	0	1	0	1	0	0	1	0	0	1	0	0
189	1	101	2	0	0	1	0	1	59.5	20	55000	0	1	0	0	0	1	1	0	0	1	0	0
190	1	1	8	1	0	1	0	1	39.5	16	55000	1	0	0	1	0	0	0	0	0	1	0	0
191	0	0	2	1	1	0	1	1	29.5	16	25000	0	1	0	1	0	0	1	0	0	1	0	0
192	0	501	2	0	0	1	0	1	49.5	20	55000	0	0	1	0	0	1	1	0	0	1	0	0
193	0	0	16	1	1	0	0	0	21	12	100000	0	1	0	1	0	0	0	0	0	1	0	0
194	1	1000	8	0	0	1	0	0	49.5	20	55000	0	0	1	0	0	1	1	0	0	1	0	0
195	1	1000	12	1	1	0	0	1	49.5	20	100000	0	0	1	1	0	0	1	0	0	1	0	0
196	0	101	2	1	1	0	0	0	49.5	20	100000	0	0	1	0	0	1	1	0	0	1	0	0
197	0	0	20	1	0	1	1	1	21	14	25000	0	1	0	0	1	0	1	0	0	1	0	0
198	0	1	16	0	1	0	0	1	29.5	16	55000	0	0	1	0	1	0	1	0	0	1	0	0
199	0	1000	12	0	0	0	0	0	29.5	16	85000	1	0	0	0	1	0	1	0	0	1	0	0
200	0	1	12	0	0	1	0	1	21	16	10000	1	0	0	0	0	1	1	0	0	1	0	0
201	0	1	8	1	1	0	0	0	49.5	20	100000	0	1	0	0	1	0	1	0	0	1	0	0
202	1	1	12	1	1	0	0	1	59.5	20	100000	1	0	0	0	0	1	0	0	0	1	0	0
203	0	101	2	1	1	0	0	0	39.5	16	25000	0	0	1	0	0	1	1	0	0	1	0	0
204	1	1	20	0	0	0	0	1	39.5	20	85000	0	1	0	0	0	1	1	0	0	1	0	0
205	1	501	2	1	1	0	1	0	59.5	20	100000	0	1	0	1	0	0	1	0	0	1	0	0
206	1	501	20	1	0	1	0	0	39.5	14	100000	0	1	0	0	1	0	1	0	0	1	0	0
207	0	1	16	1	1	0	1	0	21	14	100000	0	1	0	0	0	1	1	0	0	1	0	0
208	1	501	8	1	1	0	0	1	29.5	20	85000	0	1	0	0	0	1	1	0	0	1	0	0

ID	informed	donate	bid	bundled	yes	no_yes	yay_say	male	age	education	income	republican	democrat	other	smud	pge	neither	take_info	girlscout	peak	stone	ucd	art
209	0	1000	16	0	0	0	0	1	49.5	20	85000	1	0	0	1	0	0	1	0	0	1	0	0
210	1	1000	8	0	1	0	1	0	65	20	100000	0	1	0	1	0	0	0	0	0	1	0	0
211	1	501	20	1	1	0	0	1	29.5	16	55000	0	1	0	1	0	0	1	0	0	1	0	0
212	0	1000	20	0	1	0	0	1	65	16	100000	1	0	0	1	0	0	1	0	0	1	0	0
213	1	501	12	1	1	0	1	0	39.5	20	100000	0	1	0	1	0	0	1	0	0	1	0	0
214	1	101	8	0	0	1	0	0	49.5	20	85000	0	0	1	0	0	1	1	0	0	1	0	0
215	1	101	8	1	1	0	1	1	29.5	20	55000	0	1	0	0	0	1	1	0	0	1	0	0
216	1	1	12	0	1	0	0	0	21	16	10000	0	0	1	0	0	1	1	0	0	1	0	0
217	1	1000	16	1	1	0	0	1	39.5	20	100000	0	1	0	0	0	1	1	0	0	1	0	0
218	1	501	16	0	0	1	0	1	39.5	20	85000	0	0	1	0	0	1	0	0	0	1	0	0
219	1	1	20	0	0	1	0	1	59.5	20	55000	0	1	0	0	0	1	1	0	0	1	0	0
220	1	101	2	0	1	0	1	0	59.5	16	100000	0	1	0	0	0	1	1	0	0	1	0	0
221	1	1000	8	0	1	0	0	0	29.5	20	100000	0	1	0	0	0	1	1	0	0	1	0	0
222	1	1	20	0	0	1	0	0	29.5	16	25000	0	0	1	0	0	1	1	0	0	1	0	0
223	1	0	12	1	1	0	0	1	29.5	20	25000	0	0	1	0	0	1	1	0	0	1	0	0
224	0	101	2	1	1	0	1	0	21	14	25000	0	1	0	1	0	0	1	0	0	1	0	0
225	0	1000	8	1	0	1	0	1	29.5	20	100000	0	1	0	0	0	1	1	0	0	1	0	0
226	1	1000	16	0	0	1	0	1	49.5	20	100000	0	1	0	0	1	0	0	0	0	1	0	0
227	1	101	2	0	1	0	1	1	29.5	16	85000	0	1	0	1	0	0	1	0	0	1	0	0
228	1	0	2	1	1	0	1	1	39.5	14	10000	0	0	1	0	0	1	1	0	0	1	0	0
229	1	1000	16	1	1	0	1	1	59.5	20	100000	0	1	0	0	1	0	1	0	0	1	0	0
230	1	1000	12	0	1	0	0	1	49.5	20	100000	0	1	0	1	0	0	1	0	0	1	0	0
231	0	1000	2	0	1	0	1	0	65	14	25000	0	1	0	1	0	0	1	0	0	1	0	0
232	1	0	20	0	1	0	0	1	29.5	14	25000	0	0	1	1	0	0	1	0	0	1	0	0
233	1	1	16	1	0	1	0	1	29.5	16	25000	0	1	0	1	0	0	1	0	0	1	0	0
234	0	1	8	0	1	0	0	1	21	12	25000	0	1	0	1	0	0	1	0	0	1	0	0
235	0	0	8	0	0	1	0	0	21	14	25000	0	1	0	0	0	1	1	0	0	1	0	0
236	0	1	2	0	1	0	0	1	21	14	10000	0	0	1	0	0	1	1	0	0	1	0	0
237	0	501	12	1	1	0	1	0	49.5	20	100000	0	1	0	1	0	0	0	0	0	1	0	0
238	0	1000	12	0	1	0	0	1	49.5	20	85000	0	1	0	1	0	0	1	0	0	1	0	0
239	1	1000	16	0	1	0	0	1	65	14	100000	1	0	0	0	0	1	1	0	0	1	0	0
240	1	1000	2	1	1	0	0	0	39.5	16	85000	0	1	0	0	0	1	1	0	0	1	0	0
241	1	101	8	1	0	1	0	0	49.5	20	55000	0	1	0	1	0	0	1	0	0	1	0	0
242	1	101	12	1	0	1	0	1	29.5	20	10000	0	1	0	0	1	0	1	0	0	1	0	0
243	0	1	20	1	1	0	0	0	29.5	16	25000	0	1	0	0	1	0	1	0	0	1	0	0
244	0	1	2	1	0	1	0	0	21	14	25000	0	1	0	1	0	0	1	0	0	0	1	0
245	0	1	2	0	0	0	0	1	21	14	100000	0	1	0	0	1	0	1	0	0	0	1	0
246	0	1	2	0	0	1	0	0	21	14	55000	0	0	1	0	0	1	1	0	0	0	1	0
247	0	1	2	1	0	1	0	0	21	14	10000	0	0	1	0	0	1	1	0	0	0	1	0
248	0	1	2	0	0	0	1	0	21	12	55000	0	0	1	0	0	1	1	0	0	0	1	0
249	0	101	2	1	0	1	0	1	21	14	85000	0	1	0	0	0	1	1	0	0	0	1	0
250	0	1	2	1	1	0	0	0	21	16	25000	0	0	1	0	0	1	0	0	0	0	1	0
251	1	1	2	1	1	0	1	0	21	14	10000	0	0	1	0	0	1	1	0	0	0	1	0
252	1	1	2	0	1	0	1	0	21	14	10000	0	1	0	1	0	0	1	0	0	0	1	0
253	0	0	2	1	1	0	0	0	21	12	55000	0	0	1	0	0	1	1	0	0	0	1	0
254	1	1	2	0	1	0	0	1	21	14	100000	0	1	0	0	0	1	1	0	0	0	1	0
255	0	501	2	0	1	0	1	1	21	14	100000	1	0	0	0	1	0	1	0	0	0	1	0
256	0	0	2	1	1	0	1	1	21	12	85000	0	0	1	0	0	1	1	0	0	0	1	0
257	1	1	2	1	1	0	0	1	21	14	100000	0	1	0	0	0	1	1	0	0	0	1	0
258	0	1	2	1	1	0	1	0	21	14	85000	0	1	0	0	0	1	1	0	0	0	1	0
259	0	1	2	0	1	0	0	1	21	12	100000	0	0	1	0	1	0	0	0	0	0	1	0
260	0	101	2	1	1	0	1	1	21	14	100000	0	1	0	0	0	1	1	0	0	0	1	0

ID	informed	donate	bid	bundled	yes	no_yes	yay_say	male	age	education	income	republican	democrat	other	smud	pge	neither	take_info	girlscout	peak	stone	ucd	art
261	0	0	2	0	1	0	0	0	21	12	25000	0	1	0	0	1	0	1	0	0	0	1	0
262	1	1	2	0	1	0	1	1	21	14	25000	1	0	0	1	0	0	1	0	0	0	1	0
263	0	1	2	0	1	0	1	1	21	12	85000	0	1	0	1	0	0	1	0	0	0	1	0
264	0	1	8	1	0	1	0	0	21	14	25000	0	1	0	1	0	0	1	0	0	0	1	0
265	0	1	8	0	0	1	0	0	21	14	25000	0	1	0	0	0	1	1	0	0	0	1	0
266	0	1	8	1	0	1	0	0	29.5	20	25000	0	0	1	0	0	1	0	0	0	0	1	0
267	0	1	8	0	0	1	0	1	21	12	55000	0	1	0	0	0	1	1	0	0	0	1	0
268	1	1	8	1	0	1	0	1	21	14	85000	0	1	0	0	0	1	1	0	0	0	1	0
269	1	1	8	0	0	0	0	1	21	14	100000	0	0	1	0	0	1	1	0	0	0	1	0
270	0	1	8	1	0	1	0	1	21	12	100000	0	0	1	0	0	1	1	0	0	0	1	0
271	0	101	8	0	0	1	0	1	21	14	10000	1	0	0	0	1	0	0	0	0	0	1	0
272	0	1	8	1	0	1	0	0	21	12	55000	0	1	0	0	0	1	1	0	0	0	1	0
273	0	1	8	0	0	1	0	0	21	14	25000	0	1	0	0	0	1	1	0	0	0	1	0
274	1	101	8	0	0	0	0	0	21	14	100000	1	0	0	0	0	1	0	0	0	0	1	0
275	0	1	8	0	0	0	0	1	21	12	10000	1	0	0	0	1	0	1	0	0	0	1	0
276	0	0	8	1	0	1	0	0	21	14	55000	0	1	0	0	1	0	0	0	0	0	1	0
277	1	0	8	1	1	0	1	0	21	14	10000	0	0	1	0	0	1	1	0	0	0	1	0
278	0	501	8	0	1	0	0	1	21	12	55000	1	0	0	0	0	1	1	0	0	0	1	0
279	0	0	8	1	1	0	1	1	21	14	10000	0	1	0	0	0	1	1	0	0	0	1	0
280	1	1	8	1	1	0	1	1	21	14	85000	0	1	0	0	0	1	1	0	0	0	1	0
281	0	1	8	1	1	0	0	0	21	12	55000	0	1	0	0	0	1	1	0	0	0	1	0
282	1	1	8	0	1	0	0	1	21	12	25000	1	0	0	0	0	1	1	0	0	0	1	0
283	1	0	12	1	0	1	0	0	21	16	10000	0	1	0	0	0	1	0	0	0	0	1	0
284	0	1	12	0	0	1	0	1	21	14	10000	0	0	1	0	1	0	1	0	0	0	1	0
285	0	1	12	1	0	1	0	0	21	14	100000	1	0	0	0	0	1	1	0	0	0	1	0
286	0	1	12	0	0	1	0	0	21	14	85000	0	0	1	0	0	1	1	0	0	0	1	0
287	1	1	12	1	0	1	0	0	21	12	85000	0	1	0	0	1	0	1	0	0	0	1	0
288	0	1	12	1	0	1	0	1	21	12	55000	0	1	0	0	1	0	1	0	0	0	1	0
289	1	0	12	1	0	1	0	1	21	12	10000	0	0	1	0	0	1	0	0	0	0	1	0
290	0	1	12	0	0	1	0	0	21	12	10000	0	1	0	0	0	1	1	0	0	0	1	0
291	0	1	12	0	0	0	0	0	21	12	55000	0	1	0	0	0	1	1	0	0	0	1	0
292	0	1	12	0	0	1	0	0	21	14	10000	0	0	1	0	0	1	1	0	0	0	1	0
293	0	0	12	0	0	1	0	0	21	12	10000	0	1	0	0	1	0	1	0	0	0	1	0
294	0	0	12	0	0	1	0	1	21	12	25000	0	0	1	0	0	1	1	0	0	0	1	0
295	0	0	12	0	1	0	0	0	21	14	25000	1	0	0	0	0	1	1	0	0	0	1	0
296	1	0	12	1	1	0	0	1	21	12	100000	1	0	0	0	1	0	0	0	0	0	1	0
297	1	0	12	1	1	0	0	1	21	14	10000	0	0	1	0	0	1	0	0	0	0	1	0
298	0	101	12	1	1	0	0	1	21	12	100000	0	1	0	0	0	1	1	0	0	0	1	0
299	1	1	12	0	1	0	1	1	21	12	25000	1	0	0	1	0	0	1	0	0	0	1	0
300	0	1	12	1	1	0	0	1	21	14	10000	1	0	0	0	0	1	1	0	0	0	1	0
301	0	1000	12	1	1	0	0	0	29.5	16	10000	0	0	1	0	0	1	1	0	0	0	1	0
302	0	1	16	1	0	1	0	0	39.5	14	25000	0	0	1	1	0	0	1	0	0	0	1	0
303	1	1	16	1	0	1	0	0	29.5	14	25000	0	1	0	0	0	1	0	0	0	0	1	0
304	0	0	16	0	0	1	0	0	21	12	100000	0	0	1	0	0	1	1	0	0	0	1	0
305	0	101	16	0	0	1	0	1	21	12	55000	1	0	0	0	0	1	1	0	0	0	1	0
306	1	1	16	0	0	0	0	1	21	12	10000	0	1	0	0	1	0	1	0	0	0	1	0
307	0	1	16	1	0	0	0	0	21	12	55000	1	0	0	0	1	0	1	0	0	0	1	0
308	0	101	16	1	0	1	0	1	21	14	10000	0	0	1	0	1	0	1	0	0	0	1	0
309	0	1	16	0	0	1	0	1	21	12	55000	0	1	0	1	0	0	1	0	0	0	1	0
310	0	101	16	0	0	1	0	0	21	14	85000	0	1	0	0	0	1	1	0	0	0	1	0
311	0	1	16	1	0	1	0	1	21	14	55000	0	1	0	0	0	1	1	0	0	0	1	0
312	0	1	16	1	0	1	0	0	21	14	55000	0	0	1	0	1	0	1	0	0	0	1	0

ID	informed	donate	bid	bundled	yes	no_yes	yay_say	male	age	education	income	republican	democrat	other	smud	pge	neither	take_info	girlscout	peak	stone	ucd	art
313	0	1	16	0	0	1	0	1	21	14	25000	0	1	0	0	1	0	1	0	0	0	1	0
314	0	1	16	1	0	1	0	0	21	14	25000	0	1	0	0	1	0	1	0	0	0	1	0
315	0	1	16	0	0	0	0	0	21	12	55000	0	1	0	0	1	0	1	0	0	0	1	0
316	0	1	16	0	1	0	0	0	21	14	85000	0	0	1	0	1	0	1	0	0	0	1	0
317	0	101	16	1	1	0	1	1	21	14	10000	0	1	0	0	0	1	1	0	0	0	1	0
318	1	1	16	1	1	0	1	1	21	14	10000	0	1	0	0	0	1	1	0	0	0	1	0
319	0	101	16	0	1	0	1	0	21	12	55000	1	0	0	0	0	1	1	0	0	0	1	0
320	0	1	16	0	1	0	0	0	21	12	55000	0	1	0	0	0	1	1	0	0	0	1	0
321	1	1	16	1	1	0	1	1	21	14	100000	0	1	0	0	0	1	1	0	0	0	1	0
322	1	0	20	1	0	1	0	1	21	14	25000	0	0	1	0	0	1	1	0	0	0	1	0
323	1	0	20	1	0	1	0	1	21	14	55000	0	0	1	1	0	0	1	0	0	0	1	0
324	1	101	20	1	0	0	0	0	21	14	25000	0	1	0	1	0	0	0	0	0	0	1	0
325	0	0	20	1	0	1	0	1	21	12	55000	0	1	0	0	0	1	1	0	0	0	1	0
326	1	1	20	0	0	1	0	0	21	12	100000	0	0	1	0	1	0	1	0	0	0	1	0
327	0	1	20	1	0	0	0	1	21	12	85000	0	0	1	0	1	0	1	0	0	0	1	0
328	0	0	20	0	0	1	0	1	21	14	55000	0	0	1	0	0	1	1	0	0	0	1	0
329	0	1	20	1	0	1	0	1	21	12	85000	0	0	1	0	0	1	1	0	0	0	1	0
330	1	0	20	0	0	0	0	1	21	14	10000	0	0	1	0	0	1	1	0	0	0	1	0
331	0	1	20	1	0	0	0	0	21	12	85000	1	0	0	0	0	1	1	0	0	0	1	0
332	0	1	20	0	1	0	0	1	21	14	10000	0	1	0	1	0	0	1	0	0	0	1	0
333	1	1	20	0	1	0	0	1	21	14	10000	0	0	1	0	0	1	1	0	0	0	1	0
334	0	0	20	0	1	0	0	0	21	12	10000	0	0	1	0	1	0	1	0	0	0	1	0
335	0	0	20	0	1	0	0	0	21	14	100000	0	0	1	0	1	0	1	0	0	0	1	0
336	1	1000	20	1	1	0	0	1	49	20	85000	0	1	0	0	0	1	0	0	0	0	1	0
337	0	1	20	0	1	0	0	0	21	12	55000	0	0	1	0	1	0	1	0	0	0	1	0
338	1	1	20	1	1	0	0	1	29.5	20	25000	0	0	1	0	0	1	1	0	0	0	1	0
339	0	101	20	0	1	0	1	0	21	12	100000	0	1	0	0	1	0	1	0	0	0	1	0
340	0	0	20	1	1	0	0	0	21	14	55000	0	0	1	0	0	1	1	0	0	0	1	0
341	0	0	20	0	1	0	1	0	21	12	85000	1	0	0	0	0	1	1	0	0	0	1	0
342	0	1000	2	1	1	0	0	1	39.5	16	85000	1	0	0	0	0	1	1	0	0	0	0	1
343	1	101	20	1	1	0	0	1	49.5	20	85000	0	0	1	1	0	0	1	0	0	0	0	1
344	1	101	12	1	1	0	0	0	39.5	20	55000	0	1	0	0	0	1	1	0	0	0	0	1
345	1	1	16	1	1	0	1	0	49.5	20	100000	0	1	0	0	0	1	1	0	0	0	0	1
346	0	1	16	0	0	0	0	0	21	14	10000	0	1	0	1	0	0	0	0	0	0	0	1
347	0	101	2	0	1	0	0	0	21	14	10000	0	1	0	0	0	1	1	0	0	0	0	1
348	1	101	20	0	0	1	0	0	39.5	20	100000	0	1	0	1	0	0	0	0	0	0	0	1
349	1	501	12	0	1	0	1	1	49.5	20	100000	0	0	1	1	0	0	0	0	0	0	0	1
350	1	1000	20	1	1	0	1	1	49.5	20	100000	0	0	1	1	0	0	1	0	0	0	0	1
351	0	101	12	1	1	0	0	1	39.5	20	100000	0	1	0	0	0	1	1	0	0	0	0	1
352	1	1000	8	1	1	0	1	0	39.5	20	100000	0	0	1	1	0	0	0	0	0	0	0	1
353	1	1	16	0	0	1	0	1	49.5	16	55000	0	1	0	0	0	1	1	0	0	0	0	1
354	1	501	2	1	1	0	0	1	59.5	20	100000	0	1	0	0	0	1	1	0	0	0	0	1
355	1	1	2	0	1	0	0	1	21	14	10000	0	0	1	0	0	1	1	0	0	0	0	1
356	1	101	12	1	0	0	0	0	39.5	20	85000	0	1	0	0	1	0	1	0	0	0	0	1
357	0	501	8	0	0	1	0	0	49.5	20	100000	0	1	0	0	0	1	1	0	0	0	0	1
358	1	501	20	1	0	1	0	0	59.5	16	85000	0	1	0	0	0	1	1	0	0	0	0	1
359	1	501	12	0	0	1	0	0	59.5	14	95000	0	1	0	1	0	0	1	0	0	0	0	1
360	1	1	12	1	1	0	1	0	59.5	20	25000	0	1	0	0	0	1	0	0	0	0	0	1
361	1	101	16	0	0	1	0	0	49.5	20	100000	0	0	1	0	0	1	1	0	0	0	0	1
362	0	501	20	0	0	1	0	1	49.5	20	100000	1	0	0	0	0	1	0	0	0	0	0	1
363	1	1000	16	1	1	0	1	1	59.5	20	85000	0	1	0	0	0	1	1	0	0	0	0	1
364	1	101	8	1	1	0	0	1	49.5	20	85000	0	0	1	0	0	1	1	0	0	0	0	1

ID	informed	donate	bid	bundled	yes	no_yes	yay_say	male	age	education	income	republican	democrat	other	smud	pge	neither	take_info	girlscout	peak	stone	ucd	art
365	1	1000	2	1	1	0	0	0	39.5	20	85000	1	0	0	0	0	1	0	0	0	0	0	1
366	1	101	20	1	1	0	0	0	39.5	16	85000	0	0	1	1	0	0	1	0	0	0	0	1
367	0	101	8	0	0	0	0	0	49.5	20	25000	1	0	0	0	0	1	1	0	0	0	0	1
368	1	101	20	0	0	0	0	0	39.5	20	55000	0	1	0	1	0	0	0	0	0	0	0	1
369	1	1	12	0	0	0	0	0	39.5	20	85000	0	1	0	1	0	0	1	0	0	0	0	1
370	1	501	2	0	1	0	1	0	39.5	20	85000	0	1	0	0	0	1	0	0	0	0	0	1
371	0	501	16	0	1	0	0	1	59.5	20	85000	0	1	0	1	0	0	1	0	0	0	0	1
372	0	1000	16	1	1	0	0	0	59.5	20	100000	0	1	0	0	0	1	1	0	0	0	0	1
373	0	101	20	0	1	0	0	0	49.5	20	55000	0	1	0	0	0	1	1	0	0	0	0	1
374	0	101	8	0	0	1	0	0	65	20	25000	0	0	1	0	1	0	0	0	0	0	0	1
375	1	101	2	1	0	0	0	1	65	20	55000	0	0	1	0	1	0	1	0	0	0	0	1
376	0	1000	8	1	0	1	0	1	65	20	55000	0	1	0	0	0	1	1	0	0	0	0	1
377	1	501	12	0	1	0	0	0	49.5	20	100000	0	1	0	0	1	0	0	0	0	0	0	1
378	1	101	16	1	1	0	1	1	29.5	16	85000	0	0	1	0	0	1	1	0	0	0	0	1
379	1	1000	2	0	1	0	1	0	59.5	20	85000	0	1	0	0	0	1	1	0	0	0	0	1
380	1	101	8	1	1	0	0	1	49.5	16	100000	0	1	0	0	0	1	1	0	0	0	0	1

Key:

ID	ID number for record
informed	1=respondant answered correctly for renewable energy use question
donate	amount respondent donates to charitable causes (lowest price of range)
bid	price offered for REC
bundled	1=REC offered as bundled product
yes	1=respondant would buy REC at price offered
no_yes	1=respondant would not buy REC at price offered, but would buy at lower price
yay_say	1=respondant affirmatively answered yea-saying question (record eliminated from data set for regression analysis)
male	1=respondent is male
age	respondent's age (lowest age of range)
education	respondent's education level (years of school)
income	respondent's income range (average of range)
republican	1= respondent votes republican
democrat	1=respondent votes democrat
other	1=respondent votes neither democrat nor republican
smud	1=respondent prefers SMUD as their electricity provider at time of survey
pge	1=respondent prefers PG&E as their electricity provider at time of survey
neither	1=respondent has no preference for electricity provider at time of survey
take_info	1=respondent took information card from survey
girlscout	1=survey taken at girl scout cabin
peak	1=survey taken at Peak Performance station
stone	1=survey taken at Stonegate Country Club
ucd	1=survey taken on UC-Davis campus
art	1=survey taken at Art Center

Appendix C: Informational Door Hanger for Test Sale

(Front)

(Back)

RENEWABLE VENTURES

Support Solar Energy in Davis

One of the primary causes of **global warming** is the burning of fossil fuels, like coal, oil, and natural gas. We use these fuels to supply our homes and businesses with electricity.

Replacing fossil fuels with **renewable energy**, such as **solar power**, is an effective way to reduce the negative environmental impacts of electricity generation.

Solar Energy in Davis

There is a solar electricity generating facility in Davis, located near Pole Line and Covell Blvd. **PVUSA (Photovoltaics for Utility Scale Applications)** is on City land and leased to **Renewable Ventures LLC**, who maintains and operates it.

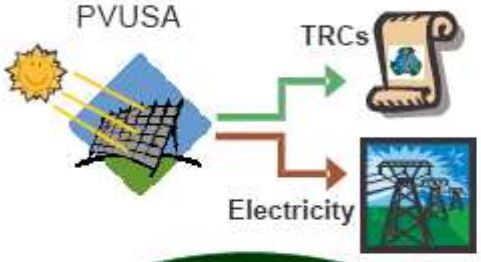
Unfortunately, the cost of production makes it difficult to compete with traditional energy sources.

TURN OVER TO LEARN HOW YOU CAN HELP MAKE SOLAR ENERGY WORK IN DAVIS!

Become 100% Green for $25

www.PVUSAsolar.com

Tradable Renewable Certificates (TRCs) are the environmental benefits that come with renewable energy production, such as cleaner air and water for everyone to enjoy. For every unit of electricity generated, a TRC is also created. These TRCs can be sold separately from the electricity.



Purchase PVUSA Solar™ TRCs today and win a free gift!

By purchasing 750kWh worth of TRCs for $25, you are offsetting the negative impacts associated with the electricity used by an average Davis household for one month. **Buying PVUSA Solar™ TRCs does not buy the electricity**, but allows 750kWh of clean electricity to be generated by the local PVUSA facility from a renewable source (the sun!)

TRCs are available for purchase online:

www.PVUSAsolar.com
Email:
info@pvusasolar.com
Or call:
415.378.9449

Use coupon code: "PV001" for free delivery and gift sticker!

Appendix D. Renewable Energy Certificate

Appendix D. Renewable Energy Certificate

PVUSASolar
A RENEWABLE VENTURES PROJECT
www.pvusasolar.com

Renewable Ventures, LLC
415.378.9449
One Front St., Suite 3300
San Francisco, CA 94111
info@pvusasolar.com

Renewable Ventures, LLC
Proudly Recognizes

for helping to keep our air and water clean through the purchase of

GREEN CERTIFICATES

Green-e Certified

100% Renewable

This purchase allows for the generation of 750kWh of solar electricity at the PVUSA Facility in Davis, California. Enough clean electricity to offset the consumption by an average household for one month.

certificate: 0000001.0000750.2005