Political Attitudes toward the Environment: The Politics of Residential Solar Panel Installations in California

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A Senior Honors Thesis Submitted to the Department of Political Science, University of California San Diego

April 1, 2013

To my loving mother, father, little brother, and relatives.

To family.

To friends.

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Acknowledgements

I would like first thank my faculty advisor, Professor Broz for the time and effort he has put in guiding me through this long process. I learned a lot and will cherish the academic rigor that was instilled in me throughout the whole process and for the rest of my life. Two of the most important skills that I learned from the honors seminar were learning how to think about and write about complex issues.

My friends deserve a special thank you especially those who helped me on this thesis. When I hit an obstacle, you will there with me to help me overcome it. I must give special thanks to Arik Burakovsky, Jonathan Chu, Harrison Gill, Christina Halstead, and Kenneth Cummings. I also want to thank my peers in the political science honors seminar for their help as well.

I also want to acknowledge my parents, my little brother, my grandparents, my aunts and uncles, cousins, and other relatives that supported me. I would not be where I am today without their love and care. And for that, I am thankful.

CHAPTER ONE: INTRODUCTION

1.1 Statement of Research Question and Thesis

My thesis seeks to understand why the use of residential solar power varies across California counties. The pattern of usage does not match solar power generating potential. Solar power generating potential is the maximum amount of energy that can be generated from residential solar panels. A county that has more days of sunshine per year has higher solar power generating potential. However, climate does not do a sufficient job of explaining the distribution of solar panel installations throughout the state of California. For example, there tends to be more residential solar power usage in northern and coastal counties than in sunnier inland countries. My argument is that residents install solar panels primarily for non-economic political and social reasons, and that pecuniary gains of solar power are of secondary importance to homeowners' decision to install solar panels.

My theoretical framework on explaining the puzzle rests on expanding the definition of politics of identity and overlapping it with economics. I delineate the decision of buying a solar panel as a political decision. The high economics costs of buying and installing a solar panel makes the decision a political one. All forms of politics "involves making comparisons and choices among- and commitments to –values and interests and groups and individuals." (54 Parker) The choices a person make in the political arena is way to identify him or her. The decision to buy a solar panel tells others in his or her social network that he or she is an environmentally conscious person. My theory is that the variances of solar panel installations per capita across California counties are based on the residents' political and environmental attitudes.

I examine three dependent variables: the number of solar system panel installations per person in the California county, solar capacity (kW) per person in the California county, and the percent of homes with solar in the California county. All three variables are similar in the sense that all three variables are outcomes. There is an interesting discrepancy in the distribution of solar panel installations throughout the state of California. One would expect counties with more days of sunshine per year to have more solar panels per resident, more solar capacity per resident, and a greater percentage of homes with solar panels. The reason for this is more sunshine translates into more energy production. The extra energy generated can be sold to other customers in the electricity grid to earn credit that can be rolled into the next utility bill to reduce the utility bill or to recuperate the costs for the investment (Cite). There is a financial disincentive for residents of California counties with less sunshine to buy a solar panel. These counties are concentrated in Northern California and along the coast. However, these are the counties that have the highest percentages of solar outcomes per person.

I argue person's political and environmental beliefs and values will be the overriding consideration in a person's decision to purchase a solar panel for their home. That decision affirms the person's identity to both him/herself and to the community at large. There is research that certifies this trend for other consumer goods.

1.1.1 Literature Review

Buying a solar panel is synonymous with being green. Another well-known product that is also known for being synonymous with being green is the hybrid automobile. The question was whether environmental ideology was a determining element in the consumer choice of vehicle?

Matthew Kahn sought to find out in statistical analysis of drivers across the state of California in his paper, *Do Greens drive Hummers or hybrids? Environmental ideology as a determinant of consumer choice* in the Journal of Environmental Economics and Management. The test was to see if "environmentalists" make private consumer choices that reflect their belief system which is to "live a less resource intensive lifestyle." (1 Kahn) He admitted that there is a possibility of free-riding from the rational thinking of process. A person could think that his or her action would have a negligible impact on the environmental quality because the actions of one person will make no difference in improving the environmental situation of the community.

In examination, he found that California environmentalists did make private choices that reflect their ecofriendly philosophy. He found that environmentalists in California "are more likely to use public transit, consume less gasoline and purchase green vehicles such as hybrids.” (16 Kahn) He also found evidence of consumer heterogeneity. The evidence suggest there is a possibility of social interaction that could lead environmentalists to make consumer decisions such as buying a hybrid car to highlight their “greenness” to their peers in the same community.

If environmental and political ideology is a determinant for transportation choices, could it apply to residential solar panels as well? Our claims are similar. He argues that environmental ideology is a determent of transportation choice. I argue that environmental and political beliefs are a determinant of the decision of whether or not to purchase a solar panel. Kahn’s geographical area of analysis was across the state of California. My area of analysis is also California.

And both products share similar characteristics. Both hybrid vehicles and solar panel are expensive investment costing thousands of dollars each. A hybrid car requires at least several years to break even. In the case of a Toyota Prius Hybrid, it takes an average of 9-10 years.[1] If you compared hybrids to their counterparts in the same class of economy cars, they are 25 % to 30% more expensive (Bradford). The break-even point for solar panels is even longer in comparison to the time it takes for a hybrid to break even. Even with all the tax credits and rebates, the costs of installing a solar panel are still quite high. In New Jersey, an above average electricity user of $100 a month can purchase a

[1] At an average of $4/gallon, you would break even after 124,000 miles from the Consumer Guide Automotive. The average American drives 13,476 miles a year according to the Federal Highway Administration. So that translates to a break-even point of approximately 9.2 years.

solar system at $54,000. Including state rebate of $18, 468 and a $2,000 federal tax credit, the system costs are reduced to $33,532. The break-even point for this system is 11 to 22 years (Darlin). The average break-point for a solar panel in California is 14 years as stated by Polly Shaw, a senior regulatory analyst at the California Public Utilities Commission (Darlin). The motivation to purchase a hybrid car or a solar panel is not economic as indicated by John Anderson, a senior principal at the Rocky Mountain Institute, an energy research and consultancy firm (Darlin). This implies that some other incentive is the driving force for people to purchase solar panels.

There is evidence that political and environmental beliefs are the determinant for the purchase and installations of solar panels in California. Samuel Dastrup, Joshua Graff Zivin, Dora Costa, and Matthew Kahn in *Understanding the Solar Home Price Premium: Electricity Generation and "Green" Social Status* wanted to find out if there was market capitalization effect from installing solar panels in San Diego and Sacramento counties. Market capitalization effect means the premium the homeowner gains when they sell his or her home. They found little evidence of a market capitalization effect. It was estimated to be three to four percent premium (17 Dastrup). They did find another fascinating condition. They found the premium to larger in communities with more Prius autos and neighborhoods with more college graduates (17 Dastrup). More significantly, they found a positive relationship between market capitalization effect and Green party registration and Democratic registration (13

Dastrup). They also observed a positive relationship between market capitalization and median income and education.

This is evidence that suggest there is a possibility of a connection between political and environmental philosophy and the percentage of solar panel and solar capacity in a California county. There is evidence of the relationship existing in San Diego and Sacramento counties. The results in Dastrup et al.'s study mirror some of the results found in Kahn's research piece. Both found a positive correlation between percentage of registered Democrats and Greens in a county and their dependent variable. Dastrup ET. Al. viewed political identification as a *predicator* of the capitalization effects of solar panels. I view political and environmental beliefs which include political identification as a *determinant* of the decision to purchase a solar panel. My thesis mirrors Kahn's analysis between transportation choices and environmental values in California. I will do the same, but my dependent variable will be solar panels per capita instead of mode of transportation.

1.2 Hypothesis

My theory is that political ideology shapes Californian's decision to purchase an energy generating solar system for their property. A person's political ideology is a unified set of beliefs. These set of attitudes are based on a set of values which are socialized by the surroundings, social networks, and reinforcing behavior. In the case of my study, I focus on environmentalists whose overall mission is conservation and mitigating the effects of human actions on global society and on the ecosystem. I take a similar supposition made by Kahn (2003). He assumes that environmentalists will make consistent choices in both the public sphere which is displayed in the ballot box and through self-identification, as well in private consumer decision-making. In both the private and public sphere, the environmentalist will make choices that will minimize his or her impact on the ecosystem and human society. That means making choices that will use fewer natural resources, pollute less, and produce less carbon emissions. The decision to purchase a solar panel will consistently reflect the environmental political philosophy.

My goal is to quantify these environmental and political attitudes and measure how much these attitudes affect Californian's decision-making on the purchase of photovoltaic panels for their homes. I have come up with three separate measures to identify whether or not a person is environmentally conscious or not. I will talk more of these measures later on. My overall thesis tests the three following hypothesis:

Hypothesis 1: Counties with a greater percentage of registered Democrats and Green party members are more likely to have a higher percentage of homes with solar panels, greater solar capacity per resident and greater number of solar panels per person.

Hypothesis 2: Counties that votes on average more in favor of pro-environment voter ballot initiatives are more likely to have a higher percentage of homes with solar panels, greater solar capacity per resident and greater number of solar panels per person.

Hypothesis 3: Counties that show more concern for environmental issues are more likely to have a higher percentage of homes with solar panels, greater solar capacity per resident and greater number of solar panels per person.

I will expand on these three hypotheses for the rest of Section 2 of this chapter.

1.2.1 Hypothesis One

My first hypothesis is if a person is a registered Democrat or a registered Green party member, he or she is more likely to purchase a residential solar system for his or her home. Party identification matters because it predicts consumer behavior. The overarching emphasis on the Green Party platform is environmentalism. Their objective is to establish a "national Green presence in politics and policy debate." (http://www.gp.org/about.php) Green party members should have the highest propensity to install a solar panel on their property. Although environmentalism is not a main precept of the Democratic platform, Democrats tend to see environmental issues as important as economic and social matters on a consistent basis.(Find environment in Democratic national platform) In fact, many Democrats see a direct link between the environment, the economy, and social concerns. Because of the high value Democrats have toward the environment, Democrats are more likely to show outward behavior that exemplify this belief and thus are more likely to purchase a solar panel.

My specific prediction is that counties in California that have more registered Democrats (and Green Party members) should have more solar panels within its boundaries. As such, I predict that counties such as San Francisco City and County, Marin County, and Santa Cruz County to have high levels of solar panels and solar capacity per person.

1.2.2 Hypothesis Two

My second hypothesis relates directly to attitudes toward the environment. While political party affiliation can proxy for such attitudes, there may be some slippage between environmental beliefs and party identification. For example, a Republican can be economically conservative but very liberal on social and environmental issues. Therefore, party measures of environmentalism may be rather imprecise.

To improve on this, I also construct county-level measures of environmental attitudes. My specific hypothesis that California counties where residents display more concern for the environment will also have more solar panels installed on residential properties than counties where residents are less concerned with environmental issues. For example, if a county has a large percentage of people who believe climate change poses a real threat to well-being, the county in which those residents reside will have more residential solar panels.

1.2.3 Hypothesis Three

My final hypothesis tests this same argument but uses a direct behavioral measure of county-level environmentalism rather than public opinion data. Responses to a public opinion survey are subject to many types of problems, from “framing” problems, to “cheap talk.” These problems can be avoided by using behavioral measures that involve costly action.

In this instance, I use county votes in favor of environmental projects on state ballot initiatives as a behavioral measure of county-level environmentalism. Voting is costly behavior; moreover such initiatives involve raising taxes to fund environmental projects, which suggests that voters approving these measures are willing to pay for them. My expectation is that in counties where more voters favor state-level environmental initiatives, residents will be more likely to install solar panels on their homes.

1.3 Significance

People are not solely motivated by economic considerations. Individuals make decisions including consumer purchases and investments based on their values and beliefs. My investigation into this puzzle can be viewed as a study into the effects of a person’s political beliefs has on consumer decision-making. Much of the literature that looks at why people purchase solar panels is based on standard consumption theory. Standard consumption theory takes a narrow view of how people make choices in the market. It takes into consideration income and relative prices as the two main elements of decision-making. Keeping in the line with the theory, much of the academic literature that aims to improve the uptake of residential solar in California and the United States focuses on the economic aspect of the industry. Many experts advocated more tax credits, more rebates, and more subsidies to producers.

The use of economic inducements for environmental objectives may not fall evenly across a population when citizens hold wildly divergent political and environmental beliefs. However, they neglect to see the social and political aspects of the problem. What if there were non-monetary solutions in increasing the uptake of solar panel purchases and use by residents?

The finding of this study hopes to raise additional questions to the policy debate. Does party identification predict whether or not you install a solar panel on your home? Does the resident’s voting behavior share a connection with their “consumption” of solar panels? Does a person’s environmental attitude correlate with buying and installing a solar panel? The answers to these questions may have broader implications on public policy dealing with climate change and future energy development policy

1.4 Research Design and Methodology

I will be using three measures to determine the effects of political viewpoints:

1) Partisan identification
2) Attitudes toward the environment.
3) Behavior by voting patterns on state voter initiatives

These three measures all capture elements of the same concept: political beliefs about the importance of the environment. The point of having three measures of political beliefs is to affirm that the results of this study are consistent across alternative indicators of political values.

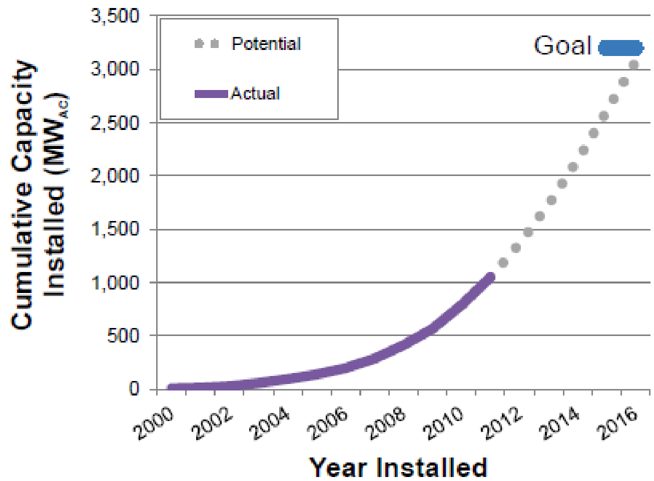
1.3.1 Dependent Variables

As mentioned previously, I have three dependent variables which are 1) number of solar system panel installations per person in the California county, 2) solar capacity (kW) per person in the California county and 3) percent of homes with solar in the California county. Although these three variables are similar they can imply different meanings. For example, a county may have a high level of solar capacity per person, but it may have a lower than expected number of solar panel person. This means each solar installation is larger. Each solar panel is larger. This may imply that the property is larger. This is more likely in less dense areas which are suburban and rural. To illustrate another example, there may many solar panel installations in a county. However, those numbers of installations may have taken place in different time periods at the same property. So a select faction of homeowners may be installing additional solar panels over a long period of time. In order to see if the level of penetration of solar panels into the residential market in the county, one needs to examine percentage of homes with solar panels. Three different dependent measures will assist in making distinctions like those mentioned after the statistical analysis.

I got the raw data for my first and second dependent variable data from the Appendix I of the *California's Solar Cities 2012: Leaders in the Race toward a Clean Energy Future* generated by Environment California Research and Policy Center. They had the number of solar installations and solar capacity of each city. I had to find the corresponding county for each city and aggregate the results. Then in order to get the per capita result, I divided the number of solar installations and solar capacity for each county by the county's population taken from the 2010 United States Census. The numbers for percentage of homes with solar panels for each of the counties are taken from Sunrun.com which is taken from the California Solar Initiative program. The data was taken to May 2010.

All the data for the three dependent variables are cumulative. At first glance, this may pose a statistical drawback. Although I am measuring the dependent variables with independent variables gathering from an eight year period, solar panel installations started in the state of California way before 2000. However, the number of installations is minimal. Therefore, it is valid to discount them. Moreover, the increase of solar panel installations starts in 2000 as shown in Figure 1 below.

Figure 1: Actual vs. Potential Solar Residential Capacity to 2016



Source: Davis, Benjamin and Travis Madsen. "California's Solar Cities 2012: Leaders in the Race toward a Clean Energy Future." Environment California Research and Policy Center. January 2012. P.16 Print.

Admittedly, having the number of solar installations for each county on a year by year basis will reveal how people changed their consumer behavior according to changes in their values and beliefs measured through public opinion surveys, voting patterns, and changes in party registration in each county. Because I have to match the cumulative data I had for solar panel installations, percentage of homes with solar panels, and solar capacity for each county, I had to aggregate the data I had for my independent variables.

1.3.2 Independent Variables

The first independent variable is the percentage of registered Democrats, Republicans, and Greens in each of the California counties. Political identification is a proxy of environmental beliefs. Modern American political parties are divided not just on economic and political issues, but on social and environmental issues as well.

The second independent variable I will be using is the public opinions of California residents. The public opinion of Californians on environmental issues is taken from survey results provided by the Public Policy Institute of California.

The last independent variable in this study is the results of voter initiatives that deal with the environment in each of the California counties. The reason why I use this as a variable because of voting for a voter initiated proposition poses a cost to the voter. The act of voting is a cost in itself. It takes a certain amount of effort to research the issues and then to actually vote for your preferred choice. On top of that, many of the state propositions stipulate increases in tax rates and/or increased costs for the state government and taxpayers to fund the implementation of the passed voter initiatives. Because of the associated costs, it is possible to get a more accurate picture of the political preferences of the residents compared to the preferences derived from a survey.

1.3.3 Control Variables

Although the purpose of my study is to explore the effects of political values on microeconomic decision making on California residents, it is prudent to look at effects of other factors. I will be using control variables to test the relative effects of the independent variables. I stipulate that counties that have a higher proportion of females, wealthier residents, Caucasians, and educated residents should display more residential solar capacity. As such, my control variables will be gender, median household income, and race.

I will also control for incentives provided for the government to install solar panels. All homeowners in California have access to incentives provided by the federal and state governments. I will assume that these incentives will be constant for all California homeowners. However, there are incentives provided by city and county governments and I will have to control for this. I will be using data derived from the Database of State Incentives for Renewables and Efficiency from North Carolina State University. Although this database does not say whether or not it lists incentives by all cities and counties, it was the most through database I came across.

1.5 Organization of the Study

My thesis contains five chapters. The first chapter of the study is my introduction to my thesis. The chapter presents the puzzle, goes over lays out my main claims, explains what my goals are, describes the methodology and rationale of my investigation, and lays out the structure of my research.

The second chapter will delve deeper in into my research question. I will describe in length the data behind my research question by presenting a number of datasets, tables, and maps.

In my third chapter, I will further elaborate on the theories connected to my research question and compare it will alternative theories of explanation.

Chapters five will cover the results of my statistical analysis. **I will *not* talk about every single regression I ran because many of the regressions turned out to be statistically insignificant.** The regressions that I will elaborate on are those that are statistically significant or display an interesting trend. I will mention a few of the regressions that were statically insignificant, but I will *not* include the corresponding scatterplots and tables in the thesis.[2] In the fourth chapter, I will take apart my statistical analysis between party identification and the dependent variables, look at the analysis between public opinion and the dependent variable, and dissect the relationship between voting patterns and my dependent variables.

[2] If you interested in taking a look at all the regressions along with the raw data, datasets, syntax, and other files, please refer to the supplement. The supplement will be separate from the thesis and will be in electronic form.

In the fifth chapter, I will briefly talk about my findings. The point of the chapter is to point out the flaws in my research design and find ways on to improve it to create an ideal research study.

There will be an electronic attachment with all the datasets, files, and statistical analysis of my thesis. It will be located in the supplement.

CHAPTER TWO: Describing the Puzzle

2.1 The Puzzle

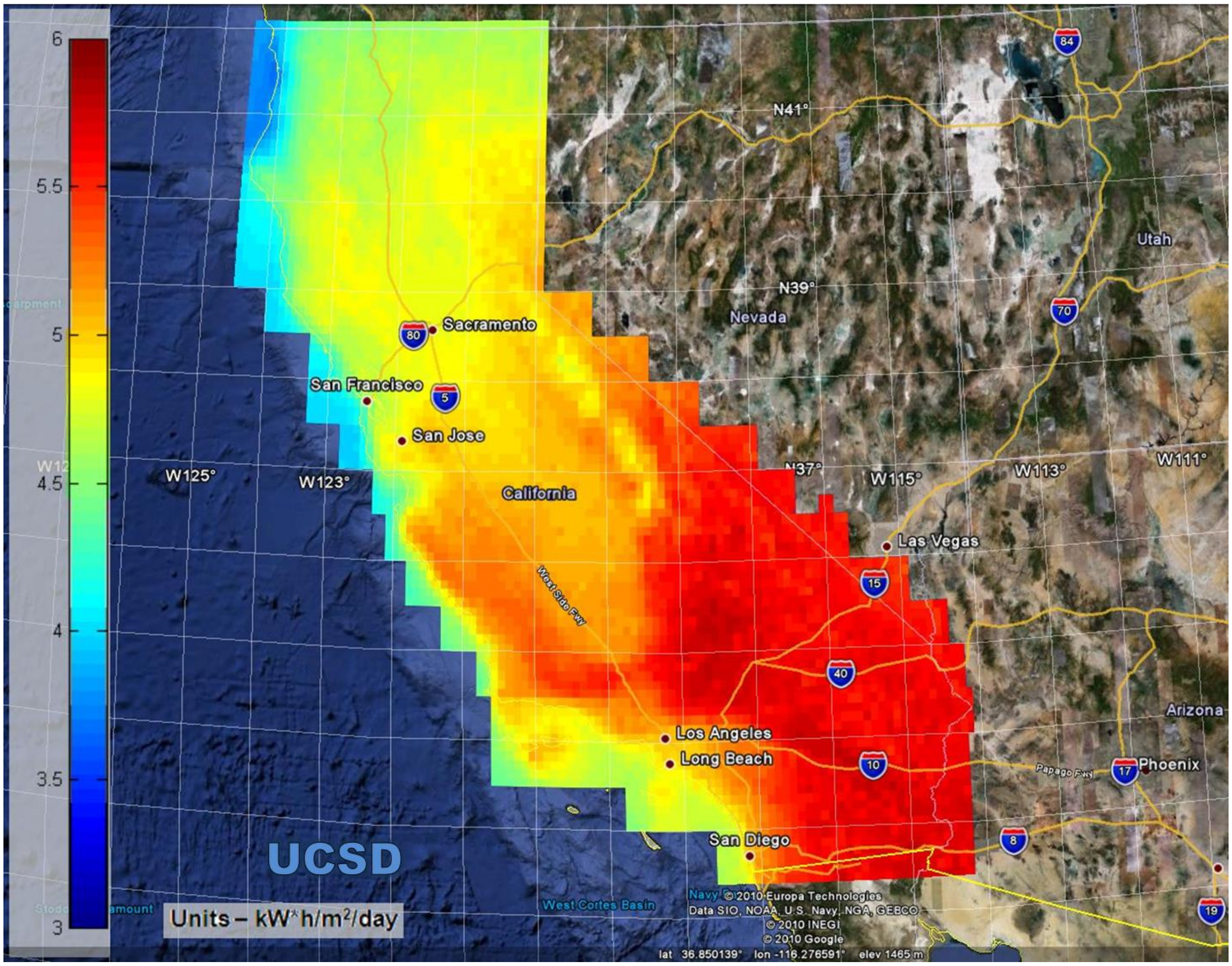
Using climate as a model to predict the concentration of solar installations, we should expect to see more solar panels per capita in counties that have potential for solar power generation. That means the counties that have more sunlight on average year around should have more solar panels installed relative to California counties that have fewer days of sunshine. The rationality for this expectation is homeowners should see a greater return on their investments when more electricity is generated by the solar panels when there is abundant sunlight. More sunlight means more electricity homeowners are able to sell to the others in the utility grid or consume their own use. Thus, it would make more fiscal sense for residents living in places with more sunshine to buy and install solar panels.

Applying this logic to California, one would expect the inland counties and southern counties of California to have the most solar installations per resident. Counties like Los Angeles, Riverside, Imperial, and San Bernardino. The reality is the opposite. This chapter will investigate how well climate predict the distribution of solar panel installations in California.

2.2 Overview of California Climate and Distribution of Solar Panel Installations

If we use climate as a predictor of who would install a solar panel, we would expect the distribution of solar panel installations to mirror the climate. The definition of climate is defined as the weather conditions prevailing in an area in general or over a long period. This includes days of sunshine. The total solar power generating potential of an area can be more accurately measured by the amount of solar radiation it receives on average per year. Figure 2 below is shows the varying degrees of solar radiation of the state.

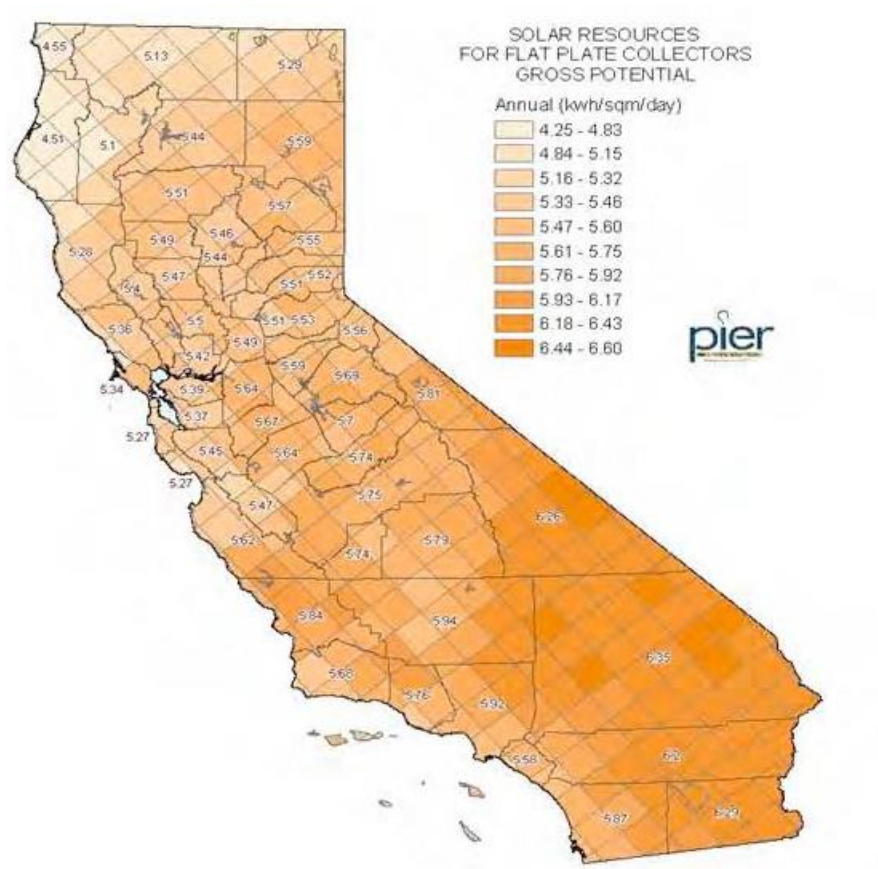
Figure 2: Solar Radiation in the California measured in kW*hours/meters squared per day



Source: Web: http://solar.ucsd.edu/images/CA_irradiance_map.png

We can accurately measure how much solar radiation will translate into solar power generating potential. Taking in consideration terrain, slope of the terrain, cloud layer and other weather and geographical factors, scientists and engineers can calculate the power generating potential of each area in California. The scientists and statisticans at the California Energy Commissino were able to map out the solar generating potential of California divded into counties as shown in Figure 3 below. The concentration of solar panel installations should reflect the map in Figure 3.

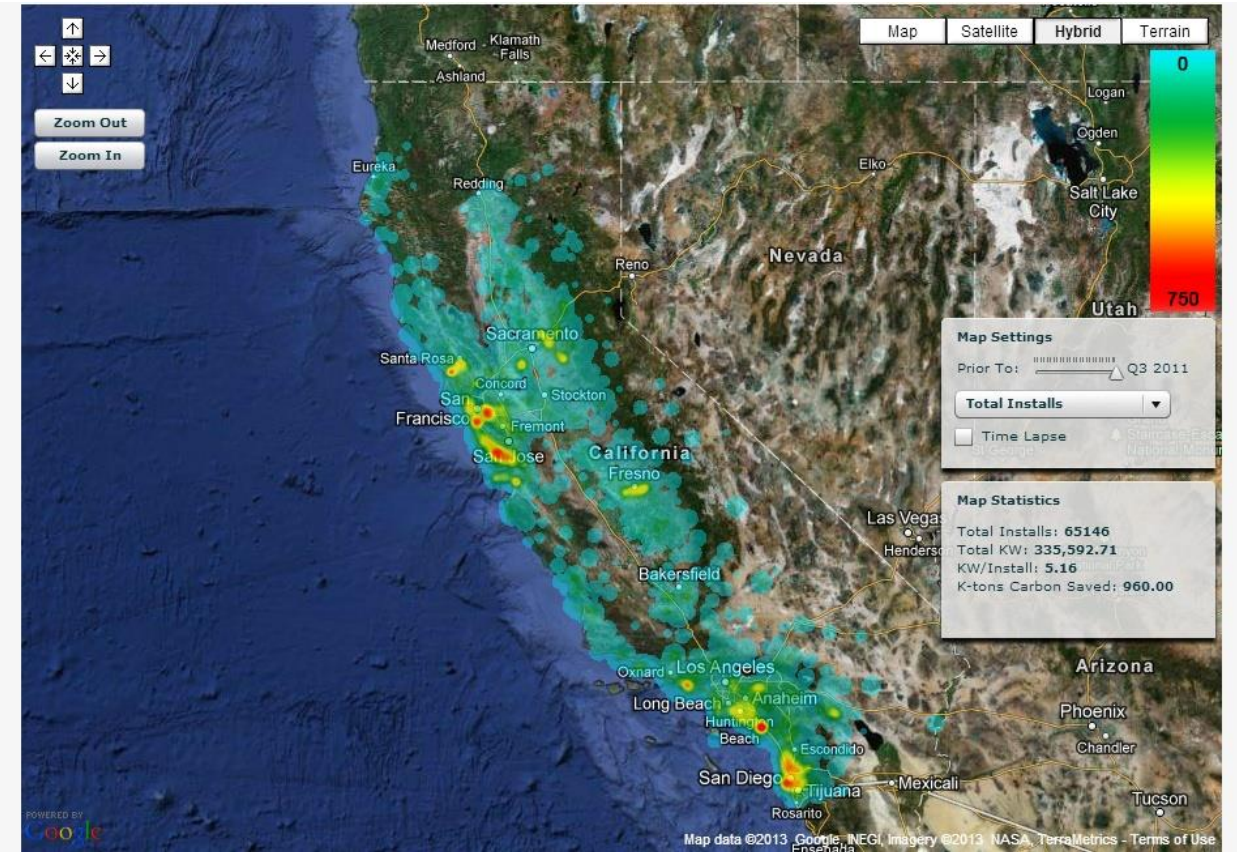
Figure 3: Map of California Counties' Solar Power Generating Potential



Source: Simmons, George and Joe McCabe. "California Solar Resources: In Support of the 2005 Integrated Energy Policy Report." Research and Development, Energy and Research Development Division, California Energy Commission. April 2005. p. 7 Print

The actual distribution of solar installations throughout the state does *not* match climate at all. Figure 4 below shows the actual concentration of solar panel instructions. There are pockets of solar panel installations concentrated heavily in southern areas in Los Angeles, San Diego, and Long Beach and in inland areas centered on Sacramento and Fresno. Conversely, there are concentrations of solar panels installed in San Francisco, Santa Rosa, Santa Cruz, and San Jose. These are areas with relatively less days of sunshine in California. The maps do have a flaw. They do not take in account population density or the size of population in those areas. The reason that areas of solar installations are concentrated is explained by the large population living in the California's large cities. There are more solar installations in cities simply because there are more people. Therefore, there is a greater chance some random person would install a solar panel.

Figure 4: Heat Map of Solar Installations throughout California Prior to Q3 2011



Source: "Solar Energy Installation Map." SolarEnergy.net. 2012. Web:
http://www.solarenergy.net/Articles/solar-energy-installation-map.aspx

2.2.1 County Level

We can also approach the climate model looking at data on a county level since my level of analysis is focused on the county level. I use "average days of one inch or more rainfall" as my dependent variable to predict the percentage of homes with a solar panel which is placed on the Y axis. I use "average days of one inch or more rainfall" instead of average days of sunshine in year because data for average days of sunshine in year for the counties in California was not readily available. Instead, I opted to use another variable that shares a negative relationship with the amount of sunshine a county experiences. The average days of one inch or more rainfall is negatively correlated with the total days of sunshine. If a county has more average days of one inch rainfall, it is likely to experience less solar radiation in the same time period. It does not share a perfect correlation, but it is the best, valid alternative with complete data for all the counties. Based on the climate model and solar power generating potential, the relationship between the amount of sunshine and percentage of homes with a solar panel can be summarized by "The more days of rainfall of one inch or more a county experiences, the smaller the percentage of homes that will have a solar panel."

Figure 5 below is a simple scatterplot that shows the actual relationship between the average days of one inch or more rainfall versus the percentage of homes that has a solar panel for each of the counties in California.[3]

[3] The data for percentages of homes with solar panels and average days of one inch or more rainfall are located in the Appendix.

Figure 5: Relationship between Percentage of Homes with a Solar Panel and Number of Days of Rainfall of One Inch or More for California Counties

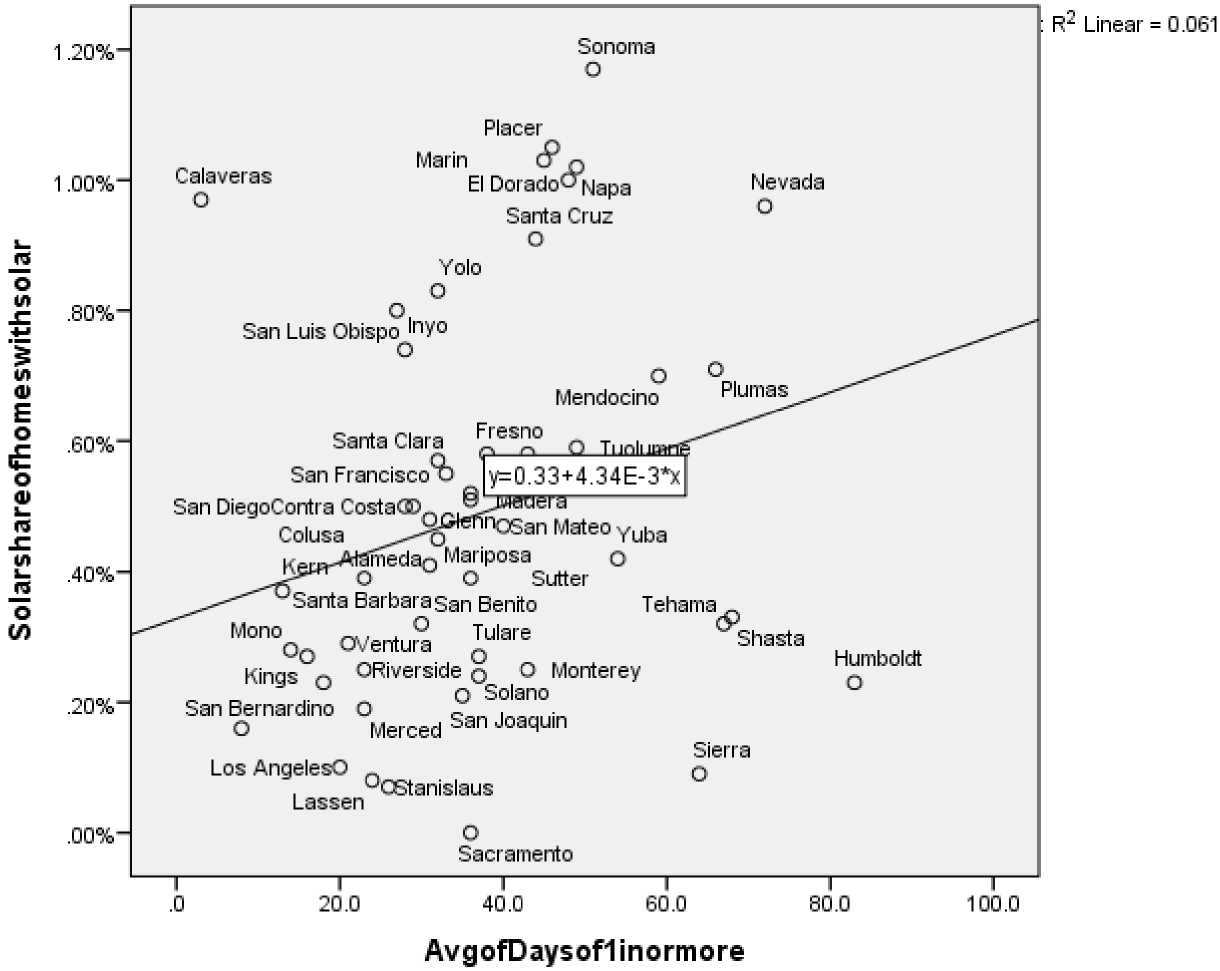


Table 1: Descriptive Statistics of “Relationship Between Percentage of Homes with a Solar Panel and Number of Days of Rainfall of One Inch or More for California Counties” Scatterplot

Descriptive Statistics

	Mean	Std. Deviation	N
AvgofDaysof1inormore	36.980	16.9133	51
Solarshareofhomeswithsolar	0.4882%	0.29810%	51

The fit line in the scatterplot shows that as the average days of one inch or more rainfall increases, the greater percentage of the of homes with a solar panel. This is the opposite of what we expected based on the climate model.[4]

Let's look at the some of the cases. Orange County has 18 average numbers of days per year with rainfall of one inch or more compared to the mean in the state which is about 37 days of one inch or more rainfall. This is at the lower end of the spectrum in the state. The expectation would be Orange County should have a more solar panels per capita than most other counties especially because it falls outside the standard deviation. However, this is not the case. Orange County only has 0.23% of its homes with solar panels compared to the state mean of 0.4882% of homes with a solar panel. Orange County is only 53% of the California mean of percentage of home with a solar panel. The climate model fails to predict the outcome in the case of Orange County.

Santa Cruz averages 44 days of rainfall of one inch or more each year. This is 7 days above the state average. Yet, the county has 0.91% of homes covered by solar panels. This is 0.61% higher than the state mean. This is over a 100% increase above the state average. This county has more than double the days of rainfall compared to Orange County but yet it has more four times the homes covered with residential solar systems than it.

[4] I had to reduce the sample size to 51 counties because some counties had missing data on percentage of homes with a solar panel side.

When comparing two like counties, the failure of climate based model becomes more apparent. Contrast the cases between San Diego County and San Francisco County. Both are coastal counties. Both are urban counties with high densities of residents per square mile. San Francisco has 8,714 people per square mile and San Diego has 710 people per square mile according to the 2005 estimates by the California Public Utilities Commission. Both counties are way above the state average of 235.68 people per square mile. Both are wealthy counties. According to the American Communities Survey (ACS) for years 2007-2011, the household median incomes for San Diego and San Francisco counties were $63,857 and $72,947 respectively. These two counties' household median incomes were above state's household median income of $61,632. Both counties rely on similar industries like tourism, high technology industries like biotechnology and internet companies, and trade.

The difference is in climate. Although San Diego has an average of 29 days of one inch or more rainfall while San Francisco has 33 days, these numbers do not present the most accurate description. It seems like the two counties experience the same amount of sunlight. This is not true. First, San Diego is located 500 miles south of San Francisco. Due to the angle of the tilt of the Earth's axis, San Diego receives more solar radiation.

This is why it is necessary to look at the data on amount of the solar radiation for each county. Appendix A displays all the solar power generating potential by county. Solar PV potential is more closely correlated with the amount of solar radiation a county receives in a year. Appendix A clearly shows that the counties with the most energy potential are the counties that are inland and in the south of the state. The top five counties are San Bernardino, Inyo, Riverside, Los Angeles, and San Diego in this order. These are desert and semi-arid areas with many days of sunshine. San Diego has 3,561,569 MWH (megawatt hours) per day solar PV potential. This far surpasses San Francisco's potential of 38,977 MWH per day. Despite the vast difference in solar power potential, San Francisco has a higher percentage of homes with a solar panel. 0.55% of homes in San Francisco have a solar panel compared to the 0.50% in San Diego.

The entire relationship between percentage of homes with a solar panel and solar power generating potential is displayed in Figure 6 underneath. The fit line shows as solar power generating potential increases for a county, there will be a smaller percentage of homes with a solar panel. Figure 6 is consistent with the previous scatterplot's statistical relationship. It shows that as the amount of solar radiation increases, the less likely a Californian will install a solar panel on their property. This is the opposite of the expectation set by the climate based model.

The two linear regression's scatterplots show that climate has little predictive power in forecasting the percentage of homes with a solar panel in a California county. The R squares in the Figure 5 is 0.061 and it is 0.042 in Figure 6. Both the relationship between solar radiation and the percentage of homes with a solar panel and the R square values indicate a better variable is needed to explain the distribution of solar panel installations across the state.

Figure 6: Relationship Between Percentage of Homes with a Solar Panel and Solar Power Generating Potential Measured in MWH per day

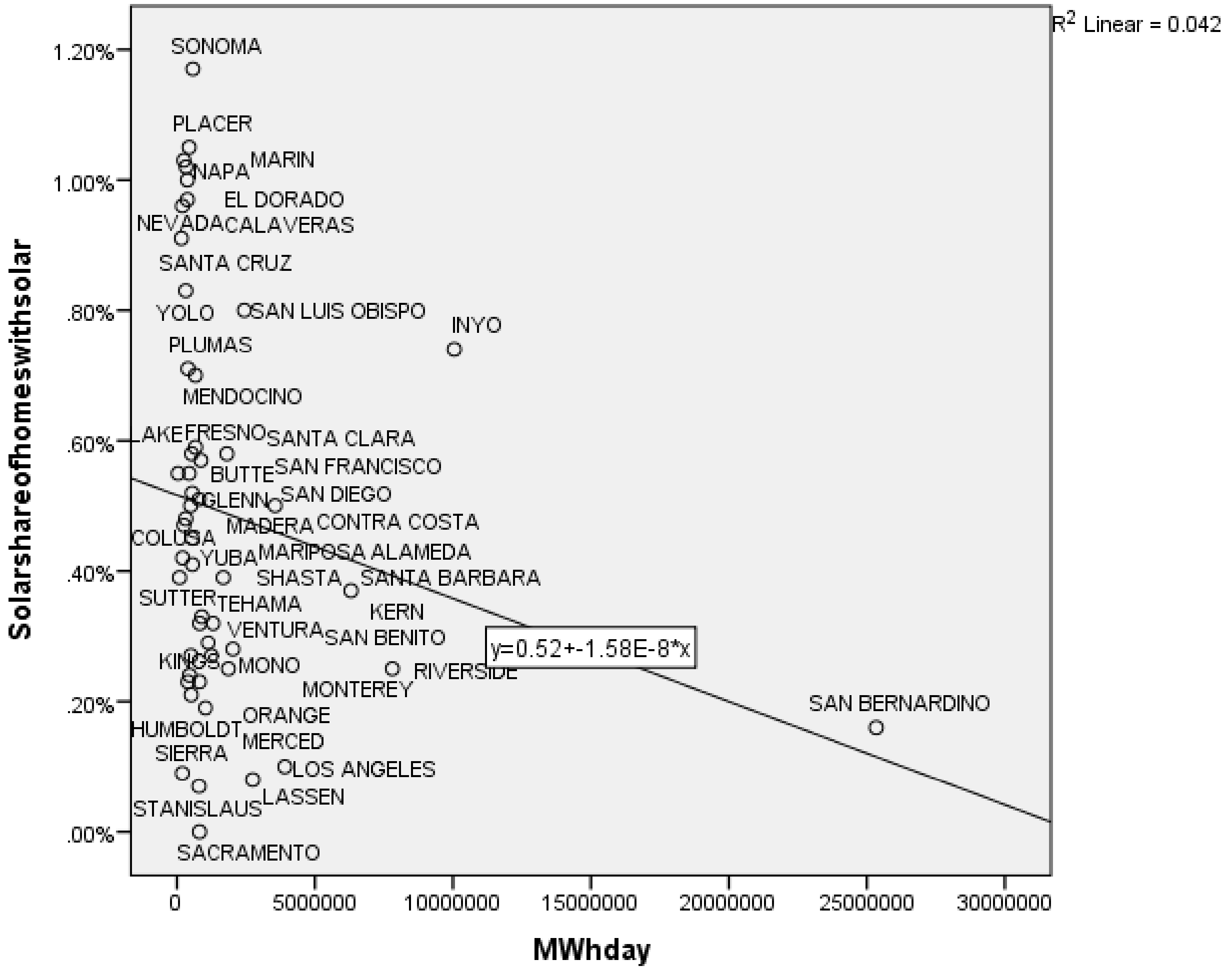


Table 2: Descriptive Statistics of "Relationship between Percentage of Homes with a Solar Panel and Solar Power Generating Potential Measured in MWH per day"

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
MWhday	51	38977	25338276	1783523.02	3878946.612
Solarshareofhomeswithsolar	51	0.00%	1.17%	0.4882%	0.29810%
Valid N (list wise)	51				

I theorize that the prevailing political and environmental attitudes in California counties have an effect on whether or not a person is likely to purchase and install a solar panel. The main difference between San Diego and San Francisco counties is political. San Francisco is considered a heavily Democratic county while San Diego leans Republican. Of the registered voters in San Francisco, 55% of them are registered Democrats and nine percent were registered Republicans.[5] On the other hand, the Republican Party has a more prominent presence in San Diego County. Of the registered voters in the general election of 2008, 35.31% were Democrats compared to 34.07% registered Republicans. San Diego County has generally voted Republican in presidential elections. It is only recently that San Diego has voted for the Democratic candidate for President. Since 1980, San Diego has placed its vote for a Republican candidate for President six times out of nine. San Francisco is liberal stronghold and it has not voted for a Republican for President since 1956.[6]

[5] Data obtained from the San Francisco Department of Elections, http://www.sfelections.org/tools/election_data/.
[6] Election data obtained from the California Secretary of State, http://vote.sos.ca.gov/.

CHAPTER THREE: THEORITICAL BACKGROUND

In place of climate as a predictive measure for forecasting the likelihood of a California resident to purchase a solar panel, I will use political and environmental ideology as the independent variable. I assert that political and environmental attitudes influence a person's decision on whether or not a person purchases and installs a solar panel on their house. The origin of my theoretical framework is based on Veblen's idea of conspicuous consumption and consumer decisions based on political identity. I will take his idea of "dress as an expression of the pecuniary culture" and transform it into "green products (hybrid vehicles and solar panels) as an expression of political-environmental culture." I will do this by connecting the politics of identity with the politics of consumption. Finally, I will narrow area of focus to green products specifically solar panels and elaborate on the "Prius Effect."

3.1 Veblen's Concept of Conspicuous Consumption and Identity

Thorstein Veblen at the turn of the 19th century came up with his theory on social-class consumerism that was arising. The added productivity of the industrial revolution created the fledging middle class and a class of elite rich owners of capital. The added surplus income experienced by many gave people to ability to spend on more goods and a wider range of goods at more frequency. As class divisions arose between the wealthy, middle class, and the poor, so did consumer behavior between the income groups. He postulated that the conspicuous consumption by the wealthy was not based on economic considerations. Why would anyone need more than a few pair of suits or dresses? The goods that the rich spent lavishly on did produce any immediate economic benefits. He pointed to goods such as silver flatware and elaborates on the economic logic behind fashion and dresses for women. The point of the conspicuous spending is to highlight one's "pecuniary success" as evidence of one's social worth (Veblen 1899). The ability to "consume freely and uneconomically" is to show others that "he or she is not under the necessity of earning a livelihood." (Veblen 1899) He defined the products the rich purchased as "socially visible" consumer goods which also known as Veblen goods. The goods are made to be plainly visible to others and send the clear message about what socio-economic characteristics the buyer possesses.

Veblen's logic of conspicuous consumption is associated with the notion of economics and identity. George Akerlof and Rachel Kranton published their version of the idea in *The Quarterly Journal of Economics* in August 2000. Like Veblen, differences in behavior arise from social differences (Akerlof and Kranton 2000, 716). The modeling of identity is based on four precepts (Akerlof and Kranton 2000, 717):

1. People have identity-based payoffs derived from their own actions.
2. People have identity-based payoffs derived from others' actions.
3. Third parties can generate persistent changes in these payoffs.
4. Some people may choose their identity, but choice may be prescribed to others.

The most relevant principles in my theoretical framework are points one and two which I will explain later in the chapter.

On these four tenets, Akerlof and Kranton further expand on the implications of identity on the field on economics. They identify identity as "fundamental to behavior, choice of identity may be the most important 'economic' decision people make." (Akerlof and Kranton 2000, 717) They identify the reason for consumer decisions that run against traditional economic logic. It is the "bolster a sense of self or to salve a diminished self-image." (Akerlof and Kranton 2000, 717) Lastly, consumer behavior based on identity can create an externality. What this means is "one person's actions can have meaning for and evoke responses in others." (Akerlof and Kranton, 2000 717)

3.1.1 Applying Veblen Concepts and Identity to Political Science

Now, I need to apply the ideas of Veblen and economic identity to my study by converting those ideas into political ones. Solar panels are Veblen goods because when installed on a roof, they are visible to neighbors. Solar panels instead of communicating class distinction, it meant to signaled to others that the homeowner is an environmentally conscious person.

As shown in chapter one, solar panels are costlier investments taking at least several years to break even. Even with incentives provided by the states, solar panels remain costly. Therefore, I assume that homeowners that decide to purchase solar panels based on non-economic reasons. I assert the reason behind the people who decide to purchase solar panels do so because they wanted to bolster their image of an environmentalist.

By installing the solar panels, earlier consumers of solar panels influence others to purchase solar panels for their homes. This is the externality that is created. This is logic behind the clustering of solar panels which I will elaborate on further later on in the chapter.

Although Akerlof and Kranton argue that choice of identity is the most economic decision, I contend that choice of identity and consumer decisions are the most important political decisions a person can make. The authors allude to the importance of political identity. They write, “Politics is often a battle over identity.” (Akerlof and Kranton 2000, 726). They go on further and say, “Symbolic acts and transformed identities spur revolutions. The authors cite the French Revolution changing national subjects into citizens and the Russian Revolution changing citizens into comrades. The environmental movement that was birthed in the 1960s made people into *environmentally conscious consumers* (Shah 2007, 7). I presuppose green consumers are the ones who purchase and install solar panels in order to display to others in their communities that they are indeed environmentally conscious consumers.

3.2 Identity Politics and Politics of Consumption

How do consumer decisions relate to political identity? Consumer decisions including the decision to buy a solar panel or not is based on the “efforts to define and defend who I am.” (Parker 2005, 53) Political activity is basically is animated by the same logic. And “all politics is identity politics.” (Parker 2005, 53) “Politics involve making comparisons and choice among- and commitments to- values and interests and groups and individuals (including choices not to choose among available choices). The choices and the commitments we make in politics are ones which we mean to- or by which we cannot help but- identify ourselves.” (Parker 2005, 53)

The act of buying a solar panel is a political act to define oneself as an environmentally aware citizen intrinsically, but exhibit that image to others. The act of buying a solar panel is also meant to differentiate oneself from others in society. The environmental movement has done a good job at stigmatizing non-green social behavior. One only has to look at public recycling campaigns that encourage people to recycle. A person has the choice to recycle or not. Choosing to recycle does have an associated cost. The act of recycling means taking the time to learn what and what not to recycle and actually taking the time and effort to carry out the act. By choosing to recycle especially done in a public fashion, one can signal to others that they are an environmentalist. The same logic applies to the purchase of solar panels. However, the decision to purchase a solar panel carries much more cost than the act of recycling. To do is clear commitment to adhere to sustainable values and a clear indicator of others of the political-environmental values the purchaser holds.

Recent research done by David Crockett and Melanie Wallendorf and by Mark Legg, Chun-Hung Tang, and Lisa Slevitch provide empirical evidence that political ideology affect consumer decision-making. In examining the driving motivations behind certain destinations tourist choose to vacation at, Legg ET. Al substituted demographic variables with political ones (Legg 2012, 54). The scholars found that this was a more "efficient" model. Analyzing the Akaike Information Criteria (AIC) and Schwartz Criteria (SC) scores of political variables and demographic variables, models that included "variables that exhibit congruity between political ideologies of travelers and destinations" improved the predictive power of destination choice models (Legg 2012, 54). Interestingly, when distance to destination (considered an additional cost to the tourist) was used as a control variable, it strengthened the influence political leaning had on the choice of destination. As costs associated with choices increase, the more powerful the political variable becomes. This could be true for the decision-making process for solar panels because of their high costs.

Additionally, Crockett and Wallendorf suggest that consumer choice is increasingly an important way for citizens to express themselves politically. People's "involvement in more traditional acts of political participation is decreasing." (Crockett 2004, 525) Traditional acts of political participation include voting, volunteering for campaigns, and following political events through media.

Therefore, the relationship between political-environmental attitudes and the likelihood to purchase a solar panel should be stronger and increased over the last ten years.[7]

3.3 Prius Effect Applied to Solar Panels

Literature from psychology gives insight on whether or not a person's values, beliefs, and attitudes impel a person to act a certain way that is congruous with their system of values. The purpose of psychological research focuses on the linkage between internal/psychological variables with behavior. The resulting research "suggests that pro-environmental behavior (PEB) originates from values, beliefs, and attitudes that orient individuals toward particular actions."(Clark 2003, 237) The inquiry determined that attitudes do influence people to carry out pro-environmental people. This theoretical framework and empirical evidence from the literature support my main claim that political-environmental beliefs cause proprietors to buy and install solar panels.

I have mentioned the research conducted by Matthew Kahn in the introduction. He sought to find out if environmental ideology was a determinant factor in the purchases of cars. His product of interest was the hybrid vehicle. Similar to my model, he assumes that a rational environmentalist would take actions that fit his or her set of sustainable values. He or she would do so even "willingly sacrifice their scare time and financial resources" to uphold those set of

[7] Unfortunately, I do not have year to year data on the number of solar panel installations for each of the counties. As a consequence, I cannot confirm if the relationship between political-environmental ideology and the propensity to install a solar panel has strengthened over time with a time-series analysis.

beliefs (Kahn 2007, 1). We can classify this behavior as “voluntary constraint”. The first reason for this is to reinforce a certain social image. The particular social image is hybrid owners are trying to reinforce is the image of a green shopper. The second reason is to remain credible within a certain political group like the Green Party. A Green Party member who drives around in a Hummer would be considered by his or her peers as a non-member since the driver’s decision are hypocritical (Kahn 2007, 3). Hypocrisy has social consequences. The Hummer driver could be shunned by other Green Party members.

The effects that Kahn has examined in his report have been classified as the “Prius Effect” by Steven and Alison Sexton. All the academic literature implies hybrid car owners particularly Prius owners are motivated by political ideology of sustainability. They suggest residents with solar panels are motivated by their environmental politics because of the fact that “solar panel installation and car ownership decisions are two of the *most visible consumption decisions* households make” (Sexton 2011,2). Given the fact that solar panels share many of the same characteristics as hybrid cars, environmentalists should respond in similar way toward this merchandise.

> All else equal, a Prius is more valuable in communities with a strong ethos like Berkeley, California than in communities with a greater heterogeneity in attitudes toward the environment like, for instance, Bakersfield, California. Thus, while shares of all green car models are expected to be greater in green communities than ‘brown’ communities to the extent individual green purchases are motivated, at least in part, by efforts to signal type, then Prius share should be disproportionately greater than other green models in

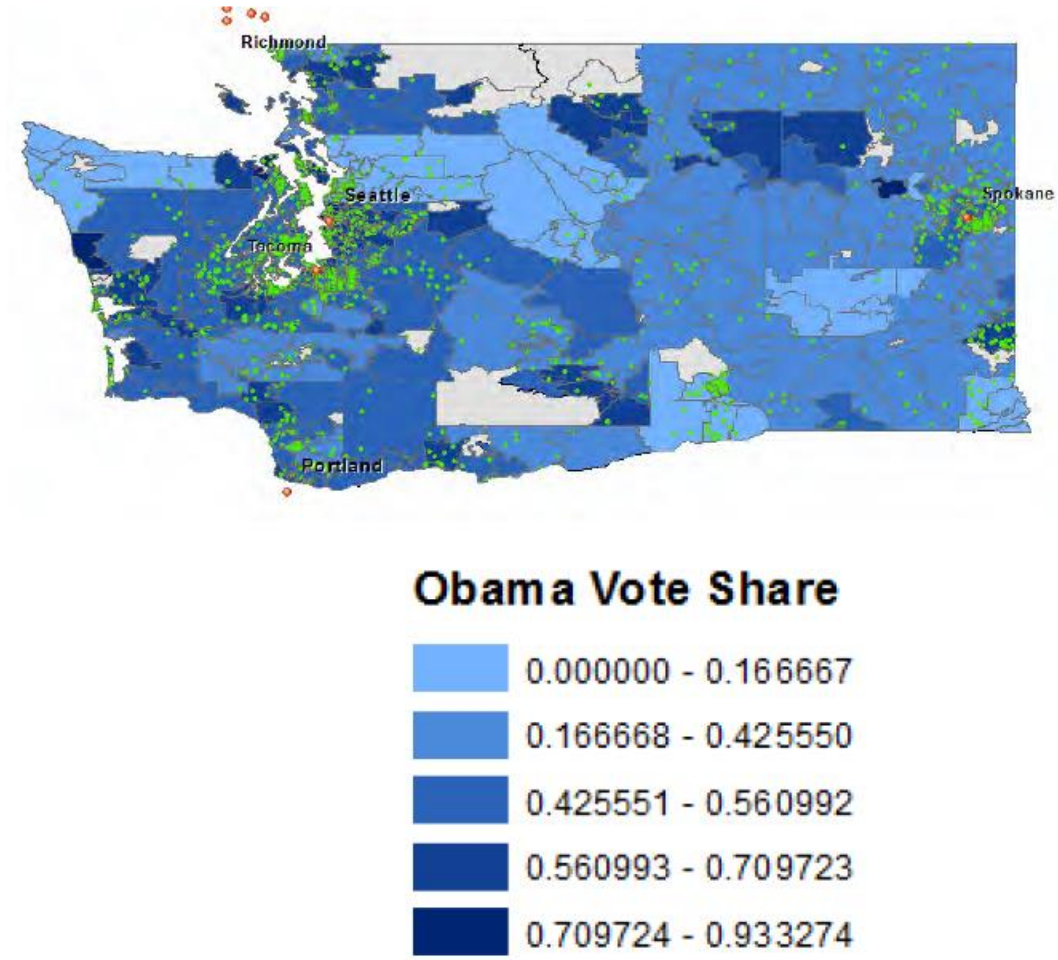
> these communities because of its unique capacity to signal green type (Sexton 2011, 3)

My model anticipates a similar model of behavior. Solar panels should be more valued in green communities and less so in brown districts. Thus, the share of solar panels in a green county should be higher than a brown county. Using the same line of reasoning, counties that are more Democratic should have a higher share of solar panels compared to Republican counties.

3.3.1 Spatial Clustering of Solar Panels

The distribution of Prius locations against the registered Democrats in the state of Washington organized by zip code is derived from Sexton's summary statistics. The geographical distributions of Priuses are represented in Figure 7. Each green dot represents five Priuses. Darker shades of blue signify that a. zip code had a greater share of vote that voted for Barack Obama in the 2008 election. The darker the color, the more Democratic the zip code. The large number of Priuses is concentrated in cities like Seattle and Spokane that are heavily Democratic. There are very few Priuses in zip codes that had smaller vote share for Obama in the 2008 election.

Figure 7: Prius Ownership and Obama Vote Share 2008 Election in Washington (1 dot represents 5 Priuses)



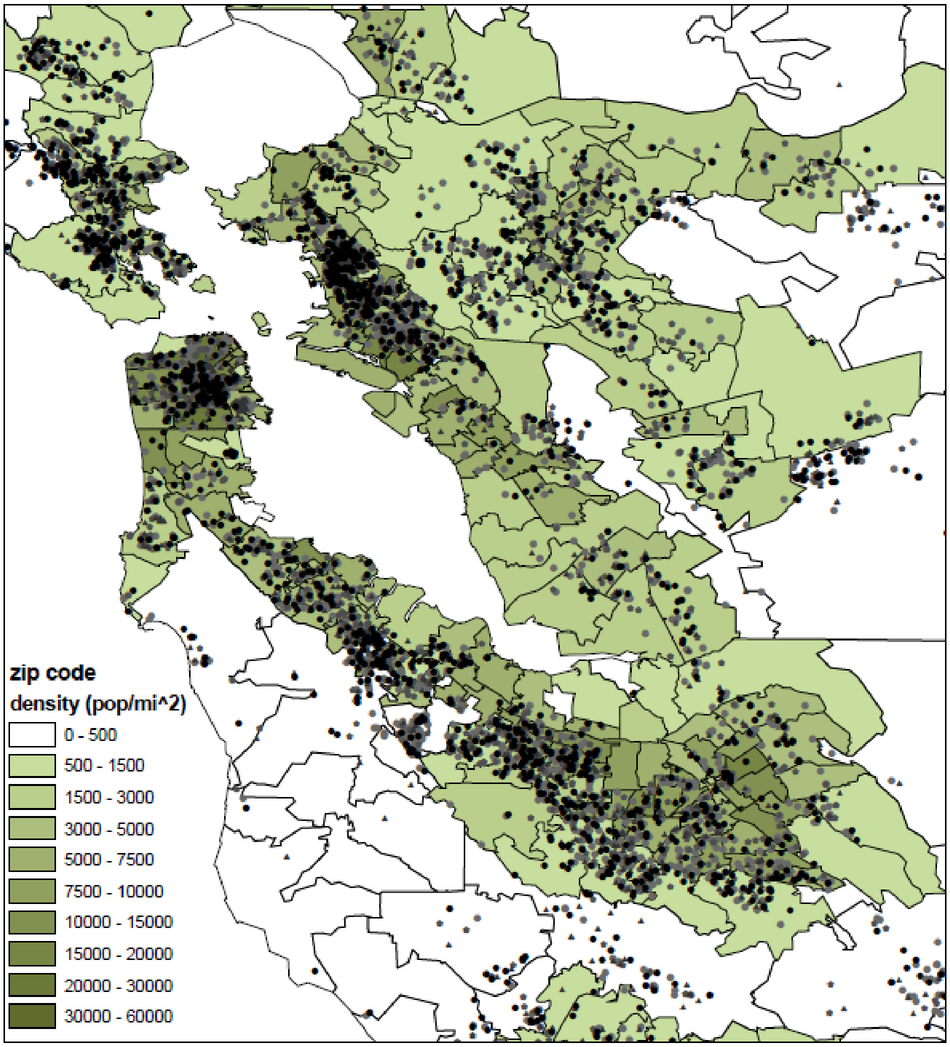
Source: Sexton, Steven and Alison Sexton. “Conspicuous Conservation: The Prius Effect and Willingness to Pay for Environmental Bona Fides.” The Selected Works of Steven E. Sexton. 2011. P. 15. Print.

If the distribution of Prius car owners strongly correlates with the level of Democratic vote in the zip code, the distribution of solar panels should correlate strongly with the share of Democratic vote as well. My model predicts counties that vote more in favor of environmental ballot initiatives, have a greater percentage of registered Democrats and Greens, and show more commonality with sustainable principles through public opinion surveys should also have more solar panels per capita.

The distribution of solar panels in the Bay Area affirms my hypothesis. A study conducted by Bryan Bollinger and Kenneth Gillingham looked at the peer effects of solar panels. They posited that social interactions propelled neighbors to buy and install PV panels because the presence of an already existing solar panel. Bollinger and Gillingham found “an additional installation increases the probability of an adoption in the zip code by 0.78 percentage points.” (Bollinger 2012, 1) This confirms the occurrence of political-environmental signaling.

What is more interesting is the location of the clusters of solar panels. Figure 8 reveals the various clusters of PV panels in the Bay Area. There are four clusters of solar panels located in Marin, San Francisco, Berkeley, and Santa Clara. These cities and corresponding counties are heavily Democratic and are densely populated municipalities. The analysis cites “more densely populated zip codes tend to have more installations, yet there densely populated zip codes with a few installations, and less densely populated ones with many installations.” (Bollinger 2012, 10) I explain differences in the uptake of solar panels in the Bay Are as a result of variances in political beliefs. The authors mention the differences could be explained by the “clustering of environmental preferences.” (Bollinger 2012, 11) I would amend “environmental preferences” to “political-environmental preferences.”

Figure 8: Clustering of Solar PV Panels in the Bay Area



Source: 3Bollinger, Bryan and Kenneth Gillingham. “Peer Effects in the Diffusion of Solar Photovoltaic Panels.” Journal of Marketing Science Volume 31, Number 6. 2012. P.32. Print.

3.4 Theoretical Framework for my Independent Variables

The purpose of this section is the lay out the framework of my model supported by prior literature. The first study that I drew inspiration from is Kahn and Matsusaka’s study, *Demand for Environmental Goods: Evident from Voting Patterns on California Initiatives.* They use voting behavior of California voters on 16 ballot initiatives on a county level to characterize the demand for environmental goods. Their focus is economic. My focus is on the political side of the story. I argue that the demand for environmental goods is originates from a person's political background. They point the advantage of using ballot initiatives as the independent variable because there is a cost in voting and the result of the election also has costs most likely in form of higher taxes. I emulate the methodology used by Kahn and Matsusaka. In their paper, they merged "county vote totals on each initiative with demographic and economic variables." (Kahn 1997, 139) What I did differently is to use demographic and economic variables as control variables. They found that the wealthy was less likely vote for public environmental goods because they had to ability purchase the same goods privately. Solar panels on the other hand are an expensive investment. In order to purchase a solar panel system, a person's income must be able to the thousands of dollars to finance asset.

My inspiration for utilizing the direct survey method comes from another paper, *Internal and External Influences on Pro-environmental Behavior: Participation in a Green Electricity Program*. Clark et al. evaluated the drivers of pro-environmental behavior. The study analyzed data from a mail survey to gauge participants and non-participants in a green electricity program. The survey conducted by Clark et al. asked respondents a series of questions that ranked their scale of "greenness". For example, one of the questions asked how strongly they agreed or disagreed with the statement, "The balance of nature is delicate and easily upset by human activity." (Clark 2002, 241) They had to ability to scale their answer from one extreme to another. The surveys that I exploit for data from the Public Policy Institute of California share many of the same characteristics. Both are randomized. Both gauge people's attitudes toward environmental issues. Both have scaled answers.

My model using party identification is based off the inquiry conducted by Dora Costa and Matthew Kahn. Their experiment, *Energy Conservation "Nudges" and Environmentalist Ideology: Evidence from a Randomized Residential Electricity Field Experiment.* They show that electricity conservation nudge in the form of a feedback is responded to differently by liberals and conservatives. Asking for feedback is shown to help "nudge" residents in conserving energy, but the strategy backfires on conservatives. Their regression estimates a household that is Democratic, donates to pro-environmental pressure groups, and live in a liberal neighborhood will reduce its electricity usage by three percentage points in response to a nudge (Costa 2010). Conservatives act in an opposite fashion increasing their consumption by one percentage point. For my inquiry, I substitute liberal and conservative with Democrat and Republican. Democrats and Republicans should behave in a similar fashion toward solar panels.

CHAPTER FOUR: RESULTS

Looking at the overall picture of all my regression, I can declare my model and research design have various flaws. These flaws adversely affected the validity of my study. As it turns out, many of my regressions were statistically insignificant. I will further elaborate on the research design flaws in chapter five. Despite this blemish, my model does draw attention to certain trends in the regressions.

The first half of my regressions did not incorporate a control variable. Despite this limitation, the statistically significant regressions do give some insight behind the factors that influence a person's decision to purchase a solar panel or not. The results of all the regressions without using control variables are summarized in Table 3.

I created a checklist of validating if the linear regression was statistically significant. The steps in my process were to check:

1. The Pearson correlation.
2. The R square value.
3. The Sig. value (significance probability or p-value)
4. The range of values in the 95% confidence interval.

If the Pearson correlation figure is close to zero, the two variables share little or no correlation with one another. The R squared value measures the proportion of variance in the dependent variable which can be explained by the independent variable(s). If the R squared value was close to zero, the independent variable does a poor job explaining the variations in the dependent variable. Finally, I looked to see if 95% confidence intervals for the coefficients include the value zero. If it does, then the regression is not statistically significant. Only if a regression model passes all four steps would I consider the specific regression to be statistically valid.

There were only four regression analyses that produced statistically significant results. The four models had number of solar installations per capita and solar power capacity per capita as the dependent variable. These two dependent variables almost mirror each other so it is not surprising to see that both variables to produce a statistically significant result measure against the percentage of registered Democrats and the share of yes votes for pro-environmental ballot initiatives. The predictive power of the Democrat variable even under my flawed model implies that being a Democratic is strongly correlated with pro-environmental behavior.

Table 3: Summary of Linear Regression Models without Control Variables

Dependent Variable	**Independent Variable**	**Statistically Significant**
Number of Solar Panels Per Capita	% of Registered Democrats	Yes
Solar Power Capacity Per Capita	% of Registered Democrats	Yes
% of Homes with a Solar Panel	% of Registered Democrats	No
Number of Solar Panels Per Capita	% of Registered Green Party	No
Solar Power Capacity Per Capita	% of Registered Green Party	No
% of Homes with a Solar Panel	% of Registered Green Party	No
Number of Solar Panels Per Capita	Average Answer to the Question, "How serious is global warming?"	No
Solar Power Capacity Per Capita	Average Answer to the Question, "How serious is global warming?"	No
% of Homes with a Solar Panel	Average Answer to the Question, "How serious is global warming?"	No
Number of Solar Panels Per Capita	Average of Yes Vote for Green Ballot Initiatives	Yes
Solar Power Capacity Per Capita	Average of Yes Vote for Green Ballot Initiatives	Yes
% of Homes with a Solar Panel	Average of Yes Vote for Green Ballot Initiatives	No

To obtain results for my regressions with control variable, I use hierarchical multiple regression method. For the first step, I inputted my predictor variables or control variables. This first step measured the relationship of the control variables with the dependent variable. The second phase incorporated all the control variables and my independent variable into the analysis. SPSS constructed a linear equation with the associated beta values of each of the control variable and the independent variable. Then I ran the regression to churn out mathematical data. I use the same checklist I use for my regressions without the control variables. As a consequence, none of my multiple regressions can be considered valid results. Table 4 encapsulate every single multiple regression that incorporated control variables. The letter “S” designates the variable as statistically significant. The label “IS” means the variable failed to meet all tests of validity.

Table 4: Summary of Linear Regression Models with Control Variables

DV	IV	CV: Median Income	CV: % Females	CV: % Whites	IV: % Democrats	IV: % Green	IV: Seriousness of Global Warming	IV: % Yes for PE Ballot Initiatives
# Solar Panels Per Capita	% Democrats	IS	IS	IS	IS	-	-	-
Capacity Per Capita	% Democrats	IS	IS	S	IS	-	-	-
% Homes w/ Solar Panel	% Democrats	IS	IS	S	IS	-	-	-
# Solar Panels Per Capita	% Green Party	IS	IS	S	-	IS	-	-
Capacity Per Capita	% Green Party	IS	IS	S	-	IS	-	-
% Homes w/ Solar Panel	% Green Party	IS	IS	S	-	IS	-	-
# Solar Panels Per Capita	Seriousness of Global Warming	IS	S	S	-	-	IS	-
Capacity Per Capita	Seriousness of Global Warming	IS	S	S	-	-	IS	-
% Homes w/ Solar Panel	Seriousness of Global Warming	IS	IS	S	-	-	IS	-
# Solar Panels Per Capita	Yes Vote for Green Ballot Initiatives	IS	IS	IS	-	-	-	IS
Capacity Per Capita	Yes Vote for Green Ballot Initiatives	IS	IS	IS	-	-	-	IS
% Homes w/ Solar Panel	Yes Vote for Green Ballot Initiatives	IS	IS	S	-	-	-	IS

There is one outcome that did stand out. The control variable, percentage of whites in a county managed to hold statistically significance in nine of the twelve permutations. Even under the framework of skewed research design, this control variable has staying powering. The durability of this predictor variable denotes a strong association with environmental behavior. The control variable, “percentage of females in a county” remains usable in two permutations. Perhaps, gender shares a robust relationship with environmental behavior.

The beta value of the coefficients for race matches with my expectations. The beta value for the standardized coefficient is 0.312. Being a Caucasian shares a positive relationship with solar PV capacity per capita. Holding all variables constant, each single unit (1%) increase in the percentage of whites in a county will predict a .312 Megawatt hour (MWH) per day increase in solar power generating capacity for a county.

The rest of the chapter will go over every single regression, both using control variables and not using control variables categorized by the independent variable. Due to the fact that many of the regressions did not bear usable outcomes, the focus of the rest of the chapter will be on how I set up the data for analysis.

Table 5: Regression Coefficients of the Control Variables and Solar Power Capacity Per Capita

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	4.066	2.121		1.917	.061	-.201	8.332
	HouseholdMedianIncome	-1.578E-005	.000	-.226	-1.820	.075	.000	.000
	PercentageofFemalesAverage	-.087	.041	-.257	-2.116	.040	-.169	-.004
	AveragePercentageWhite	.023	.008	.374	3.045	.004	.008	.038
2	(Constant)	4.369	2.154		2.028	.048	.034	8.704
	HouseholdMedianIncome	-1.287E-005	.000	-.184	-1.383	.173	.000	.000
	PercentageofFemalesAverage	-.078	.042	-.232	-1.860	.069	-.163	.006
	AveragePercentageWhite	.019	.009	.312	2.207	.032	.002	.037
	Democratic	-.015	.017	-.138	-.879	.384	-.049	.019

a. Dependent Variable: SolarPVCapacityPerCapita

4.1 Party ID

4.1.1 Setting up the Data

First, I averaged the party registration numbers from presidential elections from 2000-2012. I chose only presidential elections because in between presidential elections and primary elections have a lower registration rates and lower voter turnout. This creates a bias of who decides to register to vote for these elections. The voters that registered to vote in primary elections, special elections, and in between presidential elections tend to be more extreme both to the right and left of the political spectrum. I wanted to get a voting population that is more reflective of the actual population for each of the counties. The resulting independent variable that was created was the average percentage of Democrats and Green Party members for each county from 2000-2012.[8]

4.1.2Results

All the hierarchical multiple regressions using control variables and most of the linear regressions did not pass the statistical significance tests However, there two linear regressions that did.

The two linear regressions that passed the test had share of registered Democrats as the IV. The IV was analyzed against installations per capita and solar capacity per capita. Figure 9 is the scatterplot highlighting the link between the IV and installations per capita. The fit line in Figure 9 shows that the number of installations per capita decreases as the percentage of registered Democrats

[8] The average party registration data for Democrats and Greens are displayed in Appendix E.

goes up. The adjusted R squared is 0.18 meaning that 18% of the variation of the dependent variable is explained by the share of Democratic registered voters in the county. The Democratic counties are clustered together but there is wide variation among less Democratic counties.

Figure 9: Linear Regression of Democratic Registration and Number of Solar Panel Installations Per Capita

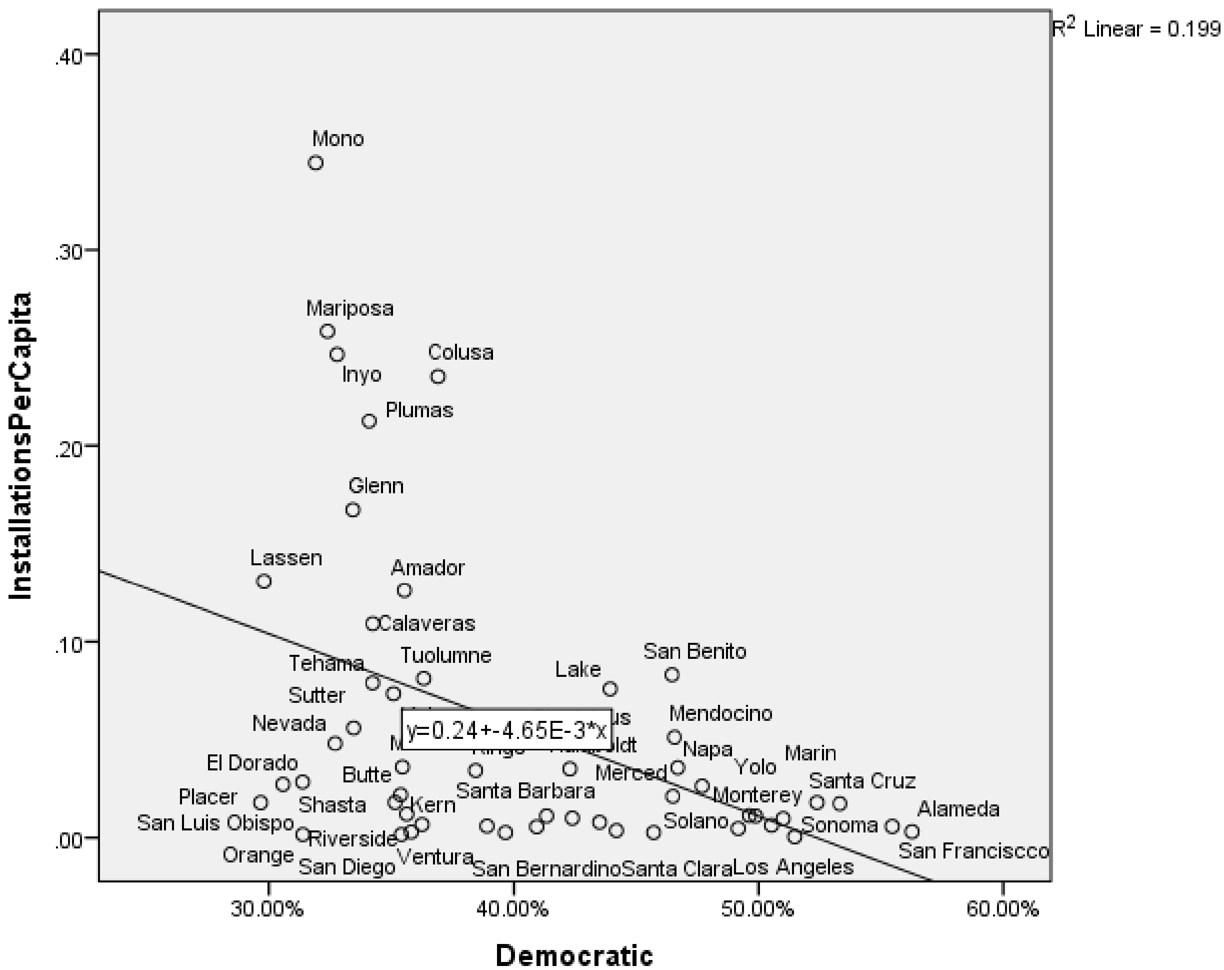


Table 6: Regression Model Summary of Democratic Registration and Number of Solar Panel Installations Per Capita

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate

1	.446[a]	.199	.183	.0712930488 42974

a. Predictors: (Constant), Democratic
b. Dependent Variable: InstallationsPerCapita

4.2 Public Opinion

4.2.1 Setting up the Data

I use survey results from the Public Policy Institute of California's annual Californians and the Environment Survey. This survey was first started in April 1998, but I will only be using data from July surveys from 2005-2009. The total number of respondents for all five surveys 12,509. Each survey asked around 40-50 questions gauging the person's environmental beliefs and attitudes. I decided to use one question that was most closely related solar panels. I choose a question on global warming. One of the biggest reasons that people cite why they bought and install solar panels was because they worried about the effects of climate change and they wanted to make contribution in curbing carbon emissions even if it was small contribution. This question fits the political logic of my model. People purchase solar panels not because it will have a noteworthy economic affect, but because they want to bolster their political-environmental image. If their behavior stayed consistent, a person that buys a solar panel will respond in way consistent with environmental beliefs in his or her political actions and in this survey.

The question I chose was asked in the same fashion and had the same options in all five surveys. The specific question asked, "How serious of a threat is global warming to the economy and quality of life for California's future. Do you think it is:"[9]

1. Very serious.
2. Somewhat serious.
3. Not too serious.
4. Not serious at all.
5. Don't know.
6. Refuse to answer.

"Very serious" had a value of one, "somewhat serious" was given a two, "not too serious" had a three, and "not serious at all" had a value four. Answers five and six were given assigned numbers of eight and nine respectively. I decided to take out the respondents that refuse to answer or don't know. I cannot make any objective observation if I include them in the analysis. That left me with 12,095 respondents. I decided not to assign weights to answers because that would arbitrarily skew the results and there is already a tendency for people to answer the first option because they want to look good in the eyes of the surveyor and there was no cost in giving an exaggerated answer. In the 2011 survey, 47% of people interviewed said that global warming was a serious threat compared 11% that said it was not serious at all (Baldassare 2011, 25). There is evidence of

[9] The exact wording of the question was taken from Public Policy Institute of California's annual survey, "California and the Environment". The wording is available in codebook form or in PDF report.

some bias here. The average responses to the global question are tabulated in Appendix F.

The methodology of the survey was sound. The interviews were conducted over landline phones. Phone numbers was randomly selected by a computer program. There may have been a slight bias in the survey result in the later years with the rising prevalence of mobile phones and the decline use of landlines. In order to avoid biases in age and gender, the researchers in employed “the last birthday method” for randomly choosing who to interview in the household. To make sure that immigrants were able to participate in the study, interviews were conducted in English, Spanish, Chinese (Mandarin and Cantonese), Vietnamese, and Korean according to the wishes of the interviewee. This made sure that the assessment was not oversampling native speakers.

4.2.2 Results

All of the regressions, both with control variables and without them, did not produce statistically significant results.

4.3 Voting Patterns

4.3.1 Setting up the Data

I use election results from the Office of the Secretary of State of California. The propositions I included in this study are listed below in Table 6.

Table 7: California State Ballot Initiatives that Dealt with Environmental Issues 2000-2012[10]

Year	Month	Proposition
2000	March	12, 13
2002	March	40
2002	November	50
2006	November	1B, 84, 87
2008	November	1A, 7, 10
2010	November	23
2012	November	39

Source: California Secretary of State

There are a total of 12 propositions from the year of 2000 through 2012 that relate directly with environmental issues. I averaged the percentage of yes votes for each of the ballot initiatives to match the cumilimative unit of analysis of my dependent variable. The only ballot initiative that was the exception was Prop 23 in 2010. If the Prop passed, it would have invalidated AB 32: Global Warming Solutions Act of 2006. If passed, the laws under AB 32 would not go into effect until the unemployment rate in California dropped under 5.5%.The main objective of AB 32 was to reduce carbon emissions in the state to 1990 levels by 2020. A "no" vote in essence was a pro-environmental vote. To keep my analysis consistent, I flipped the labels around and assumed that a "no" vote was a "yes" vote for green government policies. For a complete breakdown of the "yes" vote share for each county, please look up Appendix H.

[10] For a full description of all the environmentally related ballot initiatives, please refer to Appendix G.

4.3.2 Results

There were only two regressions that achieved statistical significance. They were linear regressions that had solar capacity per capita and installations per capita. They displayed a similar trend to the regression in Figure 9. If you are interested in looking up the specific analytics, please refer to the electronic supplement.

CHAPTER FIVE: CONCLUSION

5.1 Findings

The only real takeaway from this study is that percentage of whites in a county is a good predicator of solar outcome. In the hierarchical multiple regression, it was statistically significant nine out of twelve times. There is previous literature indicating that several demographic factors including race positively influences environmentalism (McMillan, 89). McMillan et al. found empirical evidence that whites hold more environmental attitudes as measured by the New Environmental Paradigm (NEP). The authors point to other studies that show whites are more likely than African-Americans to hold environmental attitudes (McMillan, 89). Their logic behind this phenomenon was "differences in socioeconomic status that generally exist between African-Americans and white cold also provide an explanation for their difference in attitudes." (McMillan, 91) In pursuing the research question further, one could take a look at race as a determining variable. It could be tied with politics since race and politics are not strange bedfellows.

The surprising thing is that many of the counties inland in and in northwest California have a high rate of installations per resident. Some of these are more heavily Republican counties. There are Democratic counties like Marin that have a high rate of solar outcomes per person, but there are far more Democratic counties that have low solar outcomes per capita like San Francisco and Santa

Clara. I cannot completely reject my three hypotheses because of the flawed research design, but the data gives weak and inconsistent support for my model. In many of the cases, the data showed the opposite relationship exists. The data from my analyses does *not* support my theory that political-environmental attitudes are the prime reasons a homeowners decides whether or not to purchase a solar panel for their property.

5.2 Flaws in my Research Design

There are several flaws that adversely affect the accuracy of my design. The first one is my unit of analysis. I am analyzing all the different variables on a county by county basis. The problem is that counties are just too large. San Bernardino is the largest county in the United States at 20,056.94 square miles compared the San Francisco which is the smallest county in the California at 47 square miles.[11] Population varies widely between counties as well. Los Angeles is the largest county in the state by population. 9,962,789 call Los Angeles County their home. On the other side, 1,129 people reside in Alpine County.[12] Instead of scaling nominally, I should have scaled all the dependent variables on a logarithmic scale. This would transform the values according intervals on magnitude. The use of a logarithmic scale reduces the wide variances of population between California counties.

[11] Numbers are from the US Census.
[12] Data also derived from the US Census.

Take LA County for example. It has 11,957 solar panel installations. The population of LA is near 10 million. As a consequence, installations per capita are small at around 0.0012 installations per Los Angeles resident. Contrast this with the situation in Yolo County. Yolo is home to 204,118 residents. There are 1,240 solar panel installations in the county. This gives Yolo County 0.0060 solar panels per resident. Yolo's number of panel installations per capita is 400% the rate in Los Angeles. A lot of this may be due to the sheer size of Los Angeles County which will minimize any effect of political-environmental ideals even they exist and they actually motivate homeowners to buy and install a solar panel. The problem lies in my denominator. In my data management, I had to pool all my control, dependent, and independent variable to the county level. This process skewed the results.

Two control variables that I did not take into consideration was population density and whether or not county was predominantly urban, suburban, or rural. The spatial clustering rationality of solar panels and the maps of the clustering of solar panels in the Bay Area point to a possible correlation with these two demographic considerations. However, I could not add more control variables into my model without running into a degree of freedom problem.

Using counties as my geographical boundaries of analyses meant that my study would have relied on a low number of samples. This creates a degree of freedom issue because I cannot incorporate a large number of control variables into my multiple regression analyses. Instead of using counties as my unit of analysis, it would be better to choose something smaller like ZIP code. That way, I will get a larger sample size which would increase the accuracy and validity of my results.

Another flaw of my study is it did not measure changes in political beliefs across time. Although I had data across time for my independent variables, my data for my dependent variables were cumulative. In order to match the variables up, I had average out data on the left handed variables. If I had data over time, I could measure if political-environmental shifts in beliefs and major events have an effect on the rate of installations. This is a much stronger way to see if political-environmental values actually affect consumers compared to my static model.

5.3 Creating an Ideal Research Design and Research Study

There are two ways to go on from this study. One is to find an alternative variable to explain the variances in solar panel uptake throughout California. The question still remains why solar panel installations cluster in certain locations and there are very few in other like communities.

Another is to revise this study and fix the design flaws. If I had the opportunity to design the ideal research study to investigate this problem, I would collect year-year data on California over several years. It would be a time-series analysis of survey data of new buyers of solar panels. My unit of analysis would be on the individual level. I would collect a large sampling ranging in the thousands. To collect my data, I would interview the buyers of new solar PV panels and get their information on their level of education, income, gender, political party, race, address, opinions of hot environmental issues like climate change, and other predictors. Then I would ask them was their primary reason in purchasing a solar system. This is a basic overview of my ideal study. The new research design fixed the problems in this this thesis.

This puzzle is an important field of study because the growing emphasis on renewable energy. California passed AB 32 which requires that one-third of California's energy come from renewable sources. Electricity generated by residential solar panels will play a crucial part in meeting that legal requirement. Government policies and incentives can be made more effective if we can understand the driving motivation on why people buy green products and how does the practice spread.

Appendices

Appendix A: Comparing Average Number of Days of One Inch or More Rainfall and Percentage of Homes with a Solar Panel for Each County

County	Avg # of Days of 1 in. or more	Solar share: % of homes with solar
Sacramento	36	0.00%
Stanislaus	26	0.07%
Lassen	24	0.08%
Sierra	64	0.09%
Los Angeles	20	0.10%
San Bernardino	8	0.16%
Merced	23	0.19%
San Joaquin	35	0.21%
Orange	18	0.23%
Humboldt	83	0.23%
Solano	37	0.24%
Riverside	23	0.25%
Monterey	43	0.25%
Kings	16	0.27%
Tulare	37	0.27%
Mono	14	0.28%
Ventura	21	0.29%
San Benito	30	0.32%
Tehama	67	0.32%
Shasta	68	0.33%
Kern	13	0.37%
Santa Barbara	23	0.39%
Sutter	36	0.39%
Alameda	31	0.41%
Yuba	54	0.42%
Mariposa	32	0.45%
San Mateo	40	0.47%
Colusa	31	0.48%
Contra Costa	28	0.50%
San Diego	29	0.50%

Madera	36	0.51%
Glenn	36	0.52%
San Francisco	33	0.55%
Butte	39	0.55%
Santa Clara	32	0.57%
Fresno	38	0.58%
Lake	43	0.58%
Tuolumne	49	0.59%
Mendocino	59	0.70%
Plumas	66	0.71%
Inyo	28	0.74%
San Luis Obispo	27	0.80%
Yolo	32	0.83%
Santa Cruz	44	0.91%
Nevada	72	0.96%
Calaveras	3	0.97%
El Dorado	48	1.00%
Napa	49	1.02%
Marin	45	1.03%
Placer	46	1.05%
Sonoma	51	1.17%

Source: "Info Retrieval for California." Climate National Resources Conservation Service Web: http://www.wcc.nrcs.usda.gov/cgibin/state.pl?state=ca and California Solar Initiative. Web: http://www.sunrunhome.com/solar-by-state/ca/california-solar-tax-credit/csi-counties/

Appendix B: Solar PV Technical Potential for California Counties

County	MWh/day	MW	County	MWh/day	MW
ALAMEDA	558,952	103,745	ORANGE	811,245	144,772
ALPINE	260,655	46,905	PLACER	439,756	80,747
AMADOR	214,149	38,754	PLUMAS	397,814	71,626
BUTTE	439,566	80,610	RIVERSIDE	7,811,694	1,253,372
CALAVERAS	378,300	67,423	SACRAMENTO	814,573	147,775
COLUSA	317,045	58,227	SAN BENITO	822,419	150,298
CONTRA COSTA	490,774	91,151	SAN BERNARDINO	25,338,276	3,981,405
DEL NORTE	91,916	20,329	SAN DIEGO	3,561,569	605,526
EL DORADO	373,269	67,806	SAN FRANCISCO	38,977	7,410
FRESNO	1,821,160	317,692	SAN JOAQUIN	513,946	91,113
GLENN	547,123	99,508	SAN LUIS OBISPO	2,450,572	418,263
HUMBOLDT	397,805	88,340	SAN MATEO	251,470	47,153
IMPERIAL	4,698,212	745,887	SANTA BARBARA	1,690,109	297,137
INYO	10,047,177	1,599,946	SANTA CLARA	861,570	158,437
KERN	6,300,316	1,043,071	SANTA CRUZ	157,093	29,776
KINGS	502,002	86,687	SHASTA	895,789	164,584
LAKE	529,442	98,033	SIERRA	193,077	34,794
LASSEN	2,754,941	492,190	SISKIYOU	1,345,782	261,615
LOS ANGELES	3,912,346	662,486	SOLANO	453,180	83,335
MADERA	799,540	140,005	SONOMA	576,430	106,940
MARIN	246,556	45,458	STANISLAUS	795,435	140,965
MARIPOSA	548,329	96,897	SUTTER	90,023	16,717
MENDOCINO	665,493	124,389	TEHAMA	1,316,667	239,196
MERCED	1,034,145	183,450	TRINITY	331,254	64,027
MODOC	2,237,536	423,331	TULARE	1,251,596	217,308
MONO	2,036,627	349,025	TUOLUMNE	668,673	117,463
MONTEREY	1,875,717	330,488	VENTURA	1,136,750	198,073
NAPA	330,271	60,168	YOLO	316,907	57,518
NEVADA	194,567	35,236	YUBA	202,601	37,602
			State Totals:	100,139,176	16,822,184

Source: Simmons, George and Joe McCabe. “California Solar Resources: In Support of the 2005 Integrated Energy Policy Report.” Research and Development, Energy and Research Development Division, California Energy Commission. April 2005. Print.

Appendix C: DV, Number of Installations Per Capita and Solar Capacity Per Capita for California Counties

Row Labels	Sum of Number of Solar PV Installations	Sum of Total Solar PV Capacity (kW)	# of Installations Per Capita	Solar PV Capacity Per Capita
Alameda	4427	45727	0.003066339	0.031672578
Amador	152	980	0.126125356	1.302763533
Butte	1044	17909	0.021789527	0.22506657
Calaveras	214	1363	0.109163091	1.127558317
Colusa	56	3351	0.235428632	2.431769836
Contra Costa	4325	33488	0.004665815	0.048193749
El Dorado	1259	6961	0.028323918	0.292561053
Fresno	3836	38378	0.005537855	0.05720115
Glenn	98	632	0.167353419	1.728613012
Humboldt	347	1160	0.034991068	0.361426833
Inyo	86	766	0.246698245	2.548174979
Kern	2128	26307	0.006690899	0.069111079
Kings	404	6282	0.034195626	0.353210619
Lake	379	5284	0.075923099	0.78421856
Lassen	2	6	0.13086792	1.35175003
Los Angeles	11957	123804	0.000465053	0.00480359
Madera	559	6086	0.035960003	0.37143507
Marin	1987	12020	0.017902131	0.184913199
Mariposa	64	243	0.258435493	2.669410391
Mendocino	351	2450	0.051318611	0.530075929
Merced	327	7395	0.021025485	0.217174692
Mono	9	27	0.344433206	3.557690811
Monterey	703	7938	0.011018961	0.11381614
Napa	844	14163	0.035621465	0.367938268
Nevada	915	3871	0.048102311	0.496854389
Orange	5352	41041	0.001555359	0.01606548
Placer	3500	19551	0.017822133	0.184086892
Plumas	23	122	0.212591241	2.195879754
Riverside	4548	42715	0.002864655	0.029589352
Sacramento	2937	36481	0.003618311	0.037373958
San Benito	187	1049	0.083161138	0.858981102
San Bernardino	2731	38609	0.002589746	0.02674979

San Diego	11277	87768	0.001573299	0.016250787
San Francisco	2405	16731	0.005699513	0.058870938
San Joaquin	1182	14708	0.007854889	0.081134071
San Luis Obispo	1995	17472	0.017946254	0.185368958
San Mateo	2477	15726	0.006260243	0.064662785
Santa Barbara	1202	9454	0.011085597	0.114504428
Santa Clara	7389	76322	0.002631071	0.027176636
Santa Cruz	2094	10007	0.017319896	0.178899226
Shasta	402	4459	0.027116921	0.28009384
Solano	973	16149	0.011220605	0.115898941
Sonoma	4141	39063	0.009652998	0.099706943
Stanislaus	464	12181	0.00990387	0.102298226
Sutter	374	5691	0.056087673	0.579336121
Tehama	143	1338	0.078998555	0.815985296
Tulare	1020	11835	0.012029205	0.124251062
Tuolumne	206	1223	0.081227867	0.839012128
Ventura	1974	16727	0.005877612	0.060710545
Yolo	1240	13114	0.026248073	0.271119412
Yuba	206	939	0.073515004	0.759345057
Grand Total	**96915**	**917066**	0.000130699	0.001350008

Source: California Solar Cities, US Census 2010

Appendix D: Percentage of Homes with a Solar Panel for California Counties

California solar counties	Solar share: % of homes with solar
Alameda	0.41%
Amador	0.67%
Butte	0.55%
Calaveras	0.97%
Colusa	0.48%
Contra Costa	0.50%
El Dorado	1.00%
Fresno	0.58%
Glenn	0.52%
Humboldt	0.23%
Inyo	0.74%
Kern	0.37%
Kings	0.27%
Lake	0.58%
Lassen	0.08%
Los Angeles	0.10%
Madera	0.51%
Marin	1.03%
Mariposa	0.45%
Mendocino	0.70%
Merced	0.19%
Mono	0.28%
Monterey	0.25%
Napa	1.02%
Nevada	0.96%

Orange	0.23%
Placer	1.05%
Plumas	0.71%
Riverside	0.25%
Sacramento	0.00%
San Benito	0.32%
San Bernardino	0.16%
San Diego	0.50%
San Francisco	0.55%
San Joaquin	0.21%
San Luis Obispo	0.80%
San Mateo	0.47%
Santa Barbara	0.39%
Santa Clara	0.57%
Santa Cruz	0.91%
Shasta	0.33%
Sierra	0.09%
Solano	0.24%
Sonoma	1.17%
Stanislaus	0.07%
Sutter	0.39%
Tehama	0.32%
Tulare	0.27%
Tuolumne	0.59%
Ventura	0.29%
Yolo	0.83%
Yuba	0.42%

Source: California Solar Initiative 2007. Web: http://www.sunrunhome.com/solar-by-state/ca/california-solar-tax-credit/csi-counties/

Appendix E: Party Registration for California Counties Averaged over Presidential Elections from 2000-2012

County	Registered	Democratic	Republican	Green	Declined to State
Alameda	74.91%	56.26%	17.24%	1.73%	20.39%
Alpine	85.91%	36.14%	35.40%	1.50%	22.13%
Amador	80.05%	35.54%	45.61%	0.68%	13.32%
Butte	75.34%	35.39%	40.28%	1.70%	17.69%
Calaveras	80.50%	34.25%	44.05%	1.07%	15.28%
Colusa	68.33%	36.91%	45.92%	0.24%	13.89%
Contra Costa	75.18%	49.17%	28.86%	0.79%	17.25%
Del Norte	72.03%	37.40%	38.22%	0.88%	17.94%
El Dorado	83.11%	31.37%	45.90%	0.97%	17.05%
Fresno	70.44%	40.95%	43.02%	0.44%	11.62%
Glenn	69.79%	33.42%	46.51%	0.35%	15.64%
Humboldt	80.31%	42.30%	28.26%	5.22%	19.83%
Imperial	66.25%	53.23%	27.01%	0.22%	16.15%
Inyo	77.42%	32.78%	45.74%	0.92%	15.89%
Kern	66.35%	36.25%	46.00%	0.25%	13.75%
Kings	64.82%	38.44%	45.73%	0.21%	12.08%
Lake	71.68%	43.94%	31.30%	1.32%	18.69%
Lassen	84.94%	29.80%	46.12%	0.41%	17.81%
Los Angeles	73.90%	51.47%	25.54%	0.59%	17.89%
Madera	64.77%	35.46%	47.43%	0.42%	13.23%
Marin	83.70%	52.38%	22.38%	2.14%	20.15%
Mariposa	81.35%	32.39%	46.07%	1.20%	14.68%
Mendocino	79.37%	46.56%	24.65%	4.64%	19.22%
Merced	72.15%	46.49%	37.86%	0.40%	12.08%
Modoc	77.97%	31.01%	48.96%	0.41%	14.96%
Mono	68.20%	31.91%	39.24%	1.55%	22.58%
Monterey	67.66%	49.88%	29.39%	0.82%	16.79%
Napa	75.95%	46.70%	30.85%	1.23%	17.16%
Nevada	84.52%	32.70%	42.39%	2.44%	18.24%
Orange	81.81%	31.38%	46.16%	0.49%	18.27%
Placer	82.24%	29.67%	49.76%	0.69%	16.69%
Plumas	83.25%	34.10%	43.32%	0.76%	16.87%
Riverside	65.71%	35.82%	44.71%	0.34%	15.01%
Sacramento	71.84%	44.19%	34.17%	0.78%	17.00%
San Benito	77.29%	46.46%	32.86%	0.56%	16.35%

San Bernardino	64.02%	39.65%	40.19%	0.37%	15.57%
San Diego	72.51%	35.41%	38.32%	0.62%	21.18%
San Francisco	80.57%	55.46%	10.97%	2.47%	28.01%
San Joaquin	67.93%	43.51%	40.99%	0.31%	11.74%
San Luis Obispo	81.19%	35.16%	41.57%	1.29%	17.12%
San Mateo	74.85%	50.53%	23.73%	0.94%	21.75%
Santa Barbara	73.96%	41.35%	34.39%	1.28%	18.70%
Santa Clara	72.22%	45.71%	26.44%	0.71%	23.95%
Santa Cruz	82.52%	53.32%	20.04%	3.27%	18.03%
Shasta	71.94%	30.57%	47.99%	0.52%	16.57%
Sierra	90.86%	31.58%	42.41%	1.12%	17.85%
Siskiyou	77.60%	35.87%	41.41%	0.85%	16.77%
Solano	70.16%	49.62%	27.75%	0.50%	18.58%
Sonoma	74.35%	51.00%	25.46%	2.37%	17.52%
Stanislaus	70.76%	42.39%	40.23%	0.33%	13.05%
Sutter	71.08%	33.45%	48.22%	0.30%	12.67%
Tehama	71.18%	34.24%	44.46%	0.41%	15.08%
Trinity	75.73%	36.50%	38.01%	1.64%	17.03%
Tulare	60.17%	35.63%	46.57%	0.35%	13.95%
Tuolumne	84.74%	36.32%	43.18%	0.87%	15.07%
Ventura	79.11%	38.90%	39.30%	0.71%	16.85%
Yolo	75.42%	47.70%	26.79%	1.66%	19.80%
Yuba	63.87%	35.09%	41.47%	0.55%	17.59%
State Total	73.43%	43.95%	32.99%	0.82%	18.15%

Source: California Secretary of State

Appendix F: Average of Responses to Global Warming Seriousness from 2005-2009

Row Labels	Average of Global Warming
Alameda	1.677908938
Butte	2.12037037
Calaveras	2.3
Colusa	2.105263158
Contra Costa	1.866666667
Del Norte	2
El Dorado	2.274509804
Fresno	1.835016835
Glenn	2.333333333
Humboldt	1.592592593
Imperial	1.465517241
Inyo	2
Kern	1.933884298
Kings	1.666666667
Lake	2.222222222
Lassen	2.6
Los Angeles	1.69278607
Madera	2.14893617
Marin	1.714285714
Mariposa	1.727272727
Mendocino	1.612903226
Merced	1.661016949
Modoc	1.7
Mono	1
Monterey	1.663461538
Napa	1.7
Nevada	2.055555556
Orange	1.908908909
Placer	2.076271186
Plumas	2.75
Riverside	1.873070326
Sacramento	1.910514541
San Benito	1.4
San Bernardino	1.92172524
San Diego	1.952651515
San Francisco	1.558528428

San Joaquin	**1.948863636**
San Luis Obispo	**2.2**
San Mateo	**1.721698113**
Santa Barbara	**1.880794702**
Santa Clara	**1.780346821**
Santa Cruz	**1.669724771**
Shasta	**2.134328358**
Sierra	**2**
Siskiyou	**2.03030303**
Solano	**1.884615385**
Sonoma	**1.733333333**
Stanislaus	**1.853932584**
Sutter	**2.615384615**
Tehama	**1.888888889**
Trinity	**1.625**
Tulare	**1.564516129**
Tuolumne	**2.6875**
Ventura	**1.915178571**
Yolo	**1.8**
Yuba	**2.666666667**
(blank)	
Grand Total	**1.817347445**

Source: "California and the Environment." Public Policy Institute of California. 2005-2009.

Appendix G: Environmentally Related Ballot Initiatives in California 2000-2012

Year	Month	Proposition	Description
2000	March	12	This act provides two billion one hundred million dollars ($2,100,000,000) to protect land around lakes, rivers, and streams and the coast to improve water quality and ensure clean drinking water; to protect forests and plant trees to improve air quality; to preserve open space and farmland threatened by unplanned development; to protect wildlife habitats; and to repair and improve the safety of state and neighborhood parks. Fiscal Impact: State cost of $3.6 billion over 25 years (average cost of about $144 million per year) to repay bonds. State and local parks' operating costs of potentially tens of millions of dollars annually.
2000	March	13	This act provides for a bond issue of one billion nine hundred seventy million dollars ($1,970,000,000) to provide funds for a safe drinking water, water quality, flood protection, and water reliability program. Fiscal Impact: State cost of up to $3.4 billion over 25 years (average cost of about $135 million per year) to repay bonds. Potential unknown local project operation and maintenance costs.
2002	November	40	To protect rivers, lakes, and streams to improve water quality and ensure clean drinking water; to protect beaches and coastal areas threatened by pollution; to improve air quality; to preserve open space and farmland threatened by unplanned development; to protect wildlife habitat; to restore historical and cultural resources; to repair and improve the safety of state and neighborhood parks; the state shall issue bonds totaling two billion six hundred million dollars ($2,600,000,000) paid from existing funds. This program is subject to an annual independent audit.

2006	November	50	Authorizes $3,440,000,000 general obligation bonds, to be repaid from state's General Fund, to fund a variety of water projects including: specified CALFED Bay-Delta Program projects including urban and agricultural water use efficiency projects; grants and loans to reduce Colorado River water use; purchasing, protecting and restoring coastal wetlands near urban areas; competitive grants for water management and water quality improvement projects; development of river parkways; improved security for state, local and regional water systems; and grants for desalination and drinking water disinfecting projects.
2006	November	1B	This act makes safety improvements and repairs to state highways, upgrades freeways to reduce congestion, repairs local streets and roads, upgrades highways along major transportation corridors, improves seismic safety of local bridges, expands public transit, helps complete the state's network of car pool lanes, reduces air pollution, and improves anti-terrorism security at shipping ports by providing for a bond issue not to exceed nineteen billion nine hundred twenty-five million dollars ($19,925,000,000).
2006	November	84	Funds water, flood control, natural resources, park and conservation projects by authorizing $5,388,000,000 in general obligation bonds. Emergency drinking water safety provisions.
2006	November	87	Should California establish a $4 billion Clean Alternative Energy Program to reduce California's oil and gasoline consumption by 25 percent through incentives for alternative energy, education, and training?
2008	November	1A	To provide Californians a safe, convenient, affordable, and reliable alternative to driving and high gas prices; to provide good-paying jobs and improve California's economy while reducing air pollution, global warming greenhouse gases, and our dependence on foreign oil, shall $9.95 billion in bonds be issued to establish a clean, efficient high-speed train service linking Southern California, the Sacramento/San Joaquin Valley, and the San Francisco Bay Area, with at least 90 percent of bond funds spent for specific projects, with federal and private matching funds required, all bond funds subject to an independent audit?

2008	November	7	Shall government-owned utilities be required to generate 20% of their electricity from renewable energy by 2010, a standard currently applicable to private electrical corporations? Shall all utilities be required to generate 40% by 2020 and 50% by 2025?
2008	November	87	Shall $5 billion in bonds paid from state's General Fund be authorized to help consumers and others purchase certain vehicles, and to help research in renewable energy and alternative fuel vehicles?
2008	November	10	Shall $5 billion in bonds paid from state's General Fund be authorized to help consumers and others purchase certain vehicles, and to help research in renewable energy and alternative fuel vehicles?
2010	November	23	Should the AB 32 air pollution control law be suspended until unemployment drops to 5.5 percent or less for a full year?
2012	November	39	Should the California tax code be changed to require multistate firms to pay income taxes based on a percentage of their sales in California, with roughly half of the resulting tax increase to be used to fund clean/efficient energy projects for five years?

Source: California Secretary of State and SmartVoter.org.

Appendix H: Average Pro-Environmental Vote Share for Environmentally Related Ballot Initiatives in California

County	Yes
Alameda	62.90%
Alpine	51.48%
Amador	38.73%
Butte	44.08%
Calaveras	40.87%
Colusa	34.77%
Contra Costa	57.29%
Del Norte	39.38%
El Dorado	41.21%
Fresno	49.42%
Glenn	31.91%
Humboldt	47.46%
Imperial	53.78%
Inyo	40.48%
Kern	45.76%
Kings	44.63%
Lake	47.85%
Lassen	33.40%
Los Angeles	59.77%
Madera	40.84%
Marin	62.32%
Mariposa	39.88%
Mendocino	52.78%
Merced	47.92%
Modoc	28.51%
Mono	47.06%
Monterey	57.40%
Napa	52.84%
Nevada	44.22%
Orange	48.46%
Placer	42.82%
Plumas	37.20%
Riverside	51.95%
Sacramento	51.77%

San Benito	51.33%
San Bernardino	50.08%
San Diego	54.01%
San Francisco	67.46%
San Joaquin	49.64%
San Luis Obispo	48.88%
San Mateo	60.93%
Santa Barbara	52.82%
Santa Clara	59.08%
Santa Cruz	57.94%
Shasta	35.79%
Sierra	35.89%
Siskiyou	37.87%
Solano	52.94%
Sonoma	57.57%
Stanislaus	45.64%
Sutter	39.02%
Tehama	35.09%
Trinity	38.86%
Tulare	40.93%
Tuolumne	43.67%
Ventura	52.28%
Yolo	54.13%
Yuba	42.58%

Source: California Secretary of State.

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